Posters and Exhibits

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AI039

Automated Surveillance of Thoracic and Abdominal Radiographs for Acute Incidental Findings: A Deep-Learning Based Approach

All Day Room: AI Community, Learning Center

Participants
Jack W. Luo, Montreal, QC (*Presenter*) Nothing to Disclose
Jaron Chong, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

PROGRAM INFORMATION

This invited poster is an example of the exciting work in the artificial intelligence domain being supported by the RSNA R&E grant program. Visit each one, AI027 through AI039, to learn about the latest updates.

Printed on: 10/29/20

AI027

Prostate Cancer Detection, Quantification, and Characterization with Artificial Intelligence

Sunday, Dec. 1 12:30PM - 1:00PM Room: AI Community, Learning Center

Participants
Michelle Bardis, MS, Orange, CA (*Presenter*) Nothing to Disclose
Roozbeh Houshyar, MD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Chanon Chantaduly, Irvine, CA (*Abstract Co-Author*) Nothing to Disclose
Alexander Ushinsky, MD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Justin Glavis-Bloom, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Paul A. Kohanteb, North Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Dylann Fujimoto, BA, Irvine, CA (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Chow, MD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Peter Chang, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PROGRAM INFORMATION

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AI030

Motion Correction in Digital Subtraction Angiography Using Machine Learning

Sunday, Dec. 1 12:30PM - 1:00PM Room: AI Community, Learning Center

Participants
Brendan Crabb, BS, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Gabriel C. Fine, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose

PROGRAM INFORMATION

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AI038

How Artificial Intelligence in Neuroradiology Can Revolutionize Neurological Surgery for Epilepsy

Sunday, Dec. 1 12:30PM - 1:00PM Room: AI Community, Learning Center

Participants
Ai Phuong S. Tong, Seattle, WA (*Presenter*) Nothing to Disclose
Andrew L. Ko, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Mahmud Mossa-Basha, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV

PROGRAM INFORMATION

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Printed on: 10/29/20

AI139-ED-SUA4

A Practical Guide to Natural Language Processing for Radiology

Sunday, Dec. 1 12:30PM - 1:00PM Room: AI Community, Learning Center Station #4

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Sophie Chheang, MD, New York, NY (*Abstract Co-Author*) Medical Director, Agamon Technologies
Joshua Cornman-Homonoff, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jennifer Arango, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Irena Tocino, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Michelle N. Maneevese, MD, Houston, TX (*Presenter*) Nothing to Disclose

TEACHING POINTS

• Natural language processing is an invaluable tool in the analysis of free text within radiology reports. • Abundant open-source libraries are available. • Radiologists who understand its limitations and potential will be better positioned to develop NLP models and to evaluate commercial products.

TABLE OF CONTENTS/OUTLINE

Illustrate where NLP 'sits' in the world of artificial intelligence and machine learning Discuss NLP limitations, including: Ambiguity, Synonymy, Syntax, Coreference Discuss NLP tools, including: Tokenization, Stop Words, TF-IDF, Negation, Word-grams, Normalization, Bag of Words, Word-Vectorization Compare and contrast open-source NLP libraries: NLTK, SpaCy, Stanford coreNLP, Spark NLP Suggested steps to creating the developer environment Predictive modeling: Regression, Random Forest, Decision Tree

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AI224-SD-SUA1

Comparative Study on the Efficacy of Deep-Learning-Based Detection of Pulmonary Nodules of Different Sizes between Single-Source and Dual-Source Mode

Sunday, Dec. 1 12:30PM - 1:00PM Room: AI Community, Learning Center Station #1

Participants
Lijuan Zhu, Dalian , China (*Presenter*) Nothing to Disclose
Xiaoming Zhu, Dalian , China (*Abstract Co-Author*) Nothing to Disclose
Dongdong Song, Dalian , China (*Abstract Co-Author*) Nothing to Disclose
Qing Zhang, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Dawei Wang, Beijing, China (*Abstract Co-Author*) Employee, InferVision

PURPOSE

To compare the efficacy of the deep learning (DL)-based artificial intelligence (AI) diagnosis system in detecting pulmonary nodules of different sizes from single-source and dual-source CT images.

METHOD AND MATERIALS

184 sets of routine chest CT images and 198 sets of dual-source CT images were collected. Images with 1mm-slice thickness were then reconstructed using bone algorithm at 120 kVp (composite 120 kVp from 100 / Sn 140 kVp for dual-source mode). DL-based AI diagnosis system (InferRead CT Lung Research, Infervision, Beijing) was utilized to detect nodules of different sizes, including nodules >=4mm (large) and <4mm (small) in diameter. With the aid of AI diagnosis system, six senior radiologists with over 10 years' experience in reading chest CT images were divided into 2 groups and established the ground truth for single-source and dual-source images, respectively. Sensitivity, precision, and false positive rate (false positive nodules per CT) were calculated. Chi-square test was conducted for statistical analysis.

RESULTS

AI diagnosis system detected 382 and 435 large nodules, from dual-source and single-source images, in which contained 230 and 255 true positive large nodules, respectively. For large nodules, detection sensitivity and precision for dual-source images (97.05%, 78.5%) were significantly higher than that for single-source images (91.18%, 58.6%) ($p<0.05$); false positive rate was 0.77/CT and 0.98/CT, respectively. Meanwhile, AI diagnosis system detected 805 and 895 small nodules, including 689 and 792 true positive small nodules, from dual-source and single-source images with significantly different sensitivity of 89.8% and 80.5% ($p<0.05$). Detection precision for small nodules was 85.59% and 88.49%, showing no statistical difference. In addition, false positive rate for small nodules was 0.59/CT and 0.56/CT, respectively.

CONCLUSION

AI diagnosis system displayed higher sensitivity and lower precision for long-axis >=4mm nodules in comparison to long-axis < 4mm nodules no matter in single-source or dual-source mode. In addition, the AI diagnosis system showed a better performance in detecting nodules of different sizes from dual-source images.

CLINICAL RELEVANCE/APPLICATION

Our study indicates the possibility of joint application of dual-source CT and DL-based AI diagnosis system in detecting pulmonary nodules of different sizes in clinical practice.

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AI237-SD-SUA2

Optimizing Distributed Deep Learning Methods for Medical Image Data Heterogeneity Across Institutions

Sunday, Dec. 1 12:30PM - 1:00PM Room: AI Community, Learning Center Station #2

Participants
Niranjan Balachandar, Stanford, CA (*Presenter*) Nothing to Disclose
Ken Chang, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jayashree Kalpathy-Cramer, MS, PhD, Portland, OR (*Abstract Co-Author*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd;
Daniel L. Rubin, MD, Stanford, CA (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd

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PURPOSE

Distributed training of deep learning (DL) models is useful to build AI applications using multi-institutional data without the need for direct data-sharing. However, existing distributed methods do not account for data imbalances across institutions, which can result in poor model generalizability. We developed methods to optimize distributed training of DL models using multi-institution data that avoids these issues.

METHOD AND MATERIALS

We used cyclical weight transfer as our baseline distributed algorithm, and developed several modifications to mitigate decreases in performance that arise from data imbalances across institutions. To address sample number heterogeneity, we introduce a cyclical learning rate and train the model at each site for a number of iterations proportional to the number of data samples at the site. To address label distribution heterogeneity, we developed a locally-weighted minibatch sampling approach and a weighted loss function at each site as a function of the local label distribution. We evaluated our methods by simulating distributed training of DL models for binary chest X-ray classification with the Chest X-ray14 dataset among 4 institutions under 'ideal' circumstances (same amount of data and same label distribution at each site) and where there are heterogeneities in data across institutions, comparing classification accuracy given various degrees of heterogeneity across sites with the gold standard of centrally hosted data.

RESULTS

Introducing proportional local training iterations was most effective at mitigating performance losses arising from sample number heterogeneity, and both locally weighting minibatch sampling and cyclically weighted loss were effective at mitigating performance losses from label distribution heterogeneity.

CONCLUSION

Imbalances in data across institutions can hamper distributed learning performance. We have developed methods to optimize distributed learning of DL models, mitigating deleterious effects of imbalances in data across institutions.

CLINICAL RELEVANCE/APPLICATION

Distributed DL model performance for automated medical image analysis tasks may be challenged by variations in data across institutions. Our methods may mitigate these challenges, allowing greater generalizability to real-world distributed learning tasks with medical image data, and approach performance of models trained using centralized patient data without the need for patient data sharing.

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AI267-SD-SUA3

Deep Learning with Multiclass Deep Convolutional Neural Networks to Detect Prostate Cancer on Multiparametric MRI Images Using a Multi-Institution Patient Cohort

Sunday, Dec. 1 12:30PM - 1:00PM Room: AI Community, Learning Center Station #3

Participants
Yohan Sumathipala, BS, Bethesda, MD (*Presenter*) Nothing to Disclose
Nathan S. Lay, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD, Bethesda, MD (*Abstract Co-Author*) Research support, Koninklijke Philips NV; Royalties, Invivo Corporation; Investigator, NVIDIA Corporation
Clayton P. Smith, BA, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Peter L. Choyke, MD, Rockville, MD (*Abstract Co-Author*) License agreement, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; License agreement, ScanMed; License agreement, Rakuten Medical; Researcher, Rakuten Medical; Researcher, General Electric Company; Researcher, Progenics Pharmaceuticals, Inc; Researcher, Novartis AG; ; ; ; ;
Ronald M. Summers, MD,PhD, Bethesda, MD (*Abstract Co-Author*) Royalties, iCAD, Inc; Royalties, Koninklijke Philips NV; Royalties, ScanMed, LLC; Royalties, Ping An Insurance Company of China, Ltd; Research support, Ping An Insurance Company of China, Ltd; Research support, NVIDIA Corporation; ; ; ;

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PURPOSE

To develop and evaluate two deep convolutional neural network (DCNN) CADs to detect prostate cancer lesions at the voxel level from multiparametric MRI (mpMRI) using a multi institution patient cohort.

METHOD AND MATERIALS

The 186 patient, retrospective dataset of 3T mpMRI scans from six worldwide institutions consisted of three prostate axial volumes; T2W, ADC, and High-b (92 with ERC [endorectal coil], 94 no-ERC). We adopted two DCNN architectures: U-Net, a binary classifier and LinkNet, a multiclass classifier. Networks were trained, validated, and tested with 120, 19, and 47 patients randomly selected. Pre-processing included whole prostate segmentation using contours from experts to objectively evaluate lesion detection by CADs. CAD-generated 3D lesion probability maps were analyzed. Lesion detection performance was evaluated against (1) a tumor contour reference standard drawn by expert radiologists and a pathologist using biopsy specimens and (2) a state-of-the-art CAD system, HED5x5, an edge-detection DCNN.

RESULTS

Cancers are detected in the whole prostate by U-Net and LinkNet with average AUCs of 0.94±0.01 and 0.93±0.01, respectively. In the PZ, where tumors are more common, AUCs are higher, 0.95 for U-Net and 0.94 for LinkNet, but lower for HED5x5 at 0.92. While U-Net's AUC is better than HED5x5's ($P < 0.01$) in the whole prostate, PZ, and TZ, its false positive rates (FPR) are higher. For 80% detection, LinkNet is superior with 6% FPR; U-Net is 10% and HED 9%. Both LinkNet and U-Net outperform published expert radiologist detection rates of 46.7% against whole-mount histopathology- the same reference standard method as ours. At this expert-equivalent 46.7% sensitivity, the CADs have very low FPR; 1% for LinkNet, 1.6% for U-Net. Both CADs are robust to mpMRIs with or without an ERC, with similar performance by U-Net and LinkNet. Qualitatively, LinkNet generates the best heatmaps. It captures high probability tumor regions with low predictions elsewhere.

CONCLUSION

Automated detection of PCa lesions by two DCNNs outperformed an existing state-of-the-art HED model and surpassed published expert radiologist sensitivity.

CLINICAL RELEVANCE/APPLICATION

Our CAD demonstrates the potential of prostate cancer detection with voxel-level heat map images to direct radiologists' towards suspicious regions of mpMRI and/or improve MRI-guided biopsies.

BR189-ED-SUA6

Risk-y Business: ATMs to CHEKs: Understanding Risk of Breast Cancer in Patients with Genetic Mutations

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #6

Awards
Cum Laude

Participants
Zara Wadood, MD, Providence, RI (*Presenter*) Nothing to Disclose
Lauren Massingham, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Z Liu, MD, Providence , RI (*Abstract Co-Author*) Nothing to Disclose
Bianca M. Carpentier, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Review some of the common genetic terminology as it relates to increased risk of breast cancer. 2. Understand the purpose of multi-gene panel testing and why its use is increasing. 3. Learn about five of the more common genetic mutations besides BRCA which have been linked to an increased risk of breast cancer. 4. Learn how these specific mutations relate to different types of breast cancer. 5. Learn where to access useful updated resources regarding gene mutations and their relationships to risk of breast cancer.

TABLE OF CONTENTS/OUTLINE

1. Genetic terminology (i.e. VUS) 2. Direct to consumer genetic testing (i.e. 23 and me) Uses and limitations 3. Overview of genetic mutations (p53, ATM, CDH1, CHEK2, PALB2) 4. Respective increased risk of breast cancer Specific types, when applicable 5. Sample Cases 6. Future Direction and Summary

BR190-ED-SUA7

The Picture is Clear: Acoustic Parameters in Breast Ultrasound (A Primer for Residents and Fellows)

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #7

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Matthew Bigelow, MD, Vestal, NY (*Presenter*) Nothing to Disclose
Ekta Gupta, MD, Floral Park, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. The value of breast ultrasound (US) for the detection of breast lesions depends on image quality, which itself is heavily operator dependent. 2. Knowledge of various technical parameters is imperative for image optimization and accurate diagnsois. 3. Breast US should be performed using a high-resolution broadband linear transducer (TD) with a center frequency of at least >12 MHz or greater. 4. In macromastic patients, lower frequency TDs may augment a standard exam. However, radiologists should be aware of the inverse relationship between depth penetration and spatial resolution. 5. When gain is too low, fat lobules darken and a solid mass can mimic a cyst. Conversely if the gain is too high, fat lobules brighten mistaking a cyst for a solid mass. 6. Harmonic imaging reduces artifacts such as reverberation, side-lobe, clutter and speckle, improving contrast resolution.

TABLE OF CONTENTS/OUTLINE

1. Approach for optimizing breast ultrasound images 2. Review of following US parameters along with clinically relevant US physics: a. Transducer frequency b. Depth and Field of View (FOV) c. Focal Zone d. Gain and Dynamic range e. Tissue harmonics f. Spatial compounding g. Doppler imaging 3. Physics related pearls and pitfalls in evaluating lesions

BR191-ED-SUA8

BI-RADS 5 - NOT!

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #8

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Kimberly A. Dao, MD, Boston, MA (*Presenter*) Nothing to Disclose
Rutuparna Sarangi, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Anna Rives, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael D. Fishman, MD, Boston, MA (*Abstract Co-Author*) Consultant, Zebra Medical Vision Ltd; Scientific Advisory Board, Hologic, Inc
Priscilla J. Slanetz, MD,MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

A BI-RADS category 5 assessment is used when, based on imaging findings, the likelihood of malignancy is felt to be >= 95%. However, not all BI-RADS 5 lesions are malignant. There are a variety of benign entities that may be categorized as BI-RADS 5 and prompt surgical excision or repeat biopsy when encountered on percutaneous core biopsy. Radiologists should be aware of these BI-RADS 5 mimickers in order to inform optimal patient management.

TABLE OF CONTENTS/OUTLINE

Describe the proper use of the BI-RADS category 5 and its implications for management. Review classic imaging features of breast cancer on multimodality imaging (mammography, ultrasound and magnetic resonance imaging). Discuss imaging findings (mammography, ultrasound and MRI) and management of a variety of benign diseases that may be categorized as BI-RADS 5, including: Chronic mastitis Complex sclerosing lesion/radial scar Diabetic mastopathy Fat necrosis Fibromatosis or desmoid tumor Granular cell tumor Granulomatous mastitis Infection, such as from mycobacterium avium intracellulare (MAI)

BR192-ED-SUA9

Imaging Features and Biopsy Techniques of Internal Mammary Lymph Nodes in Breast Cancer

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #9

Participants
Lucy Chow, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Craig Wilsen, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Anne C. Hoyt, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Melissa M. Joines, MD, Manhattan Beach, CA (*Abstract Co-Author*) Nothing to Disclose
Robert D. Suh, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Kara-Lee Pool, MD , Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The internal mammary lymph node basin receives lymphatic drainage from all four quadrants of the breast, but mainly from the medial and central breast. Isolated internal mammary nodal metastasis is identified in a small percentage of overall breast cancers; however internal mammary nodal disease has significant prognostic and therapeutic implications. Though more challenging than axillary lymph node biopsy, internal mammary lymph node biopsy safely delivers timely and valuable guidance for management of breast cancer patients. Objectives: 1) Describe the significance of the internal mammary lymph nodes in the setting of breast cancer 2) Appreciate multimodality ultrasound, CT, and MRI image findings for internal mammary lymph nodes 3) Review ultrasound-guided and CT-guided techniques of internal mammary lymph node biopsy 4) Understand the management of breast cancer patient with internal mammary lymphadenopathy

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Anatomy of the internal mammary lymph node chain 3. Review of multi-modality ultrasound, CT, and MRI imaging characteristics of internal mammary lymphadenopathy 4. Differential diagnosis of internal mammary lymphadenopathy 5. Ultrasound-guided and CT-guided biopsy techniques 6. Medical and surgical management of breast cancer patient with internal mammary lymphadenopathy 7. Illustrative cases 8. Summary

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BR222-SD-SUA2

We Are All SO Dense: The Continuing Challenge of Mammographic Density Assessment

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #2

Participants
Leah H. Portnow, MD, Brookline, MA (*Presenter*) Nothing to Disclose
Irfanullah Haider, MD, MBA, Salt Lake City, MA (*Abstract Co-Author*) Nothing to Disclose
Mirelys Barrios, MD , Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Dianne Georgian-Smith, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kerrie P. Nelson, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sughra Raza, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

1. To determine the effect of BIRADS 5th edition (5th-ed) guidelines on inter-reader agreement regarding visual mammographic density assessment compared to previously used BIRADS 4th edition (4th-ed) criteria. 2. To compare assessed distribution across density categories using 5th-ed vs. 4th-ed. 3. To compare agreement between visual and quantitative volumetric density assessments in 5th-ed vs. 4th-ed.

METHOD AND MATERIALS

In an IRB-approved retrospective review, 7 breast imaging radiologists reviewed 200 screening full field digital mammograms for visual density assessment using 5th-ed. This assessment was compared to previously published data of the same 7 readers evaluating the same 200 mammograms, previously selected as equal numbers in categories A, B, C, D by consensus of 2 senior imagers, using 4th-ed. Overall inter-reader agreement was compared using Nelson's kappa (κ)-statistics for ordinal data. Quantitative volumetric density using the commercially available tool Volpara was compared with both reader assessments.

RESULTS

Inter-reader agreement using 5th-ed criteria is moderately strong at 0.736 (Nelson's κ, s.e. = 0.013), similar to agreement using 4th-ed criteria at 0.721 (Nelson's κ, s.e. = 0.026). A statistically significant difference in assessed distribution of density categories is seen using 5th-ed vs. 4th-ed ($p < 0.0001$), with overall increase in category B (mean 5th-ed 30.8% vs. mean 4th-ed 25.1%) and C (mean 5th-ed 35.3% vs. mean 4th-ed 26.5%). A statistically significant difference is also seen in distribution of not dense categories A/B combined (5th-ed, 43% vs. 4th-ed 53.3%) vs. dense categories C/D combined (5th-ed, 57% vs. 4th-ed 46.7%; $p < 0.0001$). There is moderate reader vs. Volpara agreement for both the 5th-ed (weighted Cohen's κ range = 0.76-0.85) and 4th-ed (weighted Cohen's κ range = 0.76-0.83, CI 95% 0.63-0.86).

CONCLUSION

Although inter-reader agreement is similar with both BI-RADS guidelines, a significant difference in distribution across density categories is noted, with more mammograms in dense categories C/D using 5th-ed criteria. Agreement between visual and quantitative volumetric density assessment remains similar.

CLINICAL RELEVANCE/APPLICATION

Breast imaging readers in this study placed significantly more mammograms in the dense categories using BI-RADS 5th edition guidelines, which has implications for patients due to density legislation encouraging enhanced surveillance.

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BR223-SD-SUA3

Diagnostic Performance of HHUS in Differentiating Benign and Malignant Complex Cystic and Solid Breast Lesions

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #3

Participants
Huiling Xiang, Guangzhou, China (*Presenter*) Nothing to Disclose
Liu Lixian, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Guo-xue Tang, Guangzhou , China (*Abstract Co-Author*) Nothing to Disclose
Xi Lin, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

This study aimed to explore the value of handheld ultrasound(HHUS) in differential diagnosis of benign and malignant cystic and solid breast lesions.

METHOD AND MATERIALS

From January 1, 2000 to December 31, 2018, 505 pathology proven complex cystic and solid breast lesions in 492 patients were retrospectively analyzed. These lesions were divided into four types according to ultrasonic features: type I, with thick wall and/or septations (>0.5mm); type II, with one or multiple mural or papillary nodules; type III, mixed cystic and solid lesion (the cystic component>50%) or type IV, predominantly solid lesion with cystic spaces (the solid part > 50%). Features of each lesion were recorded based on ACR BI-RADS lexicon. Predictive positive values (PPVs) of all types were identified. The values of AUC, sensitivity, specificity, PPV and NPV of each related malignant factor were calculated.

RESULTS

The mean age of 492 patients included in this study was 45.3(SD 12.6). There were 279(55.2%) benign and 226(44.8%) malignant lesions confirmed by pathology. Based on ultrasonic features, 73 lesions were classified as type I, 55 lesions as type II, 100 and 277 lesions as type III and IV, respectively. The PPVs for malignancy were statistically different between any two groups, except for type III and type IV (P<0.283). PPVs of type III(55%) and IV(48.7%) were higher, compared with type I (35.6%)and II(18.2%) (P<0.001). Age over 51 years old, diameter larger than 26mm, uncircumscribed margin and the presence of structure distortion, vascularity and abnormal axillary lymph nodes were identified to be independent factors for malignancy. Combining these factors to differentiate benign from malignant group, the value of AUC, sensitivity, specificity, PPV and NPV reached 0.840, 65.5%, 87.8%, 81.3% and 75.9% respectively.

CONCLUSION

Complex cystic and solid breast lesions should be at least categorized to BI-RADS 4B, and type III lesions classified as BI-RADS 4C may also be reasonable. HHUS is useful in distinguishing benign and malignant complex cystic and solid breast lesions.

CLINICAL RELEVANCE/APPLICATION

Complex cystic and solid breast lesions are usually simply classified as category 4 and their subclassifications depend on doctors' experience. Based on a large number of cases, this study suggests more accurate subclassification of cystic and solid lesions could be achieved by HHUS which is useful in clinical practice.

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BR224-SD-SUA1

MRI Radiomics Signature: Association with Disease-Free Survival in Patients with Triple Negative Breast Cancer

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #1

Participants
Vivian Y. Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sungwon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Jung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop and validate a radiomics signature based on preoperative magnetic resonance imaging (MRI) to estimate disease-free survival (DFS) in patients with triple negative breast cancer.

METHOD AND MATERIALS

We identified 289 consecutive patients with newly diagnosed triple negative breast cancer who had underwent preoperative MRI and surgery between April 2012 and December 2016. Patients were temporally divided into training (n= 169) and validation (n=59) sets. Radiomics features were extracted from T2-weighted and contrast-enhanced T1- weighted MRI. A radiomics signature was generated by using the LASSO method in Cox regression. Univariate and multivariate Cox proportional hazards models were used to determine the association of the radiomic signature and clinicopathologic variables with DFS. A radiomics model combining the radiomics signature and clinicopathologic factors was constructed to validate the radiomics signatures for individualized DFS estimation. The incremental values of the radiomics signature were evaluated by using the integrated area under the receiver operating characteristic curve (iAUC) and bootstrapping (n = 1000).

RESULTS

The radiomics signature, which consisted of 5 selected MRI features, was significantly associated with worse DFS in both the training and validation sets ($P = 0.002$, $P = 0.033$, respectively). Among clinicopathologic factors, lymphovascular invasion and pathologic axillary lymph node metastasis (N0 vs. N1, N0 vs. N2/3) were associated with worse DFS ($P = 0.0458$, $P = 0.0347$, $P = 0.0013$, respectively). A radiomics model which incorporated the radiomics signature and clinicopathologic factors demonstrated better performance than the clinicopathologic model in the training set (iAUC, 0.844, 0.764, respectively, $P < 0.001$) and the validation set (iAUC, 0.765, 0.691, respectively, $P < 0.001$)

CONCLUSION

The radiomics signature at preoperative MRI can improve DFS survival prediction when integrated with pathologic features in patients with triple negative breast cancer.

CLINICAL RELEVANCE/APPLICATION

Radiomics features at preoperative MRI may serve as a biomarker for risk stratification for DFS in patients with triple negative breast cancer, and potentially affect patient management strategy.

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BR257-SD-SUA4

Mammography Performance Benchmarks in a Population-Based Screening Cohort of One Million Digital Examinations

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #4

Awards
Trainee Research Prize - Resident

Participants
Mattie Salim, MD, Stockholm, Sweden (*Presenter*) Nothing to Disclose
Karin Dembrower, MD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Martin Eklund, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Peter Lindholm, MD, PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose
Fredrik Strand, MD,PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Our aim was to establish performance benchmarks for AI tumor detection by examining the performance of breast radiologists and to determine for which tumor types sensitivity differ the most.

METHOD AND MATERIALS

The study population consisted of all examinations for women 40 to 74 years of age in a defined geographical area who underwent screening examinations between 2008 and 2015 using FFDM. There were 110 interpreting radiologists of which 24 were defined as breast radiologists based on exceeding 5,000 annual exams. True positive was defined by obtaining a pathology-confirmed cancer within 12 months. Performance benchmarks included sensitivity and specificity, which were examined per quartile of radiologists' performance and subdivided by tumor characteristics.

RESULTS

After exclusion of 23,033 examinations with unknown radiologist, there were 1,186,045 screening examinations with digital mammograms, of which 972,899 had been assessed by a breast radiologist. For the least sensitive quartile of breast radiologists, sensitivity and specificity was 58% and 98% respectively. For the most sensitive quartile the corresponding numbers were 83% and 95% ($p<=0.001$ for difference between quartiles). The relative sensitivity differences between most and least sensitive quartile was 4.3 ($p<0.001$) for lobular cancers, 1.6 ($p<0.001$) for ductal cancers; 1.9 ($p<0.001$) for luminal A, 3.2 ($p=0.019$) for luminal B, 4.5 ($p=0.020$) for Her2-overexpressing and 3.9 ($p=0.005$) for basal tumors. Relative sensitivity differences related to tumor size and invasiveness were less pronounced.

CONCLUSION

We determined benchmarks showing a wide range of performance differences between breast radiologists. Lobular cancers and Her2-overexpressing cancers were associated with the largest relative sensitivity differences and may require deliberate training to master.

CLINICAL RELEVANCE/APPLICATION

We have established mammographic performance benchmarks, and quantified the sensitivity differences by tumor subtypes, to use as guidance for radiologist training and AI CAD system evaluations.

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BR258-SD-SUA5

Association of the Kaiser Score with Invasiveness of Breast Cancer: Could it Provide Actionable Information?

Sunday, Dec. 1 12:30PM - 1:00PM Room: BR Community, Learning Center Station #5

Participants
Matthias Dietzel, MBA,MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Rudiger Schulz-Wendtland, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Stephan Ellmann, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Evelyn Wenkel, MD, Erlangen, Germany (*Abstract Co-Author*) Speaker, Siemens AG
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Michael Uder, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias S. May, MD, Erlangen, Germany (*Presenter*) Speakers Bureau, Siemens AG

PURPOSE

The Kaiser-Score (KS) is an evidence based decision rule based on MRI BI-RADS descriptors. High diagnostic accuracy in the differential diagnosis of benign vs. malignant lesions and high inter-observer reliability has been demonstrated by numerous investigators at multiple institutions. We investigated whether there is also an association between the KS and invasiveness of breast cancer.

METHOD AND MATERIALS

Consecutive patients scheduled for breast MRI (standardized protocols @ 1.5T: dynamic T1-GRE before/after Gd-DTPA [0.1 mmol/kg body weight]; T2-TSE), with subsequent pathological sampling, were investigated. The KS was assessed by two experienced radiologists in consensus (blinded to pathology). Association of KS with invasiveness (benign vs. ductal carcinoma in situ [DCIS] vs. malignant) was assessed by descriptive statistics, Kruskal-Wallis test, correlation- and ROC-analysis (a=5%).

RESULTS

There were 71 DCIS, 531 invasive cancers and 436 benign lesion in 986 patients (mean age: 55.3y, range: 16-87y). There was a significant correlation of the KS with invasiveness (rho=0.7; $P<0.001$). KS enabled the differentiation of DCIS both from benign lesions (AUCDCIS vs. benign=74%; $P<0.001$) and from invasive cancer (AUCDCIS vs. invasive=77.2%; $P<0.001$). A KS >9 accurately identified invasive cancers (specificity=97.6%, sensitivity=41.5%, positive likelihood ratio/+LR=17.4). A KS <6 accurately identified DCIS (specificity=94.0%, sensitivity=33.8%, +LR=5.6).

CONCLUSION

The KS reflects invasiveness of breast cancer. Using appropriate thresholds, the KS enables almost definite identification of patients with invasive breast cancers.

CLINICAL RELEVANCE/APPLICATION

The KS can differentiate DCIS from invasive cancer. Such actionable information could aid the treatment strategy and impact for example the type or extent of breast surgery and the approach to the axillary staging.

CA158-ED-SUA7

Recent Technologies in Coronary Stent CT Angiography: Impact of the Ultra High Resolution CT on Its Image Quality

Sunday, Dec. 1 12:30PM - 1:00PM Room: CA Community, Learning Center Station #7

Participants
Keiichi Ohnishi, Saitama , Japan (*Presenter*) Nothing to Disclose
Mika Tsuboi, Tokyo, Japan (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation

TEACHING POINTS

1. Understand Ultra-High Resolution CT (UHR CT) and conventional CT for angiography evaluation. 2. Understand imaging protocols for angiography evaluation. 3. Understand clinical improvements achieved by in-stent restenosis evaluation.

TABLE OF CONTENTS/OUTLINE

1. Comparison of UHR CT and conventional CT -CT angiography with 64-slice detects pathological abnormalities larger than 3.0 mm, but is not practically useful. -To improve evaluation of narrow stented vessels, coronary subtraction or dual energy imaging (discrimination of organic matter) is generally employed. -For patients meeting the requirements to receive UHR CT, it effectively detects abnormalities in stented vessels larger than 2.25 mm. -Improved image quality scores of UHR CT in-stent occlusions are 2 times larger than that of conventional CT. 2. Imaging protocols -Larger resolving power -Use of 140 kVp reduced beam hardening -Smaller focal size -Larger matrix size -Unique reconstructing technology of FBP vs. Hybrid IR/FIRST -Decreased exposure dose -Patient evaluation by stent inner diameter sizes (relationships between HR and motion) 3. Clinical improvements of the in-stent restenosis -Evaluates neointimal growth in stents. -Finds non-ACS cases for patient with coronary stenting: Saves examination time, length of hospital stay, and examination fees by eliminating treadmill and CAG.

CA159-ED-SUA6

Detecting Post-Fontan Hepatic Complications

Sunday, Dec. 1 12:30PM - 1:00PM Room: CA Community, Learning Center Station #6

Participants
Jiun Yiing Hu, MSc, Baltimore, MD (*Presenter*) Nothing to Disclose
Alan M. Ropp, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Cara E. Morin, MD,PhD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Jean Jeudy JR, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Advances in the palliative Fontan procedure for univentricular physiology have resulted in prolonged patient survival well into adulthood. However, this circuit has deleterious long-term effects on hepatic circulation with many patients going on to develop hepatocellular carcinoma in the setting of post-Fontan cirrhosis. The goals of this exhibit are to: - Review the pathophysiology of post-Fontan cirrhosis - Illustrate challenges in early diagnostic screening - Describe a novel MRI protocol for combined cardiac and hepatic functional assessment

TABLE OF CONTENTS/OUTLINE

1. Introduction to Fontan procedure and post-Fontan circulatory changes 2. Long-term complications with radiologic and pathologic correlations 3. Challenges in early diagnostic screening 4. Recommended protocol for combined cardiac and hepatic MR imaging 5. Take-home points

CA200-SD-SUA1

Diagnostic Potential and Benefits of Myocardial Infarction and Non-Ischemic Myocardial Disease Using Subtraction Myocardial Image for Late Iodine Enhancement (SMILIE) in Cardiac CT

Sunday, Dec. 1 12:30PM - 1:00PM Room: CA Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Participants
Takayoshi Yamaguchi, Sapporo, Japan (*Presenter*) Nothing to Disclose
Yuichi Kondoh, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Mari Morita, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Tanikoshi, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiichi Hanaoka, MD,PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Clinical usefulness of evaluating infarcted myocardial and non-ischemic myocardial disease in cardiac CT examination.How to improve the representation of Late Iodine Enhancement (LIE) by using image subtraction technique.Reduction of exposure dose in multi-phase imaging using 320-slice CT.Comparison with cardiac magnetic resonance imaging (MRI).

TABLE OF CONTENTS/OUTLINE

The advantage for CT: Applicable to device transplant patients who are absolutely contraindicated for MRI. Detailed assessment of myocardial lesions using high spatial resolution of CT. Positional relationship between coronary artery and myocardial lesion can be evaluated in the same space. Incidental detection by SMILIE of non-ischemic cardiomyopathy such as myocardial infarction and sarcoidosis.Advanced technique to extract LIE in 320-silice CT: Proposal of new subtraction method. Necessities for non-rigid registration processing. Noise reduction and beam hardening correction using full iterative reconstruction technique. Comparison with cardiac magnetic resonance imaging. -OUTLINE- We developed a new CT method to subtract myocardial images for later iodine enhancement (SMILIE). By using SMILIE, it is possible to diagnose various myocardial diseases with CT, even if invasive coronary angiography and MRI are omitted.

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CA201-SD-SUA2

Efficacy of Spectral Imaging Using Dual-Layer Spectral Detector Computed Tomography for Acute Coronary Syndrome

Sunday, Dec. 1 12:30PM - 1:00PM Room: CA Community, Learning Center Station #2

Participants
Junji Mochizuki, MSc,RT, Tokyo , Japan (*Presenter*) Nothing to Disclose
Takeshi Nakaura, MD, Amakusa, Japan (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

The purpose of this study was to assess the efficacy of spectral imaging with dual-layer spectral detector computed tomography (CT) for diagnosing acute coronary syndrome.

METHOD AND MATERIALS

We retrospectively included 33 consecutive patients who had undergone cardiac CT using dual-layer spectral detector CT and had been diagnosed with acute ischemic syndrome using invasive coronary angiography. We reconstructed 120-kVp images and created virtual monochromatic images (VMI, 40-200 keV in 10-keV increments), iodine concentration map, and effective atomic number (Z) map. We calculated the contrast and contrast-to-noise ratio (CNR) between the normal and hypoperfused myocardium and selected the VMI of the best CNR for quantitative analysis. Furthermore, we compared the image noise, contrast, and CNR at 120 kVp and the best VMI, CT value, iodine concentration, and effective Z between normal and hypoperfused myocardium using a paired t-test. Qualitative analyses were performed by two board-certified radiologists for 120-kVp images and the best VMI using a Wilcoxon signed-rank test.

RESULTS

The 40-keV image displayed the best CNR. No significant difference was observed in the image noise between the 120-kVp images (12.6 ± 4.8 HU) and the 40-keV images (16.6 ± 13.0 HU; $P = 0.07$). The contrast (120 kVp: 41.5 ± 20.4 HU vs. 40 keV: 1113.4 ± 49.0 HU) and CNR (120 kVp: 3.6 ± 2.0 vs. 40 keV: 9.1 ± 6.7) between normal and hypoperfused myocardium were significantly higher in the 40-keV images than in the 120-kVp images ($P < 0.01$). The iodine concentration and effective Z were significantly higher in the normal myocardium (1.4 ± 0.6 and 8.1 ± 0.2 mgI/mL) than in the hypoperfused myocardium (0.3 ± 0.3 and 7.4 ± 0.4 mgI/mL; $P < 0.01$). In qualitative analyses, the visual scores of the image contrast and overall image quality were significantly higher in the 40-keV than in the 120-kVp images ($P < 0.05$).

CONCLUSION

Spectral imaging using dual-layer spectral detector CT is a feasible technique for detecting hypoperfused areas in acute ischemic syndrome.

CLINICAL RELEVANCE/APPLICATION

Spectral imaging might be a promising technique to evaluate the myocardial hypo-perfusion in acute coronary syndrome.

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CA202-SD-SUA3

Comparison of the Prevalence of High-Risk Plaque Between Metabolic Syndrome and Non-Metabolic Syndrome: Evaluation with DSCT Angiography

Sunday, Dec. 1 12:30PM - 1:00PM Room: CA Community, Learning Center Station #3

Participants
Rui Shi, Chengdu, China (*Presenter*) Nothing to Disclose
Zhigang Yang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Jin Wang, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Metabolic disorder was proven to be a risk factor for coronary artery disease. However the association of metabolic syndrome with high-risk plaque was unclear. The present study aimed to compare the incidence of high-risk plaques (HRP) in coronary artery disease(CAD) patients treated with selective percutaneous coronary intervention(PCI) between metabolic syndrome patients and non-metabolic syndrome individuals using dual-source CT.

METHOD AND MATERIALS

A total of 124 subjects had prior PCI were consecutively included. All the patients were grouped into two groups according to their metabolic condition:metabolic syndrome(49) and non-metabolic syndrome(75). Clinical variables and CAD risk factors of the two groups were obtained through patient questionnaire and medical records systems. Metabolic syndrome were diagnosed based on the recommendation of Chinese Diabetes Society(CDS). The coronary computed tomography angiography(CCTA) scans were analyzed. The distribution, stenosis severity and types of plaques and high-risk plaques (including low-attenuation plaque, napkin-ring sign, spotty calcification, and positive-remodeling) showed on the CCTA data were recorded and compared.

RESULTS

No significant differences on the segment involved score (SIS), segment severity score (SSS) or types of plaques between diabetic patients and non-diabetic patients(P=0.232). More high-risk plaques(HRP) were found in metabolic syndrome patients(14 patients [45.2%]) than in non-metabolic syndrome patients(11 patients [17.2%]) (P=0.032). It showed that the napkin-ring sign was the most common type, followed by the positive-remodeling. Further, logistic regression analysis showed that matabolic syndrome was independently associated with HRP (OR 4.965; 95% CI:1.525-16.165, P=0.007).

CONCLUSION

Metabolic syndrome patients and non-metabolic syndrome patients share the same degree of coronary plaque burden after undergoing PCI, whereas metabolic syndrome patients have more high-risk plaques. In addition, metabolic syndrome may be an important predictor of high-risk plaques in PCI treated patients. Thus, more attention should be payed to metabolic management after PCI to combat the development of HRP, which was proven to be a potential risk for acute coronary syndrome.

CLINICAL RELEVANCE/APPLICATION

CCTA possesses the ability of assessing coronary plaque composition and evaluating HRP, which was proven to be a potential risk for acute coronary syndrome.

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CA239-SD-SUA5

"One-Stop" Computed Tomography Myocardial Perfusion Imaging: A Novel Protocol for Comprehensive Evaluation in Patients with Coronary Artery Disease

Sunday, Dec. 1 12:30PM - 1:00PM Room: CA Community, Learning Center Station #5

Participants
Keling Liu, Chengdu, China (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate the feasibility of 'one-stop' computed tomography (CT) myocardial perfusion imaging (CTP) in patients with coronary artery disease (CAD) using 16-cm wide detector CT, compared with conventional coronary CT angiography (CCTA).

METHOD AND MATERIALS

Totally 470 patients with suspected CAD were enrolled and randomly divided into two groups. Patients in group A underwent 'one-stop' CTP examination [CCTA+CTP+CT cardiac function (CTF)], whereas group B underwent conventional CCTA examination. Subjective image quality was independently evaluated by two radiologists using a 4-score system. Objective Image quality of CT images was assessed by the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). Radiation and contrast medium doses and scan time of the two groups were recorded. Group A was further divided into four subgroups according to the degree of coronary artery stenosis, for which transmural perfusion ratio (TPR) and left ventricular ejection fraction (LVEF) were measured on the software Ziostation2 (Minato-kuTM, Japan). One-way ANOVA or Kruskal-Wallis test was used to analyze the difference between the LVEF and the minimum TPR of four subgroups. Spearman correlation was used to analyze the relation between the degrees of coronary artery stenosis and the minimum TPR or LVEF.

RESULTS

Scan time was 73.1 ± 7.3 (s) longer in group A than in group B with 11.5% reduction of radiation dose ($P < 0.001$) and no significant difference in image quality was noted. Significant differences regarding the minimum TPR ($F = 24.657$, $P < 0.001$) and LVEF ($\chi 2 = 36.98$, $P < 0.001$) were observed among the four subgroups. A negative correlation was found between the degree of coronary artery stenosis and the minimum TPR of the corresponding myocardial segments ($r = -0.55$, $P < 0.001$). Patients with moderate to severe arterial stenosis exhibited a decreased LVEF compared with those with normal coronary arteries (48.0% vs 56.5%, $P < 0.001$).

CONCLUSION

Compared with conventional CCTA, 'one-stop' CTP can be a novel protocol to comprehensively evaluate coronary artery stenosis, myocardial perfusion and LV cardiac function, with reduced radiation and contrast medium doses.

CLINICAL RELEVANCE/APPLICATION

'one-stop' CTP examination using 16-cm wide detector CT can provide more diagnostic information than conventional CCTA, not only coronary anatomy, but also cardiac function and myocardial perfusion.

CH212-ED-SUA8

Essentials of Thoracic Neurogenic Tumors

Sunday, Dec. 1 12:30PM - 1:00PM Room: CH Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
Kirang Patel, MD, Kansas City, MO (*Presenter*) Nothing to Disclose
Sherief Garrana, MD, Kansas City, MO (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Jimenez, MD, Mission Hills, KS (*Abstract Co-Author*) Reed Elsevier
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Sonia L. Betancourt Cuellar, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Because neoplasms may arise from any portion of the complex intrathoracic neural anatomy, prospective diagnosis of neurogenic tumors is challenging. Definitive diagnosis requires histologic examination, but imaging features may help suggest the diagnosis. Understanding and recognizing the spectrum of imaging and histopathologic features of thoracic neurogenic tumors and identification of involvement of adjacent structures is important in the prospective diagnosis of these lesions and helps expedite management of affected patients.The purpose of this exhibit is to: - Review the spectrum of intrathoracic neurogenic neoplasms- Highlight common patterns and characteristic imaging features- Discuss the differential diagnosis of these lesions including thoracic meningoceles, perineural cysts, and extramedullary hematopoiesis

TABLE OF CONTENTS/OUTLINE

Familiarity with the imaging features and distinguishing characteristics of intrathoracic neurogenic tumors helps formulate a focused differential diagnosis. After reviewing the gross and histologic features of these tumors, the imaging characteristics of each of the following will be discussed. A. SchwannomaB. NeurofibromaC. Malignant peripheral nerve sheath tumorD. GanglioneuromaE. GanglioneuroblastomaF. NeuroblastomaG. Paraganglioma

CH213-ED-SUA5

Finding Hemo: Imaging in Hemoptysis

Sunday, Dec. 1 12:30PM - 1:00PM Room: CH Community, Learning Center Station #5

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Kaitlin Marquis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Constantine A. Raptis, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Santiago E. Rossi, MD, Buenos Aires City, Argentina (*Abstract Co-Author*) Speaker, Boehringer Ingelheim GmbH; Speaker, Novartis AG
Daniel D. Picus, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Review the clinical definition of hemoptysis2. Discuss how CT can be used in the evaluation of patients with hemoptysis3. Introduce treatment strategies employed in the management of patients with hemoptysis

TABLE OF CONTENTS/OUTLINE

1. Hemoptysis - clinical definition2. Etiologies of hemoptysis A. Infections i. Bacterial ii. Mycobacterial iii. Fungal B. Bronchiectasis C. Malignancies D. Fistulae E. Vasculitis F. Pulmonary embolism G. Fibrosing mediastinitis H. Anticoagulation I. Dieulafoy lesion J. Bronchitis and anthracosis3. CT in the diagnosis of hemoptysis A. Technique B. Identifying source i. Bronchial ii. Pulmonary iii. Other systemic C. Indirect signs i. Focal tree-in-bud ii. Ground glass and consolidation iii. Enlarged/increased number of arteries iv. Focal enhancing pleural thickening D. Direct signs i. Blush or extravasation ii. Culprit lesion iii. Ground glass surrounding aneurysm or enlarged vessels iv. Irregular pulmonary artery or aorta, particularly with abutment of bronchial tree4. Treatment options A. Angiogram with embolization B. Surgery

CH214-ED-SUA6

The Role of Thoracic Imaging in Cystic Fibrosis: Correlation with Clinical and Physiological Findings

Sunday, Dec. 1 12:30PM - 1:00PM Room: CH Community, Learning Center Station #6

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Participants
Konstantinos Stefanidis, MD, PhD, London, United Kingdom (*Presenter*) Nothing to Disclose
Hasti Robbie, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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Dean Y. Huang, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Gibran Yusuf, MBBS, London, United Kingdom (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, Siemens AG
Ioannis Vlahos, MRCP,FRCR, Houston, TX (*Abstract Co-Author*) Director, Grayscale Ltd; Co-owner, Grayscale Ltd

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TEACHING POINTS

Cystic fibrosis (CF) is one of the most common genetic disorders with lung involvement. Imaging plays a pivotal role in the diagnosis, follow-up and staging of this clinical entity. Objectives:1. Present the current clinical guidelines and imaging recommendations.2. Illustrate and recognize the typical radiological patterns and complications. 3. Present the clinical significance of imaging-derived disease severity and progression.

TABLE OF CONTENTS/OUTLINE

1. Clinical presentation and current clinical guidelines.2. Common radiological patterns (CXR/CT).3. Imaging characteristics of common complications and imaging.• Infection- e.g. bacterial infections, non-tuberculous mycobacterial infection (NTM), fungal• Vascular - bronchial artery hypertrophy• Inflammatory - Allergic Bronchopulmonary Aspergillosis (ABPA).4. Staging of cystic fibrosis and current scoring systems.5. Correlation between imaging and pulmonary function tests.6. New imaging techniques (DECT, MRI).

CH216-ED-SUA7

Smoking-Related Lung Diseases: HRCT Findings, Clinical and Pathological Correlations

Sunday, Dec. 1 12:30PM - 1:00PM Room: CH Community, Learning Center Station #7

Participants
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Giovanni Gentile, Palermo, Italy (*Presenter*) Nothing to Disclose
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Ambra Di Piazza, MD, Palermo , Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Mamone, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Mariapina Milazzo, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Luigi Maruzzelli, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Miraglia, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Smoking related lung disease are a heterogeneous group of disorders characterized by damage to the pulmonary interstitial tissue, dyspnea, restrictive pulmonary function and impaired gas exchange. High-resolution CT is highly sensitive in the detection of abnormalities in the lung parenchyma and airways, however, in cases of non-specific findings, clinical findings and pathological anatomy play a fundamental and complementary role in order to make the right diagnosis and differentiating among the various entities.

TABLE OF CONTENTS/OUTLINE

To describe the high-resolution computed tomography (HRCT) features of lung disease smoking-related and their clinical and pathological abnormalities: Chronic obstructive pulmonary disease (COPD) Emphysema Respiratory bronchiolitis (RB) Respiratory bronchiolitis-associated ILD (RB-ILD) Desquamative interstitial pneumonia (DIP) Pulmonary Langerhans cell histiocytosis (PLCH) Acute eosinophilic pneumonia (AEP) Idiopathic pulmonary fibrosis (IPF) Combined pulmonary fibrosis and emphysema (CPFE) Airspace enlargement with fibrosis (AEF)

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CH243-SD-SUA2

Lung Tumor Segmentation for Volume Measurement Using Coupling-Net in Chest CT Images of Lung Cancer Patients

Sunday, Dec. 1 12:30PM - 1:00PM Room: CH Community, Learning Center Station #2

Participants
Sohyun Byun, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Julip Jung, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Volumetric lung tumor segmentation in CT images is essential for monitoring tumor response to therapy through longitudinal tracking of tumor volume changes and for finding prognostic and diagnostic predictions via CT radiomics. The main challenges with lung tumor segmentation are that the size distribution of the tumors varies from 1cm to 18cm and there are varying tumor locations. In this study, we propose coupling-net for robust lung tumor segmentation in various tumor shapes and locations.

METHOD AND MATERIALS

Contrast-enhanced CT images were obtained from 127 lung cancer patients with a cancer size ranging from 1.38 to 8.83cm confirmed by pathology images, which has a pixel size of 0.54~0.9mm, and a slice thickness of 2.5~10mm. To localize the tumor in consideration of 2.5D spatial information, a 2D segmentation network based on 2D U-net was learned in each axial, coronal, and sagittal planes. To generate a shape-focused prior of the tumor, the 2D segmentation results obtained from three orthogonal planes were combined through the maximum value voting. To refine the fine details of the tumor, a 3D segmentation network based on 3D U-net was learned by considering 3D spatial information and shape-focused prior.

RESULTS

In the experimental setting, 127 datasets were divided into 83 training sets, 21 validation sets, and 23 test sets, depending on the acquisition date. For performance evaluation, the test datasets were divided into four classes according to tumor location: isolated tumor(Class 1), chest wall and mediastinum attached tumor(Class 2 and 3), and tumors in apex and based of the lungs(Class 4). The performance of the proposed coupling-net showed the best performance of the comparison networks with 79.49% in the DSC at overall classes, and it showed 86.94%, 80.35%, 73.57%, and 84.08% in the DSC at Class 1, Class 2, Class 3, and Class 4, respectively. In the mediastinum attached tumor (Class 3), it showed relatively low performance compared to other classes because of the variety of tumor shapes.

CONCLUSION

Our coupling-net is able to segment lung tumors robustly without being significantly affected by size, shape and location of the tumor. (This research was supported by the Bio & Medical Technology Development Program of the NRF funded by the Ministry of Science &ICT(2015-2015M3A9A7029725)).

CLINICAL RELEVANCE/APPLICATION

Our method can be used for volume measurement and labeling for radiomics analysis of tumor.

CH244-SD-SUA3

Mono-Exponential Diffusion Weighted Imaging (DWI) of Chest Wall Tumors

Sunday, Dec. 1 12:30PM - 1:00PM Room: CH Community, Learning Center Station #3

Participants
Jordi Broncano, MD, Cordoba, Spain (*Presenter*) Nothing to Disclose
Javier Royuela, Cordoba, Spain (*Abstract Co-Author*) Nothing to Disclose
Pilar Caro, MD, Cadiz, Spain (*Abstract Co-Author*) Nothing to Disclose
Javier Sanchez, MD, PhD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Paula Montesinos de la Vega, Madrid, Spain (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Antonio Luna, MD,PhD, Jaen, Spain (*Abstract Co-Author*) Speaker, Canon Medical Systems Corporation; Speaker, Koninklijke Philips NV; Speaker, Siemens AG

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PURPOSE

To evaluate the feasibility and diagnostic performance of quantitative analysis of mono-exponential DWI in chest wall tumors.

METHOD AND MATERIALS

51 patients, 21 males and 30 females were included. DWI including b=0 and 800 s/mm2 were acquired in axial orientation covering the entire lesion. Automatic Apparent Diffusion Coefficient (ADC) maps were generated. Manual ROI were placed on the lesion and pectoralis muscle both at high b value and ADC map images. Mean signal intensity (SI), mean and minimum ADC were recorded at the lesion and pectoralis muscle. Normalized values (signal intensity ratio; SIR = SIlesion/SIpectoralis muscle; mean and minimum ADC ratios; ADCr=ADClesion/ADCpectoralis muscle) were calculated. 18 Malignant and 33 benign lesions of the chest wall were analyzed. Benign lesions were divided into three categories: lipomas, elastofibroma dorsi (EFD) and other origin. U Mann-Whitney, Kruskall Wallis tests and ROC curves were applied with a two - tailed a error of 0.05.

RESULTS

Significant differences in SI and SIR were obtained between benign and malignant chest wall tumors (386.68 +/- 561.99 vs. 1277.16 +/- 767.64 and 2.44 +/- 5.46 vs. 7.04 +/- 5.53; $p<0.05$). Significant differences in ADCminimum of the lesion was also obtained (788.38 +/- 752.38 vs. 1414.49 +/- 746.94; $p<0.05$), being lower in lipomas and EFD. ROC curves revealed significant higher area under the curve in SI based measurements (0,89; $p<0,001$) rather than in ADC based ones (0.67-0.76; $p<0.05$).

CONCLUSION

DWI is feasible in the evaluation of chest wall tumors. Intensity based parameters displayed better diagnostic performance than ADC based ones for differentiation of benign and malignant origin.

CLINICAL RELEVANCE/APPLICATION

DWI of chest wall tumors may aid in the differentiation of benign from malignant masses.

CH276-SD-SUA4

The Value of Fast Scanning Protocol on 16cm Wide-Detector Scanner in Chest CT for Patients with Severe Chronic Obstructive Pulmonary Disease

Sunday, Dec. 1 12:30PM - 1:00PM Room: CH Community, Learning Center Station #4

Participants
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Yong Yu, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the value of fast scanning on a 16cm wide-detector CT in reducing motion artifacts in images of patients with severe Chronic Obstructive Pulmonary Disease (COPD).

METHOD AND MATERIALS

Sixty patients with severe COPD for non-enhanced chest CT were assigned to either study group (group A, n=30) or control group (group B, n=30). In both groups, 120kV tube voltage and automatic tube current modulation for achieving noise index (NI) presets were used. Group A used a 256-row 16cm wide-detector CT (GE Revolution CT) with 8cm collimation 0.992:1 pitch, 0.28s rotation speed, NI of 14HU and pre-30%ASIR-V. Group B used a 64-row CT with the conventional protocol of 4cm collimation, 0.984:1 pitch, 0.6s rotation speed and NI of 11HU. Images were reconstructed with 70%ASIR-V in Group A and 40%ASIR in Group B, both at 1.25mm slice thickness. The CT value and standard deviation (SD) of the back muscle and fat at the level of tracheal carina were measured. Two experienced radiologists using a 5-point system (5: best, 1: worst) blindly assessed the subjective image quality including the sharpness of small lung structures, and heart and breathing-induced motion artifacts. The scanning time was recorded and effective dose calculated using the recorded dose length product. Measurements were statistically compared.

RESULTS

The two groups had similar z-axis coverage of about 30cm. Group A had significantly shorter acquisition time (1.08±0.13s vs. 4.84±0.54s, $p<0.05$) and significantly lower radiation dose (1.94±0.55mSv vs. 5.30±0.94mSv, $p<0.05$). The CT and SD values in the two groups were statistically the same ($p>0.05$). However, Group A significantly improved image quality compared with Group B (4.76±0.49vs. 3.63±0.94) ($p<0.05$), and with much less occurrence of motion artifacts.

CONCLUSION

Fast scanning protocol in chest CT on a 16cm wide-detector scanner requires about 1s to cover the entire chest, results in much lower radiation dose and improved image quality with reduced motion artifacts for severe COPD patients with impaired respiratory function.

CLINICAL RELEVANCE/APPLICATION

Fast scanning protocol in chest CT on a 16cm wide-detector scanner can provide excellent images with reduced motion artifacts for severe COPD patients and much reduced radiation dose.

ER157-ED-SUA7

Pancreatic Injury: Comprehensive Imaging Review and Management Update

Sunday, Dec. 1 12:30PM - 1:00PM Room: ER Community, Learning Center Station #7

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Tarek N. Hanna, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Pancreatic injury can result from penetrating or blunt trauma, and is relatively uncommon, occurring in only 0.2-2% of trauma patients.Greater than 50% of pancreatic trauma patients suffer from associated vascular or visceral injuries. Following this exhibit the viewer will: 1. Understand fundamental principles of pancreatic trauma imaging with computed tomography (CT), including suggested imaging protocols. 2. Learn the American Association for the Surgery of Trauma (AAST) Injury Scoring Scale for pancreatic trauma, including best practices for classification and reporting. 3. Become proficient in the imaging factors that guide operative versus non-operative management of pancreatic trauma. In the setting of operative repair, understand what the surgeon needs to know.

TABLE OF CONTENTS/OUTLINE

A brief review of the epidemiology of pancreatic trauma will be followed by an overview of the AAST injury scoring scale. Pancreatic anatomy will be reviewed, particularly as it pertains to injury and traumatic surgical treatment. Subsequently, multiple cases of pancreatic trauma covering the spectrum of injury will be presented, including blunt and penetrating trauma. Each case presentation will include injury features, AAST grading, tips for best reporting, and management.

ER158-ED-SUA6

The Whole Spine Yards: A Review of Pediatric Spine Trauma

Sunday, Dec. 1 12:30PM - 1:00PM Room: ER Community, Learning Center Station #6

Awards
Magna Cum Laude

Participants
Devanshi I. Mistry, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Shehanaz K. Ellika, MD, Shreveport, LA (*Abstract Co-Author*) Nothing to Disclose
Apeksha Chaturvedi, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Imaging appearances of the immature spine vary with age and stage of development. 2. Normal developmental phenomena can mimic fractures. 3. Certain spine injury mechanisms are specific to children, such as mechanical birth-related trauma and non-accidental trauma. 4. Unique patterns of osseous, ligamentous, and spinal cord injuries are seen in children, for example Spinal Cord Injury Without Radiographic Abnormality (SCIWORA). 5. Imaging-based algorithms have been proposed for evaluation and treatment of pediatric spine trauma.

TABLE OF CONTENTS/OUTLINE

1. Review normal developmental radiographic anatomy of the spine. 2. Describe osseous, ligamentous, and spinal cord injuries in children on an illustrative, case-based template. 3. Outline non-traumatic mimics/pitfalls. 4. Overview current imaging-based algorithms for evaluating pediatric spine trauma.

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ER200-SD-SUA1

DECT Evaluation of Acute Appendicitis Using Iodine Maps

Sunday, Dec. 1 12:30PM - 1:00PM Room: ER Community, Learning Center Station #1

Participants
Hamza Rahimi, MD, Boston, MA (*Presenter*) Nothing to Disclose
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Stephan W. Anderson, MD, Cambridge, MA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Koninklijke Philips NV
Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Avneesh Gupta, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Wilson Chavez, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the utility of DECT in distinguishing acute appendicitis from normal appendix using Iodine maps.

METHOD AND MATERIALS

This retrospective study was IRB approved and HIPAA compliant. Informed consent was waived. Patients who had an emergent CT of the abdomen and pelvis from 10/1/2018 - 1130/2018 using rapid kV-switching dual-energy CT (GE Revolution) who were found to have appendicitis were identified. During this interval, 20 patients met inclusion criteria (11 male, 9 female; mean age of 35; age range 19-61 years old). Within this time interval, 20 additional consecutive patients with normal appearing appendix were identified (8 male, 11 female; mean age of 53; age range 28-72 years old). DECT material density iodine maps with were used in order to measure the iodine content of the appendiceal wall using three ROIs. The unpaired T-test was employed compare the iodine content of the appendiceal walls between patients with acute appendicitis and normal appendices.

RESULTS

20/40 (50%) patients with appendicitis on DECT iodine maps with water subtraction had average ROI 18.217 (SD 4.440, SEM 0.9928) and those with a normal appendix with an average ROI 13.238 (SD 2.480, SEM 0.5545). An unpaired T-test was calculated using two tailed test and found to be statistically significant difference with $P<0.0001$.

CONCLUSION

Statistically significant increases in iodine content are found with acute appendicitis when compared to normal appendices. Iodine content of the appendiceal wall is a promising biomarker in the diagnosis of acute appendicitis.

CLINICAL RELEVANCE/APPLICATION

Iodine content of the appendix wall is a promising biomarker that may be used to improve the level of confidence in diagnosing appendicitis in the emergency department setting.

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ER230-SD-SUA5

Eliminating Radiologist Pre-Approval of CT Protocols: Impact on Emergency Department Turnaround Times

Sunday, Dec. 1 12:30PM - 1:00PM Room: ER Community, Learning Center Station #5

Participants
Aayushi Rai, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose
Carol Morrissey, Cambridge , MA (*Abstract Co-Author*) Nothing to Disclose
Wilson Chavez, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Cambridge, MA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Koninklijke Philips NV

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No

PURPOSE

The aim of this study was to evaluate whether the elimination of radiologist pre-approval for protocoling of certain CT examinations would reduce turnaround times for patients in the emergency department undergoing CT imaging.

METHOD AND MATERIALS

Six commonly utilized CT examinations and commonly associated indications- CTPA ('chest pain', 'recent travel', 'elevated d-dimer'), CT abdomen and pelvis (CTAP; 'abdominal pain', 'LLQ pain', 'RLQ pain'), CT Non-contrast Brain ('headache', 'fall'), CT renal stone- ('flank pain', '?stone'), CT maxillofacial ('trauma'), CT trauma head and C-spine (CTHCS; 'MVC', 'fall', 'trauma') were chosen to be protocoled without direct radiologist pre-approval. Orders with different clinical parameters continued to require radiologist review. From 10/28/18-2/28/19, for patients >18 years presenting to the ED with these indications (total 558 patients), the median turnaround times from the ED documented event of patient 'Ready for CT' to both the 'Patient arrived' and the 'Exam begun' in the CT scanner were recorded. The median turnaround times before (September and October 2018) and after the initiation of the study were determined. Linear trend estimates were used to illustrate differences in dependent variables over time, using the Philips' PerformanceBridge Practice solution. Cost analyses were undertaken.

RESULTS

The median 'Ready for CT' to 'Exam begun' for all six CT orders showed a steady decrease over the months observed. For CT non-contrast Brain, the median time in September (before the initiation of the study) was 59 minutes and in February was 39 minutes (33% improvement), for CT Maxillofacial- 65 vs 28 minutes (65% improvement), for CTPA- 97 vs 58 minutes (36% improvement), for CTAP- 86 vs 64 minutes (46% improvement), for CT renal stone- 65 vs 31 minutes (51% improvement), for CTHCS -54 vs 43 minutes (29% improvement). We calculated a monthly cost savings of $19,133 and a yearly cost savings of $229,595 for these CT orders.

CONCLUSION

Removing radiologist-approved protocoling of certain CT studies resulted in a median turnaround savings time of 18 minutes per patient and an overall 35% improvement in median turnaround times for all CT examinations.

CLINICAL RELEVANCE/APPLICATION

Eliminating the requirement of radiologist-approved protocoling of CT studies can lead to accelerated patient care and cost savings in the emergency setting.

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ER242-SD-SUA2

Cervical Spine CT's Ordering in the Trauma Setting Based on NEXUS and Canadian C-Spine Rules: An Institutional Experience

Sunday, Dec. 1 12:30PM - 1:00PM Room: ER Community, Learning Center Station #2

ER

Participants
Marie Tominna, MD, Troy, MI (*Presenter*) Nothing to Disclose
Kurt E. Tech, MD, Grosse Pointe, MI (*Abstract Co-Author*) Nothing to Disclose
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Patrick Pettengill, MD, Royal Oak, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The majority of cervical spine CT's performed for the indication of trauma are negative. Both the NEXUS criteria and the Canadian C-Spine Rules (CCR) are validated decision rules to reduce imaging utilization in the trauma setting. The NEXUS criteria is a widely used method with 5 basic criteria to determine the need for imaging. CCR has 3 basic categories, but more subcategories than the NEXUS criteria. Imaging is not warranted if all criteria are negative. The purpose of this study was to assess if cervical spine CTs performed at our institution met imaging criteria to determine if there was an opportunity to reduce image utilization.

METHOD AND MATERIALS

A retrospective review within a 3 month period from June 2016 to August 2016 was performed for cervical spine CTs ordered for trauma. After exclusions, 216 cases were evaluated. A chart review was performed to determine if imaging was warranted based on the application of the NEXUS criteria. If the NEXUS criteria was not met, we evaluated to see if CCR was met. For each case, we determined if the CT spine was positive or negative.

RESULTS

Of the 216 emergent cervical spine CT's performed for trauma, 153 (71%) met criteria for imaging based on the NEXUS criteria. 12/153 (8%) were positive for acute injury. Of the 216 CT's, 63 did not meet NEXUS criteria for imaging; however, 50 of those 63 (79%) did meet CCR criteria for imaging. Of those 50 cases, 3 (6%) were positive. The remaining 13 cases that did not meet NEXUS criteria nor CCR were all negative for acute injury on imaging.

CONCLUSION

The EC physicians ordering patterns remain in sync with the NEXUS and Canadian C-Spine Rules criteria for suspected trauma to the cervical spine in the current environment of increased advanced imaging availability. NEXUS alone is not completely sufficient for the detection of acute cervical spine injury. All C-Spine injuries were detected when NEXUS and CCR were both utilized.

CLINICAL RELEVANCE/APPLICATION

Utilizing a combination of the NEXUS and Canadian C-spine Rules may prevent missing detection of a fracture through imaging and decrease the number of unnecessary imaging exams.

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ER243-SD-SUA3

Diffusion Tensor Imaging (DTI) Indices in Spinal Cord Injury Patients

Sunday, Dec. 1 12:30PM - 1:00PM Room: ER Community, Learning Center Station #3

ER

Participants
Sarita Magu, MD, Rohtak, India (*Presenter*) Nothing to Disclose
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PURPOSE

To study the change in Diffusion tensor imaging (DTI) indices namely FRACTIONAL ANISOTROPY(FA) and MEAN DIFFUSIVITY(MD) in spinal cord injury patients and comparison with data from control group

METHOD AND MATERIALS

Twenty-five cases of acute spinal cord injury patients and 25 age and sex-matched healthy controls were enrolled in a study conducted in the department of Radiology Pt B D Sharma PGIMS Rohtak. Scoring of the extent of clinical severity was done based on the Frankel grading system. MRI was performed on a 3T(GE Healthcare DISCOVERY MR 750W with GEM Suite Milwaukee U.S) system. Quantitative DTI indices namely FA and ADC were performed within the ROI. These indices were evaluated at the level of injury, and one vertebra above and below the level of injury. In controls, the FA and MD values were evaluated at individual vertebral levels and the average FA and average MD values for respective regions (i.e cervical, thoracic and lumbar) computed in each subject. Correlation of DTI changes with clinical severity (based on Frankel grading) was performed using Spearman correlation.

RESULTS

In patients, the Mean FA values at the level of injury in cervical,thoracic &lumbar (0.56/-0.16 , 0.49+/-0.11 , 0.31+/-0.1)respectively were less than in controls (0.46+/ 0.07 , 0.65+/-0.02 , 0.49+/-0.07)respectively which were statistically significant (p-value <0.001). Further, the Mean MD values at the level of injury in cervical,thoracic &lumbar (6.06+/ -3.85 , 2.53+/-2.65 , 2.18+/-0.66)respectively in cases was higher than in controls (1.64+/ _0.2, 1.8+/-.08 , 1.71+/-0.13 p-value <0.001). Statistically significant positive correlation was found between clinical grading (Frankel grade) and FA values at the level of injury (r-value = 0.149). Negative correlation was found between clinical grade and Mean MD at the level of injury (r-value = -0.113) which was however statistically not significant

CONCLUSION

Quantitative DTI indices are a useful parameter for detection of spinal cord injury. FA value was significantly decreased while MD value was significantly increased at the level of injury in cases as compared to controls. Further, FA showed significant correlation with clinical grade. DTI could thus serve as a reliable objective imaging tool for assessment of white matter integrity and prognostication of functional outcome

CLINICAL RELEVANCE/APPLICATION

Prognostication of spinal cord injury

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ER244-SD-SUA4

Do TBI Patients with ICH Have a Signature Symptom Profile?

Sunday, Dec. 1 12:30PM - 1:00PM Room: ER Community, Learning Center Station #4

ER

Participants
Kyle Costenbader, BSC, Washington, DC (*Presenter*) Nothing to Disclose
Fahimul Huda, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Previously, we have shown that patients with small acute intracranial hemorrhage (ICH) at initial presentation (ICHi) have a relatively uneventful hospital course, as compared to those with larger ICH. The impact of ICHi on the clinical course of patients after hospital discharge is unclear. In this study, we tested the null hypothesis that ICHi does not impact the symptom profile of patients with traumatic brain injury (TBI).

METHOD AND MATERIALS

In this retrospective study, TBI patients over 18 years of age with a head CT at the time of presentation and with at least one outpatient follow-up visit between 2015 and 2018 were included. Those with vascular risk factors, major psychiatric comorbidities, neurologic disorders other than TBI, and prior TBI / CT evidence of ICH within five years prior to this study were excluded. Patients were stratified based on the presence or absence of ICHi. Symptom profiles were characterized during early (0-3 months post-TBI) and/or late follow ups (4-12 months post-TBI). At each visit, an adapted 15-question Post-Concussion Symptom Scale and a thorough Vestibulo-Oculomotor (VOM) exam were assessed by a physician specializing in TBI. The age adjusted clinical symptom profiles between those patients with ICHi and those without ICHi at each visit were compared.

RESULTS

69 patients met inclusion/exclusion criteria. 26 (37.8%) had ICHi and 43 (62.32%) did not have ICH. The volumes of subdural hemorrhage (SDH) spanned the three categories described in our prior study, with relatively few patients in category A (SDH <10 cm3). At neither early nor late follow up were the severity of measured symptoms or VOM findings more severe in those with ICHi. Age-adjusted analyses did not show any effect on these outcomes.

CONCLUSION

ICHi does not impact the symptom profile of patients with TBI in either the short or long term.

CLINICAL RELEVANCE/APPLICATION

ICHi cannot be used to predict long-term clinical sequelae.

GI008-EB-SUA

Multidisciplinary Oncologic Approach of Anal Cancer: What the Radiologist Needs to Know

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Hardcopy Backboard

FDA Discussions may include off-label uses.

Participants
Miguel E. Nazar, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Luciano Castro Cavallo, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria B. Saborido, CABA, Argentina (*Presenter*) Nothing to Disclose
Maria A. Ramirez, CABA, Argentina (*Abstract Co-Author*) Nothing to Disclose
Eduardo Eyheremendy, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Identify relevant anatomical landmarks for local staging of anal cancer in MRI. Recognize the optimal MRI protocol indicated for the staging of the primary tumor and the readjustment of the anal canal. List the key points that should be included in the radiological report for primary staging, restaging after neoadjuvant and local recurrence.

TABLE OF CONTENTS/OUTLINE

Currently, the multidisciplinary approach in anal cancer requires a more meticulous analysis of the pathology, which reflects in staging (TNM) and treatment. This leads to a more generalized use of anal canal MRI and demands a greater radiologist knowledge of the staging features. Rectal MRI plays a key role in pre- and post-treatment evaluation of rectal cancer, helping the multidisciplinary team to select the most appropriate therapy option. In primary staging, anal canal MRI enables the radiologist to describe the location and morphology of the tumor, provides its categories T and N, detects the presence of extramural vascular invasion and identifies its relationship with surrounding structures, including the sphincter complex and the intersphincteric space. In post-adjuvant re-evaluation, in addition to reevaluating the characteristics observed during primary staging, anal MRI is a useful tool in the evaluation of the response to treatment.

GI272-ED-SUA9

Imaging Chemotherapy-Induced Liver Toxicity: What Every Radiologist Should Know

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #9

FDA Discussions may include off-label uses.

Participants
Matheus Dorigatti Soldatelli, MD, Porto Alegre, Brazil (*Presenter*) Nothing to Disclose
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Gustavo F. Luersen, MD, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose
Caroline Lorenzoni Almeida Ghezzi, MD,PhD, Porto Alegre, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is to: Review the hepatic chemotherapy-induced toxicity and correlate to the major contemporary chemotherapeutic agents and their clinical use. Discuss and illustrate the pathophysiologic mechanisms and imaging findings of diffuse and focal hepatic conditions secondary to chemotherapy and their main differential diagnosis. Increase radiologists' awareness of these imaging features allowing for early detection, avoiding misdiagnosis for neoplastic progression and improving patient care.

TABLE OF CONTENTS/OUTLINE

Major classes of chemotherapeutic agents, clinical use and hepatotoxicity Diffuse liver manifestations: Steatosis/steatohepatitis Sinusoidal obstructive syndrome (SOS) Pseudocirrhosis Chemotherapy-induced focal hepatopathy: Focal nodular hyperplasia Focal steatosis Focal SOS Conclusion and future directions

GI273-ED-SUA10

Cross-Sectional Imaging of Malabsorption Syndromes: A Primer for the Contemporary Radiologist

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #10

Awards
Identified for RadioGraphics

Participants
Samir A. Khwaja, FRCR,MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nasir M. Jaffer, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Korosh Khalili, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Khaled Y. Elbanna, MBChB,FRCR, Vancouver, ON (*Abstract Co-Author*) Nothing to Disclose
Richard Kirsch, MD, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Luis S. Guimaraes, MD,PhD, Toronto, ON (*Presenter*) Nothing to Disclose

TEACHING POINTS

1. To familiarise radiologists with cross-sectional imaging findings that lead you to suspect an underlying malabsorption syndrome. 2. To show how CT/MR enterography are useful tools in diagnosing malabsorption syndromes. 3. To summarize key clinical investigations a radiologist should know which can confirm the diagnosis.

TABLE OF CONTENTS/OUTLINE

Malabsorption syndromes can be challenging to diagnose clinically due to vague symptoms which develop slowly over time. Although our understanding of these entities has evolved from barium studies, recognition of typical cross-sectional imaging findings is often overlooked which can lead to delayed diagnosis. In our exhibit you will: 1. Learn the pathophysiology, causes and clinical investigations for malabsorption. 2. Recognise how specific CT/MR findings together with clinical presentation can narrow the differential diagnosis. 3. Highlight diseases involving the small bowel associated with malabsorption such as celiac disease, scleroderma, lupus enteritis, amyloidosis, Whipple's disease, jejuno-ileal diverticulosis, eosinophilic duodenitis, intestinal lymphangiectasia, radiation enteritis and infectious enteritides with endoscopic and pathologic correlation.

GI274-ED-SUA8

Weighing In: Fluoroscopy of Anatomy and Complications After Weight Loss Surgery

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #8

Participants
Elizabeth A. Bellew, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose
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Riya Goyal, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. Review of appropriate fluoroscopic technique and timing for an esophagram/Upper GI series in the post-operative period2. Review of the common weight loss surgical procedures, including their expected post-surgical anatomy and their acute and chronic common/uncommon complications: -Gastric banding-Gastric sleeve-Roux-en-Y-Duodenal switch

TABLE OF CONTENTS/OUTLINE

1. Background/Introduction -Indications and considerations for the various weight-loss surgical procedures -Mechanisms of weight loss based on procedure-Review of appropriate technique of esophagram/upper GI in post-operative period including a discussion of choice of oral contrast, positions, magnification, and delayed or overhead radiographs -Review of the individual procedures (gastric band, gastric sleeve, Roux-en-Y, duodenal switch), based on their complexity and efficiency, their post-operative anatomy, and complications in the acute post-operative period as well as long-term complications 2. Examples of expected post-operative fluoroscopic findings and post-operative complications with multi-modality imaging, with an emphasis on fluoroscopic diagnosis, and including radiographic and CT findings, when appropriate3. Discussion of the benefits and limitations of the use of fluoroscopy in the post-operative period for weight-loss surgeries

GI275-ED-SUA11

MR Imaging of Anal Canal: A Primer for Radiologists

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #11

Awards
Cum Laude

Participants
Adriano Basso Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
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Shannon P. Sheedy, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Sergio Nahas, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marc J. Gollub, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

- Understand the current concepts and management of anal disorders - Recognize anal anatomy and the main surgical techniques of benign and malignant diseases of the anal canal - Comprehend the anal MRI technique, common difficulties, and how to overcome them - Know the role and limitations of anorectal MRI - Recognize the most important imaging features to report in benign and malignant anal lesions

TABLE OF CONTENTS/OUTLINE

INTRODUCTION - Epidemiology of anal and perianal disorders / ANATOMICAL AND HISTOLOGICAL CONCEPTS - Key anatomical landmarks demonstrated by illustrations with MRI correlation / SURGICAL TECHNIQUES - Types of surgical approaches in anal disorders / MRI TECHNIQUE - Preparation - MRI protocol and how to optimize it - Difficulties and how to overcome them / ROLE OF IMAGING IN THE DIAGNOSTIC APPROACH AND MANAGEMENT OF THE MOST COMMON BENIGN AND MALIGNANT DISEASES OF THE ANAL CANAL / Classification A) Benign entities - Perianal fistulas - Hemorrhoidal disease - Proctitis - Perianal abscess - Anal stricture / stenosis - Anal mucosal prolapse - Scarring from obstetrical trauma - Skin tags B) Anal squamous cell carcinoma / SYSTEMATIC APPROACH TO EVALUATE ANAL MRI - What to report in the evaluation of benign and malignant anal diseases - MRI anal carcinoma structured report template

GI276-ED-SUA12

Intestinal Failure and Small Bowel Transplantation: Spectrum of Imaging Features and Complications

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #12

Awards
Cum Laude

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TEACHING POINTS

Review history, advances and surgical techniques in small bowel transplantation Discuss causes of intestinal failure and indications of small bowel transplantation Illustrate the role of different imaging modalities in assessing these patients pre- and post-operatively Describe spectrum of imaging features in cases of intestinal failure and small bowel transplantation Assess complications of small bowel transplantation

TABLE OF CONTENTS/OUTLINE

Overview / Introduction Etiology, clinical presentation of intestinal failure and indications of small bowel transplantation Imaging modalities and spectrum of imaging features Case presentation illustrating indications, postoperative changes and complications Impact of imaging findings on management

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GI330-SD-SUA1

Quantitative Measurement of Hepatic Fibrosis on Gadoxetic Acid-Enhanced Magnetic Resonance Imaging in Patients with Chronic Liver Disease: Multicenter Study

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #1

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PURPOSE

The aims of this study were to compare coefficient of variation (CV) in MR hepatobiliary image and serum biomarkers such as aspartate aminotransferase to platelet ratio index (APRI) and fibrosis-4 index (FIB-4) values according to the histopathologic fibrosis score, to identify the diagnostic performance of CV map in diagnosing hepatic fibrosis and to assess measurement reliability.

METHOD AND MATERIALS

This study was a prospective multicenter study which included 51 patients with 3-T liver MR imaging using gadolinium EOB DTPA and liver biopsy or surgery. Patients were divided into 4 groups according to the liver fibrosis score ; Group 1 (F0, 1), Group 2 (F2), Group 3(F3), Group 4 (F4). To quantitatively measure the hepatic fibrosis, MR hepatobiliary image was analyzed to identify inhomogeneous signal intensities calculated from CV map in the liver parenchyma. We also evaluated the comparison study of among CV, APRI and FIB-4. The diagnostic performance of the CV map for significant (>F2) and advanced (F3) fibrosis was evaluated using receiver operating characteristic (ROC) curve. Intra and interobserver agreement of CV measurement was analyzed.

RESULTS

Mean CV values in each group were Group 1 : 3.73 ± 0.21, Group 2 : 4.17 ± 0.89, Group 3 : 4.40 ± 0.82, and Group 4 : 5.22 ± 1.10, respectively (P=0.014). APRI and FIB-4 didn't show statistical significance among each group (APRI p=0.642, FIB-4 p=0.188). Area under curves of ROC were 0.828 for significant fibrosis and 0.781 for advanced fibrosis. Intra and Interobserver agreement of CV map measurement were 0.993 and 0.834.

CONCLUSION

CV value based on hepatobiliary MR image provides accurate discrimination of hepatic fibrosis with reliable measurements and demonstrates high diagnostic performance.

CLINICAL RELEVANCE/APPLICATION

MRI is commonly used to diagnose hepatocellular carcinoma and for surveillance. Hepatobiliary image can provide the information of hepatic fibrosis even if the liver biopsy is not perfomed.

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GI331-SD-SUA2

Quantitative System for Assessment of Imaging Features in Chronic Pancreatitis: A Feasibility and Validation Study

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #2

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PURPOSE

In line with recent imaging guidelines and mechanistic approach for understanding chronic pancreatitis (CP), there is an unmet need for new systems for quantitative pancreatic imaging assessment. The aims were to present a new approach for assessment of imaging features in CP, to apply this system in a multi-center cohort of CP patients (feasibility study), and to report inter-reader agreement between expert radiologists (validation study).

METHOD AND MATERIALS

The feasibility study included pancreatic computed tomography (CT) or magnetic resonance imaging (MRI) from 496 patients with definitive CP in the Scandinavian Baltic Pancreatic Club (SBPC) database. Images were assessed according to the new SBPC imaging system (quantitative assessment of ductal and parenchymal features). Inter-reader agreement of reported imaging parameters was investigated for 80 CT and 80 MRI examinations by two expert radiologists.

RESULTS

Reporting of the imaging features into the imaging system was deemed feasible for >80% of CT and >90% of MRI examinations. Quantitative assessments of main pancreatic duct diameters, presence/number/diameter of calcifications, and gland diameters had high levels of inter-reader agreement with kappa-values of 0.75-0.87 and intraclass correlation coefficients of 0.74-0.97 (see Figure). The more subjective assessments, e.g. irregular main pancreatic duct and dilated side-ducts, had poor to moderate agreement with kappa-values of 0.03-0.44.

CONCLUSION

The presented system provides a feasible mean for systematic assessment of CP imaging features. Imaging parameters based on quantitative assessment, as opposed to subjective assessments, have better reproducibility and should be preferred in the development of new grading systems for understanding pathophysiology and disease progression in CP.

CLINICAL RELEVANCE/APPLICATION

Our system could support the ongoing new strategies for improved understanding and diagnosis of CP, identifying better quantitative imaging biomarkers for exploring early CP and progression of CP.

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GI332-SD-SUA3

Predictive Performance of Ultrasound-Determined Non-Alcoholic Fatty Pancreas Disease Severity for Intermediate and High Coronary Heart Disease Risk

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #3

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PURPOSE

To evaluate non-alcoholic fatty pancreas disease identified by ultrasound (US-determined NAFPD) as a risk factor for coronary heart disease (CHD), and to evaluate its predictive value for intermediate/high CHD risk, compared to US-determined non-alcoholic fatty liver disease (US-determined NAFLD) severity.

METHOD AND MATERIALS

We conducted a retrospective analysis of young adults (18- to 40-years-old) who underwent a health screening examination September, 2017 and June, 2018. NAFPD was categorized as non/mild/moderate/severe based on the echogenicity of the pancreas relative to that of the renal parenchyma. NAFLD were categorized as absent/mild/moderate/severe based on difference in echogenicity between the liver and kidney, visibility of the intrahepatic vessel walls, and of the diaphragm. CHD risk was calculated using the Framingham risk score (FRS). Spearman correlation, multivariate and receiver operating characteristic (ROC) curve analyses were used to compare predictive performance.

RESULTS

FRS increased with increasing US-determined NAFPD severity (rho=0.624, $p<0.001$), with a concomitant increase in the odds ratio for intermediate/high CHD, with an area under the ROC curve [AUC] for determining intermediate/high CHD risk in NAFLD patients of 0.687. There was no difference between the predictive performance of US-determined NAFLD or NAFPD severity with regard to intermediate/high CHD risk ($p=0.17$). The combination of US-determined NAFPD and NAFLD severity significantly improved the ability to distinguish intermediate/high CHD risk (AUC, 0.807; $p<0.001$).

CONCLUSION

US-determined NAFPD severity was well correlated with the FRS and associated with the prevalence of intermediate/high CHD risk.

CLINICAL RELEVANCE/APPLICATION

US-determined NAFPD severity combined with US-determined NAFLD severity may be useful for predicting which patients may have a higher risk of CHD.

GI333-SD-SUA4

Feasibility of Dose Modulation for Reducing Radiation Dose with Arms-Down Patient Position in Abdominopelvic Computed Tomography

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #4

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PURPOSE

To demonstrate for patients with arms-down position that the radiation dose can be reduced without affecting the diagnosis at abdomen computed tomography (CT).

METHOD AND MATERIALS

The control group was eight patients with arms-down position, and dose modulation-on was applied in abdomen CT Pre phase. The experimental group was twenty-three patients with arms-down position, and dose modulation-off was applied in abdomen CT Pre phase. Quantitative evaluation in two groups was compared with Hounsfield units (HU), standard deviation (SD), and signal-to-noise ratio (SNR) of liver, abdomen aorta, paraspinal musculature and subcutaneous fat. The qualitative evaluation was assessed on a scale of 5 points for overall image quality, subjective image noise, and beam hardening artifacts by comparing Pre and hepatic venous phase (HVP) only to experimental group divided into four BMI groups. Dose evaluation was compared for CT dose index (CTDI) and dose length product (DLP) by comparing Pre and HVP only to experimental group.

RESULTS

The experimental group has no significant statistical difference from the control group except for the SD of liver and HU of subcutaneous fat in HU, SD, and SNR ($p<0.05$). The Pre phase with dose modulation-off had slightly increased beam hardening artifacts and subjective image noise compared to HVP with dose modulation-on. In addition, overall image quality had slightly decreased. In the dose evaluation, the Pre phase had significantly lower CTDI and DLP compared to the HVP ($P < 0.05$).

CONCLUSION

In conclusion, our results demonstrated that dose modulation-off can reduce radiation dose for patients with arms-down position without affecting the diagnosis in abdomen CT.

CLINICAL RELEVANCE/APPLICATION

In particular, dose modulation-off can reduce radiation dose for patients with arms-down position with low weight and normal weight without affecting the diagnosis in abdomen CT.

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GI378-SD-SUA5

CT-Derived Radiogenomic Signatures Predicting BRAF/KRAS Mutations and Overall Survival in Primary Colorectal Carcinoma Patients

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #5

FDA Discussions may include off-label uses.

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PURPOSE

To determine the ability of CT-derived radiogenomic signatures/models to predict between key mutation (BRAF/KRAS/other wild-type {WT}) of primary colorectal carcinoma (CRC) patients and their overall survival (OS).

METHOD AND MATERIALS

In this retrospective study, we evaluated 134 histopathological proven CRC patients with known genomic data, and available treatment naïve contrast-enhanced CT scans. Using 3D slicer, the entire primary tumor was semi-automatically segmented on the porto-venous phase, and the volume of interest (VOI) was extracted; subsequently, the VOI was imported into our in-house pipeline radiomic analysis to obtain 610 radiomic features per volume. For feature selection, classification model and validation, the least absolute shrinkage selection operator regression (LASSO), Xgboost, and leave-one-out-cross-validation were used, respectively.

RESULTS

Of 134 patients (male, 66; female, 68; average age, 57.9 years) with BRAF (N=47), KRAS (N=46), and WT (N=41); for mutation status, top 55 LASSO features were able to stratify the CRC patients, with an accuracy (99.3%), area under the curve (99.88%-100%), and *P*-value (2.2e-16). For overall survival 40 LASSO features were able to predict good versus poor OS (30 months), with sensitivity, specificity, and *P*-value of 100%, 97%, and 2e-16 respectively. Additional subgroup analysis revealed the ability of only 10 LASSO features to predict OS for BRAF, KRAS and WT with *P*-value of 3.049e-9, 9.19e-11, and 2.87e-7.

CONCLUSION

Our radiogenomic signatures were able robustly to stratify the CRC patients based on their molecular data, and to predict their OS status using pre-treatment CT scans.

CLINICAL RELEVANCE/APPLICATION

Radiogenomics is an emerging field that lends a non-invasive tool for quick CRC patients stratification based on their genomic/molecular profiles.

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GI379-SD-SUA6

Radiomics and Enhancement Ratio in Colorectal Cancer (CRC) Liver Metastases: Determination of Mutational Status

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #6

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PURPOSE

To determine if triple-mutant (MT) versus wildtype (WT) mutation status in colorectal cancer (CRC) can be identified using CT enhancement ratios and texture analysis of liver metastases.

METHOD AND MATERIALS

We identified 39 stage 4 colorectal cancer patients with molecular profiling; 33 of 39 had liver metastases and pre-treatment multiphase CT (triple-mutant: APC/KRAS/TP53, n=21; wildtype, n=12). We performed a 2 part analysis on portal venous phase images using: i) Enhancement ratios of manual attenuation measurements and ii) CT texture. i) Enhancement ratio: Attenuation of largest metastasis, liver, and aorta was measured at the same axial level. Attenuation ratio of metastasis to aorta was correlated with the molecular profile. ii) CT texture: Image segmentation and quantitative imaging feature extraction were performed including image gradients, co-occurrence matrices, and pixel neighborhood statistics. Statistical analysis included Spearman correlation and AUR for ROC. Pairwise analyses and independent t-tests were used to compare the means of identified imaging features for CT texture. A random forest classifier was built to determine an integrated imaging signature for triple-mutant detection; $p < 0.05$ was considered statistically significant.

RESULTS

The median number of metastases/patient =2 (range, 1-9), median size =2.9 cm (range, 0.5 - 9.6). Average attenuation of metastases was MT 53.6 HU and WT 57.4 HU. For MT only, attenuation of metastases correlated with liver attenuation (R=0.86), $p \leq 0.001$. On ROC analysis, the AUC was 0.8 for identification of mutation status with metastasis/aorta ratio. An attenuation ratio threshold of <0.33 for MT status had 70% sensitivity, 84.6% specificity, 87.5% PPV, 64.7% NPV, and 75.8% accuracy. For CT texture, imaging feature analyses of pairwise differences between MT and WT images were statistically significant; top features including skewness (p=0.02), energy (p=0.03), and entropy (p=0.03). In-sample training accuracy for prediction of tumor mutation status was 66%.

CONCLUSION

CT features of liver metastases may be used to determine mutation status in CRC. The inclusion of the aorta as an internal standard may be beneficial in CT characterization.

CLINICAL RELEVANCE/APPLICATION

Triple-mutant colorectal cancer is associated with poor survival and lack of response to targeted therapies. CT identification of genomic mutations in CRC may help identify resistance to targeted therapy.

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GI380-SD-SUA7

The Diagnostic Performance of LI-RADS Version 2018 and Modified LI-RADS Major Features in the Diagnosis of 10-19 mm HCC Using Extracellular Contrast-Enhanced MRI

Sunday, Dec. 1 12:30PM - 1:00PM Room: GI Community, Learning Center Station #7

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PURPOSE

To evaluate the diagnostic performance of LI-RADS v2018 for 10-19 mm HCC and whether modifications of LI-RADS criteria could improve sensitivity without reducing specificity.

METHOD AND MATERIALS

Our IRB approved this retrospective singe-center study with waived informed consent requirement of all patients with chronic liver disease with 10-19 mm observations on extracellular contrast agent-enhanced (ECA-) MRI from 2004 to 2018. Based on histopathology or composite clinical and imaging data after a minimum of two years of follow up, the 160 observations in 156 patients included 136 (85%) HCCs, 3 (1.9%) iCCAs, 2 (1.3%) cHCC-CCAs, 1 (0.6%) dysplastic nodule, 2 (1.3%) hepatocellular adenomas, 4 (2.5%) focal nodular hyperplasias, 4 (2.5%) hemangiomas, 7 (4.4%) perfusion alterations, and 1 (0.6%) inflammatory scarring. LI-RADS MR major features (except threshold growth) were retrospectively assessed by two radiologists in consensus, blinded to the reference standard. Observations were categorized according to LI-RADS v2018 as well as four modified LI-RADSs versions including the following as LR-5 criteria: arterial phase hyperenhancement(APHE) and capsule only (mLI-RADS I), "washout" without APHE (mLI-RADS II), "washout" and "capsule" without APHE (mLI-RADS III), "washout" or "capsule" without APHE (mLI-RADS IV). Diagnostic performance parameters of LR-5 using v2018 and of each modified LI-RADS were assessed.

RESULTS

Using LI-RADS v2018, 0% LR-1 (0/3) and LR-2 (0/8), 75% (21/28) LR-3, 87.5% (14/16) LR-4, 97.9% (94/96) LR-5, and 77.8% (7/9) LR-M were HCC. As shown in Table 1, the accuracy of LR-5 using LI-RADS 2018 for 10-19 mm HCC was modest. mLI-RADS II provided higher sensitivity (72.1 vs. 69.1%) and accuracy (75.0% vs. 72.5%) than LI-RADS v2018 while maintaining high specificity (91.7% vs. 91.7%). mLI-RADS IV provided the highest accuracy (78.1%) and sensitivity (76.5%) but lower specificity (87.5%).

CONCLUSION

The diagnostic accuracy of LR-5 using LI-RADS v2018 for 10-19 mm HCC was modest using ECA-MRI in patients with chronic liver disease. Modification of LI-RADS criteria may improve sensitivity without reducing specificity.

CLINICAL RELEVANCE/APPLICATION

Expanding the LI-RADS 5 criteria to include "washout" without APHE for 10-19 mm observations may improve sensitivity for HCC without impairing specificity.

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GU201-SD-SUA2

Clinical Usefulness of Thin-Slice T2-Weighted Imaging Using a 3T MR Scanner with Deep Learning Reconstruction for VI-RADS Evaluation of Bladder Cancer

Sunday, Dec. 1 12:30PM - 1:00PM Room: GU/UR Community, Learning Center Station #2

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PURPOSE

VI-RADS using T2-weighted (T2WI), diffusion-weighted (DWI), and dynamic contrast-enhanced (DCE) imaging has been recently introduced to evaluate transmural extent of bladder cancer (BC). A 3T MR scanner with deep learning reconstruction (DLR) to reduce image noise has newly become clinically available. We assessed clinical usefulness of thin-slice T2WI using this MR scanner with DLR for VI-RADS evaluation.

METHOD AND MATERIALS

We retrospectively enrolled consecutive 18 patients with BC undergoing preoperative MR with this scanner for VI-RADS evaluation and transurethral resection for the BC. On 2-mm-thick T2WI with and without DLR in each patient, we placed ROIs in the largest BC and normal bladder wall to measure their signal intensity (SI) and SD and calculate contrast-noise ratio (CNR) with the following equation: CNR=(SI in the BC-SI in the bladder wall)/SD in the bladder wall; 2 readers subjectively assessed image contrast between the BC and bladder wall, VI-RADS score, and diagnostic confidence (1 [maybe] to 3 [definite]). A radiologist definitely graded VI-RADS category for each patient using T2WI, DWI, DCE, and histological results. The VI-RADS scores and categories of 1-3 were diagnosed as non-muscle-invasive BC and otherwise, as muscle-invasive BC. Between the both T2WI types, we compared diagnostic accuracy of this differentiation, used paired t-test to compare CNR, and used Wilcoxon signed-rank test to compare the subjective contrast and, if accurate, diagnostic confidence.

RESULTS

The CNR and mean subjective contrast were significantly greater with DLR (17.2±17.7 and 3.5±0.8, respectively) than without DLR (6.6±4.0 and 3.1±1.0) ($P<0.05$ for both). The diagnostic accuracy was the same between the both T2WI types for Reader 1 (89%) and greater with DLR (100%) than without DLR (94%) for Reader 2. The diagnostic confidence was significantly greater with DLR than without DLR for both Readers 1 (2.6±0.5 vs. 2.3±0.8) and 2 (2.8±0.4 vs. 2.3±0.7) ($P<0.05$ for both)

CONCLUSION

Thin-slice T2WI with DLR can improve tumor contrast and diagnostic confidence for VI-RADS evaluation of BC.

CLINICAL RELEVANCE/APPLICATION

Use of thin-slice T2WI with DLR allows more accurate and confident evaluation regarding transmural extension of BC based on VI-RADS without administration of contrast media.

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GU202-SD-SUA3

Utility of T2-Weighted (T2W)-MRI to Differentiate Lipid-Rich and Lipid-Poor Adrenal Adenomas from Adrenal Metastases Using Subjective and Quantitative Analysis

Sunday, Dec. 1 12:30PM - 1:00PM Room: GU/UR Community, Learning Center Station #3

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PURPOSE

To compare T2W-MRI features in benign adrenal adenomas and adrenal metastases.

METHOD AND MATERIALS

With IRB approval, we identified 40 consecutive adrenal metastases with MRI between 2010-2019. During the same study period, 40 consecutive adrenal adenomas with MRI formed the control group. A blinded Radiologist measured:T2W signal-intensity(SI).ratio (adrenal nodule/psoas muscle), chemical-shift SI.index and calculated texture analysis features. Two blinded Radiologists assessed T2W-SI relative to muscle and T2W-homogeneity (using 5-Point Likert scales). Comparisons were performed between groups using multi-variate analysis and ROC.

RESULTS

Subjectively, T2W-SI.ratio ($p<0.0001$) and T2W.homogeneity ($p<0.0001$-0.0659) were higher in metastases for both Radiologists, but with overlap between groups. Agreement was moderate for T2W.SI ($K=0.40$) but fair for T2W.homogeneity ($K=0.17$). After multi-variate regression, metastases had significantly higher T2W-SI.ratio (3.62±1.67 [0.23-8.16] versus 1.95±0.88 [0.45-4.28], $p<0.001$) and T2W-entropy (6.63±0.64 [4.93-7.46] versus 5.80±0.70 [4.13-7.16], $p<0.001$). Chemical-shift SI.index was higher in adenomas (52.8±31.4% [-21.6-90.2%] versus 0.41±19.9% [-40.6-69.4%], $p<0.001$) with 19.5% (8/41) adenomas lipid-poor and 7.5% (3/40) metastases with SI.index >16.5%. There was no difference comparing T2W-SI.ratio (0.5932) or T2W-entropy (0.099) in lipid-rich or lipid-poor adenomas. Area under ROC curve (AUC) for T2W-SI.ratio, T2W-entropy and chemical-shift SI.index were: 0.816 (SE 0.049), 0.814 (SE 0.047) and 0.91 (0.04). A logistic-regression model combining T2W-SI.ratio+Entropy yielded AUC, sensitivity/specificity of 0.864 (SE 0.406) and 82.5%/72.5%.

CONCLUSION

Higher T2-weighted signal intensity and heterogeneity, assessed subjectively and with texture analysis may differentiate metastases from both lipid-rich and lipid-poor adrenal adenomas. Quantitative results were more robust compared to subjective assessment.

CLINICAL RELEVANCE/APPLICATION

In patients with adrenal nodules showing heterogeneously increased signal intensity on T2W and a history of malignancy, a diagnosis of metastasis should be strongly considered. This may help to better characterize lipid-poor adenomas (which appeared similar to lipid-rich adenomas on T2W) and metastases containing microscopic fat on chemical-shift MRI.

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GU236-SD-SUA4

The Arrowhead Sign (AS) a Novel, Reproducible Radiographic Indicator of Intramuscular Venous Branch Invasion (pT3a) in Patients with Renal Cell Carcinoma

Sunday, Dec. 1 12:30PM - 1:00PM Room: GU/UR Community, Learning Center Station #4

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PURPOSE

Accurate preoperative prediction of T3a disease in renal cell carcinoma (RCC) is a clinical challenge. Knowledge of renal intramuscular venous invasion can influence clinical decision-making regarding the suitability of nephron-sparing surgery. We report and validate the observation that tumors that exhibit invasion into the muscular branches of the venous vasculature form a 'beak-shaped' irregularity as they grow towards the renal sinus fat and resembles an 'arrowhead'. We sought to determine if the 'Arrowhead Sign (AS)' CT finding could be used as a preoperative predictor of proximal venous invasion on final histopathologic evaluation

METHOD AND MATERIALS

We queried our IRB-approved, kidney cancer database and identified 174 patients with localized renal tumors who underwent surgical resection between 2009 and 2018 and had a pre-operative contrast imaging within 90 days of surgery. Two fellowship-trained junior abdominal radiologists and a senior radiologist with 25 years of experience blindly and independently reviewed the imaging. To evaluate for likelihood of tumor venous invasion on final histopathology, images were assessed for the following radiographic predictors of cT3a disease: sinus fat infiltration, perinephric invasion, and AS.Indicators were scored on a 1- 4 scale according to reader's degree of confidence in the finding, with a score of 1 - definitely present,to 4 - definitely absent. Statistical analyses were performed.

RESULTS

Final pathologic staging revealed pT1=116 (66.6%), pT2=9 (5.1%), pT3=48 (27.5%) and pT4=1 (0.006%). The sensitivity and specificity of AS for predicting muscular venous invasion were 92% and 73%, respectively. Perinephric invasion had 62% sensitivity and 85% specificity, while sinus fat infiltration was 89% sensitive and 73% specific. Inter-reader agreement for AS was moderate (x = 0.64).

CONCLUSION

The arrowhead sign is a novel and potentially clinically actionable predictor of muscular venous invasion in patients with RCC. Of the three indicators, it had the highest sensitivity and moderate intra-reader agreement. These initial findings justify further investigation.

CLINICAL RELEVANCE/APPLICATION

The ability to stage pT3a (RCC) with imaging can influence surgical management and eligibility for clinical trials. Of the three commonly reported imaging features the,' arrowhead sign,' had the highest sensitivity and larger validation studies are warranted.

HP006-EC-SUA

How to Read a CT of the Abdomen and Pelvis: Creating an Interactive Educational Website for Residents, Medical Students, and Technologists

Sunday, Dec. 1 12:30PM - 1:00PM Room: HP Community, Learning Center Custom Application Computer Demonstration

Participants
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TEACHING POINTS

(1) Focused and practical online teaching is a highly accessible way to lay the foundation of search pattern and image interpretation for trainees. It provides earlier, independent opportunities for student and resident learning, and fosters increased engagement and productivity on service. (2) The basic structure of an online teaching website such as "learnabdominal.com" involves annotated teaching cases, search-pattern videos, reporting templates, and a case library. Content can be created using several free or low-cost resources such as Google Sites, Youtube, Radiopaedia, and Pacsbin, and is a great way to involve students and residents. (3) Online teaching libraries can be organized to target different levels of training and serve as a guide. Medical students can start with a "primer" and move on to case sets tailored to their chosen specialty. Resident case sets can be tailored to year in training, call preparation, and "mini-fellowship" experiences.

TABLE OF CONTENTS/OUTLINE

(1) Review of key resources for site building:a. URLb. Case annotationc. Teaching videosd. Online case library(2) Build a "How-to read" tutorial a. Interactive case with detailed but focused annotationsb. Search pattern videosc. Template checklist d. Test cases (3) Organization of teaching case librarya. Medical studentsb. Residentsc. Fellows

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HP200-SD-SUA1

Survey of Competitive Behavior of Screening Mammography Facilities in the United States

Sunday, Dec. 1 12:30PM - 1:00PM Room: HP Community, Learning Center Station #1

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PURPOSE

Competitive marketplaces improve the quality of goods and services and ensure fair prices across the economy. Screening mammography performance measures in the United States (U.S.) are below international benchmarks, especially regarding recall rates. We performed an establishment survey of the competitive behavior of U.S. facilities providing screening mammography services. Given a standardized product with a large number of providers, we anticipated competitive behavior.

METHOD AND MATERIALS

We generated a random sample of 400, or 4.6%, of the 8740 Mammography Quality Standard Act of 1992 (MQSA) certified mammography facilities excluding U.S. territories as of March 1, 2016. We measured competition based on four facility activities either internet advertised or readily available from a single phone call. These parameters included cash prices (self-pay), reading quality (MQSA mandated screening performance measures), convenient hours (beyond 8-5), and newer technology (advertised tomosynthesis). We used a facility's website information when available and if not, we called the facility phone number during March 2016 to complete each parameter except for reading quality.

RESULTS

Excluding government, HMO and closed practice facilities, 360/400 or 90% of facilities could compete for consumers. 355 of these facilities had websites. 130 facilities had global cash prices; 130/360 (36.1%; 95% CI 31.3%-41.2%). 81 had only the facility price available with no radiologist fee; 81/360 (22.5%, 95% CI 18.4%-27.1%). Five facilities had cash prices on the internet, and six advertised breast imaging specialists. One claimed a higher cancer detection rate. No facility listed recall rates or audit results. 139 had convenient hours; 139/360 (38.6%; 95% CI 33.7%-43.8%). 63% of 95 facilities with tomosynthesis advertised on their website.

CONCLUSION

Competition based on screening performance measures is negligible. Around one third of facilities compete based on cash prices or convenient hours. Many facilities with tomosynthesis advertise.

CLINICAL RELEVANCE/APPLICATION

Market forces through consumer choice cannot reward facilities with better performance measures (and avoid worse performers) if relevant quality information is not easily accessible. Modifying the MQSA to mandate facility posting of performance measures or making them easily accessible in the facility database may be a viable mechanism to improve U.S. recall rates.

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HP201-SD-SUA2

Transcontinental Thematic Analysis of Gender Role in Medical Schools Leadership: A Message to Academic Radiology & Hospital Administration

Sunday, Dec. 1 12:30PM - 1:00PM Room: HP Community, Learning Center Station #2

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PURPOSE

The underrepresentation of females in senior leadership positions of medicine continues to prevail despite the ongoing efforts to reach gender parity. Our aim is to compare the extent and influences for gender imbalance in the leadership of the top medical schools in North America, Europe, Asia, and Oceania.

METHOD AND MATERIALS

We adopted the theoretical framework of the Systems and Career Influences Model. The leadership were classified into four tiers of leadership hierarchy. The faculty members holding leadership positions at the medical schools who met the inclusion criteria (n=3155) were compiled into an Excel spreadsheet in which the data was recorded from September 2017 to January 2018. Variables of interest included gender, H Index, number of documents published, total number of citations, and number of years in active research. SCOPUS database was used to generate author metrics.

RESULTS

A total of 2448 (77.59%) males and 707 (22.41%) females met the inclusion criteria. Male majority was detected in all regions, and we noted a significant difference between the number of males and females in all levels of leadership throughout the four regions (Chi square = 91.66; p value = 0.001). Females had a lower mean H Index across all positions in all regions, and when we adjusted for number of years invested, M Index for females was still significantly lower than males (T test = 6.52; p value = 0.02).

CONCLUSION

Organizational and individual influential factors are transcontinental within the top 100 medical school leadership hierarchy. Those factors were critically assessed through in-depth analysis of the Systems and Career Influences Model. Evidence-driven actionable recommendations to remedy those influential factors were outlined.

CLINICAL RELEVANCE/APPLICATION

No Clinical relevance.The relevance is awareness regarding policy change for academic radiology and hospital administration.

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HP202-SD-SUA3

Gadolinium Retention in Tissues and Biofluids Following Intravenous Gadolinium-Based Contrast Administration in a Preclinical Animal Model

Sunday, Dec. 1 12:30PM - 1:00PM Room: HP Community, Learning Center Station #3

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PURPOSE

The effects of the chemical identity and properties of gadolinium based contrast agents (GBCAs) on gadolinium (Gd) retention in tissues and biofluids is incompletely understood. We sought to better quantify this relationship and examine gross and cellular changes in tissues of rats exposed to various commercially-available GBCAs.

METHOD AND MATERIALS

Male Wistar rats exposed to 20 or 80 human equivalent doses (20 daily injections of 0.6 or 2.5 mmol Gd/kg) of linear (gadobenate dimeglumine, gadodiamide, gadopentetate, gadoxetate disodium) or macrocyclic (gadobutrol, gadoterate meglumine, gadoteridol) GBCAs were compared to saline-exposed controls. Inductively coupled plasma mass spectrometry, transmission electron microscopy (TEM), and histopathology were performed on urine, serum, cerebrospinal fluid (CSF), basal ganglia and dentate nucleus at 6 and/or 34 weeks post-GBCA injection.

RESULTS

Gd concentrations were significantly higher in linear vs. macrocyclic GBCA-exposed rats in the dentate nucleus and basal ganglia at 6 and 34 weeks post-injection ($p<.0001$). Gd washout between 6 and 34 weeks varied between GBCAs, with the largest washout observed with gadobutrol (median 62% basal ganglia, 70% dentate). No washout was observed with gadodiamide. Gd concentrations in CSF were significantly higher following linear vs. macrocyclic GBCA exposure ($p=.002$ and $p=.003$, 6 vs. 34 weeks). At 6 weeks, non-significant differences in Gd biofluid concentrations were observed between linear and macrocyclic GBCAs ($p=.11$ serum, $p=.88$ urine). At 34 weeks, Gd was largely cleared from CSF and serum with more pronounced clearance among macrocyclic agents (70-98% removal CSF, 34-94% serum) and nearly eliminated from urine for all GBCAs agents (96-99%). TEM detected Gd foci in the perivascular lumen and neuropil of brain samples of both agent classes. No histopathology differences between GBCA-exposed and control rats were observed.

CONCLUSION

In a rat model, higher concentrations of Gd were observed in brain tissues following linear vs. macrocyclic exposure. Linear GBCA administration was associated with more attenuated washout in tissues and biofluids.

CLINICAL RELEVANCE/APPLICATION

The pharmacokinetics and biodistribution of Gd following GBCA exposure are complex and demonstrate some overlap between linear and macrocyclic agents. Additional patient studies are needed to better understand the potential clinical effects of chronic GBCA exposure, if any.

IN017-EC-SUA

National Cancer Institute Imaging Data Commons

Sunday, Dec. 1 12:30PM - 1:00PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Awards
Certificate of Merit

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TEACHING POINTS

Learn about National Cancer Institute Cancer Research Data Commons (CRDC), and the newly initiated Imaging Data Commons (IDC) resource of CRDC. Understand the strategy and implementation approach followed by the IDC team.

TABLE OF CONTENTS/OUTLINE

1. National Cancer Data Ecosystem, and CRDC 2. Imaging Data Commons (IDC), core team and major collaborating partners 3. Guiding principles The importance of data standards and models for imaging Availability of large-scale curated data collections and computing architectures for Artificial Intelligence/Machine Learning/Deep Learning training The need for continued input from the community for guidance and governance Paradigm shift to encourage and support cloud computing on big image data Open source, interoperability with other CRDC nodes 4. Implementation strategy DICOM as the foundation Harmonization with existing data models Initial focus on radiology and pathology visualization Metadata management, search and retrieve Annotation, integration of image analysis results Research use cases: radiomics, pathomics, AI/ML 5. Key building blocks Google Cloud Platform and Google Healthcare API DICOM implementation stack Open Health Imaging Foundation ISB-CGC infrastructure 6. Availability

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IN203-SD-SUA4

Accuracy of Coronary Artery Calcium Score on Low-Dose Screening Chest CT by Using Deep Learning-Based Denoising and Kernel Conversion

Sunday, Dec. 1 12:30PM - 1:00PM Room: IN Community, Learning Center Station #4

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PURPOSE

To evaluate the feasibility of coronary artery calcium score (CACS) on low-dose non-gated screening chest CT using a Deep Learning model for denoising and reconstruction kernel conversion.

METHOD AND MATERIALS

Forty-four health screening participants underwent both unenhanced ECG-gated cardiac CT and low-dose non-gated screening chest CT (iCT 256, Philips Healthcare) on same day. ECG-gated cardiac CT scans were acquired at 120 kVp, 50 mAs and reconstructed with the following parameters: slice thickness 2.5mm, filed of view (FOV) 150-180 mm, reconstruction kernel CB. Low-dose non-gated screening chest CT scans were acquired at 120 kVp, 20 mAs and reconstructed following parameters: slice thickness 1mm, FOV 300-400 mm, reconstruction kernel YA. Since low-dose screening chest CT scans were acquired at low-dose condition and reconstructed with 1mm slice thickness and sharp kernel, we applied the previously-trained Deep Learning model (ClariCT.AI, ClariPI, Seoul, South Korea) which enabled denoising and conversion of reconstruction kernel from YA to CB kernel. CACS (volume score, Agatston score) of cardiac CT and Deep Learning processed low-dose chest CT (DL chest CT) were calculated using conventional measurement methods with HU threshold and connective components. For both scan sets, Agatston score>=400 was categorized to high risk group whereas Agatston score<400 was categorized to low risk group. Taking cardiac CT as standard reference, the accuracy, sensitivity, and specificity of the DL chest CT in classifying high risk patients were calculated.

RESULTS

Mean volume and Agatston score were 257±162, 386±251 in cardiac CT, and 182±131, 412±329 in DL chest CT. The correlation coefficients of volume and Agatston score between cardiac CT and DL chest CT were 0.92 and 0.87, respectively. For high risk classification, accuracy, sensitivity, and specificity were 88%, 89%, and 88%, respectively.

CONCLUSION

CACS assessment on low-dose non-gated screening chest CT is feasible by applying a Deep Learning technique for denoising and kernel conversion. Our study demonstrated the potential of the Deep Learning to be used for providing additional risk factor in low-dose chest CT screening.

CLINICAL RELEVANCE/APPLICATION

By applying a pre-trained Deep Learning model for denoising and kernel conversion, CACS could be measured on low-dose non-gated screening chest CT by using simple and conventional measurement method.

Printed on: 10/29/20

IN220-SD-SUA6

Evaluation of an Artificial Intelligence-Based Double Read System in Capturing Pulmonary Nodule Discrepancy in CT Studies

Sunday, Dec. 1 12:30PM - 1:00PM Room: IN Community, Learning Center Station #6

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CONCLUSION

The PN discrepancy algorithm was able to sensitively detect missed PN with minimal impact to radiology workflow. Radiologists spent six hours to review flagged cases. The false positive rate will continue to decline with improved algorithm algorithm, reducing radiologist review time. We have successfully implemented an automated 2nd read system to identify PN misses and this represents a fundamental change to the way both NLP and MV have been applied to improve quality in radiology. In future, this system can be extended to do 100% 2nd read and in different modalities and pathologies as use cases arise.

Background

Studies show that up to 80% of all radiology errors are due to errors in perception. The early detection of pulmonary nodules (PN) is critical in diagnosing primary lung cancer and lung metastasis, but PN are among the most commonly missed findings despite their prevalence. Lung nodules are common on CT, at least 1 PN is present in 32% of all CT studies containing lung parenchyma. With the growth of AI technologies, a new paradigm can be implemented where automated 2nd read algorithms can be used to second read all studies and flag suspicious findings for review.

Evaluation

We prospectively applied a Machine Vision (MV) algorithm to CT studies containing lung tissue for the detection of PN and applied a Natural Language Processing (NLP) algorithm to the report text for documentation of PN. This algorithm compared nodules detected via the MV algorithm with the radiology report, and subsequently flagged misses in perception - where a radiologist does not observe and document a finding - for a secondary review. Two radiologists reviewed and scored the flagged cases based on RadPeer ratings.

Discussion

4900 studies were prospectively processed with 1518 cases having PN. The automated 2nd read system initially flagged 450 cases but there was a high rate of false positive cases. After preliminary manual review and algorithm adjustment, 104 cases were flagged of which 50 contained undocumented PN ie 3.3% of cases of PN were not documented. 38 nodules were classified as not clinically significant. 7 cases were classified as likely to be significant (report addendum was done and the clinician notified.)

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IN223-SD-SUA1

The Effect of Radiation Dose on the Characterization of Ground Glass Nodules: A Thoracic Phantom Study

Sunday, Dec. 1 12:30PM - 1:00PM Room: IN Community, Learning Center Station #1

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PURPOSE

To investigate the effect of different radiation doses on the characterization of ground glass density nodules (GGN).

METHOD AND MATERIALS

Twenty ground glass nodules of different sizes were randomly placed in a thoracic phantom, and scanned with 120kVp tube voltage, automatic tube current modulation. The ASiR-V weightings for the preset and post reconstruction were both at 40%. The chest phantom was scanned at different noise index values (NI = 10, 12, 14, 16, 18, 20, 25, 30, 35, 40). The effective doses (ED) for the different NI values were calculated and compared. The CT values, standard deviation (SD) values and contrast-to noise ratio (CNR) of GGN with 1cm diameter, aorta, vertebral body and paraspinal soft tissue were measured and used as objective indicators. Two experienced doctors also subjectively scored the morphology and edges of GGN.

RESULTS

ED decreased as NI increased, ED values for NI of 25, 30, 35, 40HU (0.99mSv, 0.83mSv, 0.42mSv, 0.3mSv) were significantly lower than the value of 1.78mSv with NI of 20HU. All GGNs were detected in all dose levels studied. However, SD values (in HU) of GGN with NI of 25, 30, 35, 40HU (16.67±1.13, 17.14±0.35, 21.96±1.79, 21.96±2.01) were significantly higher than the value of 14.11±0.98 with noise index of 20HU ($P<0.05$), the CNR values were significantly lower (45.28±1.65, 38.62±1.87, 38.98±3.12 and 43.48±0.63 vs. 55.38±0.65 with NI of 20HU) ($P<0.05$). The subjective scores of GGN at these 4 NI values in the lung window (2.12±0.65, 1.78±0.23, 1.16±1.04 and 1.09±0.87) and mediastinal window (2.23±1.09, 1.94±0.94, 1.28±1.02 and 1.13±0.97) were also significantly lower than those of NI=20HU (lung window: 3.09±1.02, mediastinal window: 3.21±2.19) ($P<0.05$). In addition, when NI was greater than 20HU, the morphology of GGN gradually changed and GGN became irregular with the edges blurred.

CONCLUSION

Ground glass density nodules can be detected at very low radiation dose. However, lower dose can affect the accurate characterization of GGN. When NI is greater than 20HU in the phantom study, the characterization for GGN became less accurate and the clarity decreased.

CLINICAL RELEVANCE/APPLICATION

GGN can be detected at very low radiation, but to accurately characterize GGN, higher dose is required.

IN231-SD-SUA2

Feasibility of Nakagami Parametric Imaging for Texture Analysis of Ultrasound Images

Sunday, Dec. 1 12:30PM - 1:00PM Room: IN Community, Learning Center Station #2

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CONCLUSION

Quantifying texture provides a useful diagnostic tool. Texture can be defined using parametric imaging, which extracts backscattered tissue signal from the RF data that is not affected by ultrasound bias. Analyzing the distribution of scatterers and texture in lesions could be useful in the future for lesion characterization and classification.

Background

Despite many uses of ultrasound imaging, the modality introduces operator bias due to adjustments in depth and TGC. The goal of this study was to examine the effectiveness of the Nakagami distribution in characterizing backscattered signal texture by utilizing the pre-processed B-mode image in its native format. Studying unbiased scans can reveal more accurate texture descriptors to better diagnose lesions.

Evaluation

The Nakagami parametric image is constructed with the sliding window technique to create a map of local parameters. A window of three times the pulse length is digitally moved in steps of one pixel through the entire image, where the parameter is calculated using the window and assigned to the central pixel of the window. The average Nakagami parameter (m) for the entire image was found by averaging all values. Two agar phantoms were constructed, using flour in the mixture as scatterers. Phantom 1 consisted of less flour, meaning less scatterers, than phantom 2. The respective agar:flour gram ratios were 19:2 and 19:4.

Discussion

When m is greater than 1, the distribution is post-Rayleigh. When m is equal to 1, the distribution is Rayleigh. Phantom 1 displayed a post-Rayleigh distribution ($m = 36.1 \pm 7.0$), while phantom 2 did so, to a lesser extent ($m = 1.64 \pm 0.12$). As the distribution transitions from Rayleigh to post-Rayleigh, the scatterers in the sample go from being periodically located and randomly distributed to large numbers of randomly distributed scatterers.

IN252-SD-SUA3

Comparison of Radiomics-Based Feature Reduction Methods and Machine Learning Classifiers for Prognostic Biomarkers of Glioma Grading

Sunday, Dec. 1 12:30PM - 1:00PM Room: IN Community, Learning Center Station #3

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PURPOSE

Most radiomics-based researches have shown predictive abilities with multitudinous machine-learning approaches. However, it is still unknown whether different feature reduction and classification methods in radiomics-based strategies affect the prediction performance. The aim of this current study is to compare the prediction performance of the frequently utilized feature reduction and classification methods in predicting glioma grades.

METHOD AND MATERIALS

Quantitative radiomics features were extracted from the tumor regions in 210 Glioblastoma (GBM) and 75 low-grade glioma (LGG) multiparametric MRI. Fifteen feature reduction methods and fifteen classification methods (shown in Figure.1A) were subsequently evaluated for the diagnostic performance by repeated ten-fold cross-validation. Accuracy, sensitivity and specificity were used as indicators to compare the performance of feature reduction and classification methods. Besides, the roles of selected feature number, feature type, MRI modality and tumor sub-region were also evaluated to optimize the radiomics-based prediction.

RESULTS

Feature selection method L1-based linear support vector classification (L1-SVC) + classifier multi-layer perceptron (MLPC) achieved the highest diagnostic performance (accuracy:0.975, sensitivity:0.987, specificity:0.973) in glioma grading as shown in Figure.1B. Meanwhile, four feature reduction methods including L1-SVC, least absolute shrinkage and selection operator (LASSO), xgboost (XGB) and gradient boosting decision tree (GBDT) demonstrated valuable and stabile feature reduction performance. For the classification capabilities, XGB, linear discriminant analysis (LDA), MLPC and logistic regression (LGR) were superior to other classifiers. For radiomics feature extraction, the enhancing tumor region (ET) combined with necrotic and non-enhancing tumor (NCR/NET) regions in T1 post-contrast (T1Gd) modality provided the considerable tumor-related phenotypes than other tumor region and MRI modality combinations.

CONCLUSION

The cross-combination strategy for comparison of feature reduction and classification methods provided a way of searching optimal model for future radiomics-based prediction.

CLINICAL RELEVANCE/APPLICATION

The comparative investigation may be an important reference in identifying the reliable and effective machine-learning methods for radiomics-based diagnostic and prognostic analyses in glioma grading non-invasively.

MI110-ED-SUA4

Molecular Imaging and Theranostics in Pheochromocytoma and Paraganglioma

Sunday, Dec. 1 12:30PM - 1:00PM Room: MI Community, Learning Center Station #4

Participants
Sara Sheikhbahaei, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Steven P. Rowe, MD, PhD , Baldwin, MD (*Abstract Co-Author*) Research funded, Progenics Pharmaceuticals, Inc
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TEACHING POINTS

This education exhibit provides a case-based review of the role of molecular imaging in the diagnosis, staging, and follow-up of patients with pheochromocytoma and paragangliomas (PPGLs). This includes reviewing the mechanism of different functional imaging modalities, and proposed algorithm for imaging of PPGLs. We discuss the application, efficacy and adverse reactions of targeted radiotherapy in PPGLs.

TABLE OF CONTENTS/OUTLINE

1. Background- Classification and clinical spectrum of Pheochromocytoma and Paragangliomas (PPGLs) 2. Metabolic imaging phenotypes in PPGLs including catecholamine metabolism, somatostatin receptors, and glucose uptake imaging 3. Appropriate use criteria and clinical algorithm for molecular imaging of PPGLs 4. Physiologic bio-distribution, and pitfalls in interpretation of 123I-MIBG and 68Ga-DOTA SSA PET imaging 5. Application, efficacy and adverse reaction of targeted radiotherapies in PPGLs including the FDA approved 131I- iobenguane (AZEDRA) therapy and potentially 177Lu-DOTATATE (Lutathera) 6. Future directions

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MI200-SD-SUA1

MRI Relaxometry for Tracking Nanoparticle Mediated Ablation Therapy of Colorectal Cancer Liver Metastasis

Sunday, Dec. 1 12:30PM - 1:00PM Room: MI Community, Learning Center Station #1

Participants
El-Sayed H. Ibrahim, PhD, Milwaukee, WI (*Presenter*) Nothing to Disclose
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Amit Joshi, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Surgical intervention is only possible in less than one third of colorectal liver metastases cases. Chemotherapy and hyperthermia ablation are the only other clinically available treatment options. In this respect, detecting accurate tumor location during the therapeutic procedures is essential to effective treatment. In this study, we explore the value of MRI relaxometry for identifying the tumor response to theranostic nanoparticles (TNPs) mediated photothermal therapy (PTT) and distinguishing it from normal surrounding tissues.

METHOD AND MATERIALS

Au nanorods resonant at 830nm were synthesized, and encapsulated with Gd2O3:Yb/Er shell and PEGylated, resulting in formation of sub-100 nm TNPs. Three WAG/RijCmcr rats implanted with colorectal cancer liver metastasis (CLRM) tumors were scanned on 9.4T MRI scanner. TNPs (0.5 mL, 1013 NP/mL) were locally injected into the liver via hepatic portal vein. The rats were imaged to determine MRI R2* relaxometry immediately after TNPs injection, followed by 3-minute laser ablation (~700 mW/cm2), and at 10 days post procedure. R2* relaxometry was assessed using a gradient-echo T2* mapping sequence to acquire axial and coronal stacks of 6-12 images covering the liver. Nine echoes were acquired with echo times ranging from 4ms to 48ms in 5.5ms increments. R2* was measured for each pixel as 1000/T2*, and the results were used to generate R2* maps.

RESULTS

The TNPs' R1 =1.1 × 108 mM-1 s-1 and R2 =4.8 × 108 mM-1 s-1. The CLRM tumor R2* =25.2±0.6 s-1 in post-PTT rats, which is ~5 times higher than normal liver R2* relaxivity (5.9±0.6 s-1). The tumor R2* relaxivity decreased to 15.3±0.9 s-1 at 10-days post therapy, which is ~3 times higher than normal value in the liver (5.9±0.6 s-1). The results showed significant difference between R2* values in tumor and normal tissues at the two imaging timepoints.

CONCLUSION

In conclusion, inclusion of MRI contrast in gold nanoparticles with plasmon resonance in near-infrared optical region can play a significant role in precise image-guided PTT by accurately tracking the tumor boundaries, which enables high-efficiency PTT by delivering a sufficient amount of light to the tumor.

CLINICAL RELEVANCE/APPLICATION

MRI contrast can be used for targeting colorectal cancer liver metastasis tumors, which enables delivering sufficient amount of light during photothermal tumor ablation and tracking therapy response.

Printed on: 10/29/20

MI215-SD-SUA3

Dynamic Contrast-Enhanced Magnetic Resonance Imaging for Monitoring The Anti-Angiogenesis Efficacy in a C6 Glioma Rat Model Dynamic Contrast-Enhanced Magnetic Resonance Imaging for Monitoring the Anti-Angiogenesis Efficacy in a C6 Glioma Rat Model

Sunday, Dec. 1 12:30PM - 1:00PM Room: MI Community, Learning Center Station #3

Participants
Weishu Hou, Hefei, China (*Presenter*) Nothing to Disclose
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Hongli Pan, Hefei, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To observe the changes of dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) parameters in monitoring the early effects of antiangiogenic therapy in a C6 glioma rat model.

METHOD AND MATERIALS

Twenty-six rats were used to establish a C6 glioma model and were randomly divided into a treated group (n = 13) and a control group (n = 13). Rats in the treated group were administered with bevacizumab (Bev) for 7 days, while rats in the control group were administered with vehicle at the same dose. Conventional MRI and DCE-MRI scans were obtained, respectively, on days 0, 1, 3, 5, and 7 after treatment; tumor volume and MRI parameters were dynamically observed. Hematoxylin and eosin (HE) and immunohistochemical (IHC) examination including MVD and proliferating cell nuclear antigen (PCNA) were performed on day 7. One-way ANOVA was used to compare intra-group differences in each group and t-test was used to compare inter-group differences of MRI parameters between the two groups. Correlations between MRI quantitative parameters and IHC scores were analyzed.

RESULTS

The tumor volume and relative change of tumor volume in the treated group were significantly lower than that of control group on day 7 after treatment with Bev. Ktrans and Kep decreased in the treated group while they increased in the control group; Ve increased in the treated group while it decreased in the control group. A significant difference in MRI parameters between the two groups was observed on days 5 and 7 after treatment. Ktrans and Kep showed positive correlations with MVD, while Ve showed negative correlation with PCNA.

CONCLUSION

DCE-MRI dynamically and accurately assessed the early effects of anti-angiogenic therapy against tumors and may be used as a therapeutic strategy.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI can assessed effects of anti-angiogenic therapy of glioma.

MK289-ED-SUA5

Dynamic MR Imaging of Thoracic Outlet Syndrome - Imaging Protocol and Pictorial Review of Various Etiologies

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #5

Participants
Islam I. Fayed, MD,DO, Mount Sinai , NY (*Presenter*) Nothing to Disclose
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Daichi Hayashi, MD,PhD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To describe Thoracic outlet syndrome and its types as well as the role of dynamic imaging in diagnosing TOS To illustrate and discuss image finding is different types of TOS

TABLE OF CONTENTS/OUTLINE

1. Summary of the anatomy, pathophysiology, types and clinical features and the role of dynamic imaging in diagnosing TOS 2. Detailed imaging protocol, including patient positioning and preparation 3. Pictorial review of the TOS utilizing dynamic/stress MRI and MRA Types: (Vascular and Neurogenic) *Vascular (arterial and/or venous)* Compression by bone and soft tissue abnormalities; Axillary/subclavian vein thrombosis with collaterals development; Axillary/subclavian artery aneurysm or pseudoaneurysm; Arterial thrombus with distal emboli and enlarged collaterals; Fixed axillary/subclavian vessels stenosis at the site of dynamic narrowing; Axillary/subclavian vessels narrowing with abduction *Neurogenic* Compression by bone and soft tissue abnormalities; Loss of fat about brachial plexus with abduction; Edema in brachial plexus 4. Discuss alternative imaging modalities such as CT, ultrasound, and radiograph 5. Conclusion: Dynamic MRI/MRA may be helpful in informing the clinician as to the anatomic structures undergoing compression, the location of that compression, and the anatomic structures responsible for it

MK291-ED-SUA6

Postsurgical Imaging of the ACL: Everything You Always Wanted to Know But Were Afraid to Ask

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #6

Participants
Ericka M. Leon, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Araceli S. Cabanillas, MD, Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose
Ricardo Salazar, MD, Mexico City , Mexico (*Abstract Co-Author*) Nothing to Disclose
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Christian A. Zamora, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Describe basic anatomy of the anterior cruciate ligament (ACL). Discuss reconstruction techniques and normal postoperative appearance/criteria. Review the functional classification of ACL postsurgical complications: decrease in the range of motion vs laxity.Recognize the role of the radiologist in the postsurgical follow-up.

TABLE OF CONTENTS/OUTLINE

A comprehensive review of the ACL reconstruction procedures : - Autologous and grafts MRI appearances- Femoral and tibial tunnel anatomyA case-based review of main complications: - Impingement, arthrofibrosis, intraarticular bodies, ganglion cysts- Graft tearing, graft stretching

MK292-ED-SUA7

Metabolic and Endocrine Bone Disorders and Conditions: A Current, Comprehensive Review

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #7

Participants
Sirisha Koneru, DO, Mineola, NY (*Presenter*) Nothing to Disclose
Jawad Hussain, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Michael K. Brooks, MD, Roslyn, NY (*Abstract Co-Author*) Nothing to Disclose
Jonathan A. Flug, MD, MBA, Phoenix, AZ (*Abstract Co-Author*) Nothing to Disclose
Kevin R. Math, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To discuss and refresh the concepts of various metabolic and endocrine disorders which can affect bone, to help radiologists identify and diagnose these conditions appropriately.To review the multi-modality imaging features of these disorders and conditions.

TABLE OF CONTENTS/OUTLINE

Pathophysiology of Vit D, Ca, Phosphorous, PTH, other metabolic diseases that affect bone,collagen,and cartilage-osteoporosis and types,transient osteoporosis of the hip, migratory osteoarthritis, rickets/osteomalacia, renal osteodystrophy,hyperPTH,hypoPTH, x-linked hypophosphatemic rickets.DEXA Screening, BMD and FRAX tool.Biomarkers and proteomic analysis for OA. Review of current role of high-spatial resolution peripheral quantitative CT (HR-pQCT). Radiographic features of ossification disorders including heterotopic ossification, DISH, hypertrophic osteoarthropathy and spondyloarthropathies.Stages of Paget's with radiographic correlation,review complications.Endocrine diseases affecting the bone-pituitary disorders, growth hormone abnormalities, and thyroid hormone disorders. Other diseases affecting the bone-Gaucher's,osteopoikilosis,myelofibrosis,sickle cell anemia,heavy metal poisoning,chronic inflammatory and malabsorption disorders.Radiographic,CT, MRI & NM imaging features of diseases,with selective pathology correlation. Recent advances in diagnosis and management.

MK293-ED-SUA8

An Educational Approach to Dynamic Contrast-Enhanced MRI Techniques for Arthritis Assessment

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #8

Awards
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Participants
Teodoro M. Noguerol, MD, Jaen, Spain (*Presenter*) Nothing to Disclose
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Marta Gomez Cabrera, MD, Cadiz, Spain (*Abstract Co-Author*) Nothing to Disclose
Rafael Barousse, MD, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD,PhD, Jaen, Spain (*Abstract Co-Author*) Speaker, Canon Medical Systems Corporation; Speaker, Koninklijke Philips NV; Speaker, Siemens AG

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TEACHING POINTS

1. Review the physical basis and technical adjustments for DCE-MRI and T1 permeability sequences acquisition for joints assessment. 2. Explain, from an educational point of view, the biological meaning of parameters derived from DCE-MRI and T1 permeability acquisitions. 3. Show potential applications of DCE-MRI and T1 permeability sequences for arthritis evaluation in different clinical scenarios.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Physical basis and main differences between: a. DCE-MRI studies b. T1 permeability studies 3. Technical adjustments. a. Sequences design b. Coils selection and patient positioning c. How to identify and avoid potential pitfalls 4. Post-processing and Biological meaning of parameters derived a. Semi-quantiative model (AUC, wash in, wash out, maximum relative enhacement, time to peak...) b. Pharmacokinetic model (Ktrans, Kep, Ve, Vp) 5. General considerations a. When do I have to perform DCE-MRI studies for arthritis evaluation? b. Is necessary to integrate DCE-MRI in routine protocols? c. ROIs positioning and histograms. d. How should I report DCE-MRI studies? 6. Potential applications a. Rheumatoid arthritis b. Psoriatic arthritis. c. Sacroiliitis and other seronegative arthritis d. Crystal induced arthritis e. Infectious arthritis f. Osteoarthritis. g. Treatment monitoring 7. Conclusions and take home messages

MK294-ED-SUA9

Ultrasound Features of Sport-related Muscle Injuries of the Lower Limb

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #9

Participants
Catherine Phan, MD, Paris, France (*Presenter*) Nothing to Disclose
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Clement Cholet, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Raissa Lotte, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1- To understand how different types of muscle injuries relate to biomechanics, pathophysiology, and anatomy of the muscle 2- To describe the ultrasound findings using comprehensive grading system for intrinsic and extrinsic muscular lesion 3- To define sonographic features of acute skeletal muscle trauma as strains, tears, contusions, and hematomas 4- To depict sonographic features of chronic lesions after muscle trauma including fibrous scars, muscle hernias, and calcification 5- To emphasize what should not be missed for patient's outcome

TABLE OF CONTENTS/OUTLINE

1- Echo-anatomy of lower limb muscles 2- Normal echotexture of the muscle, and the myoaponevrotic and myotendinous junctions 3- Durey and Rodineau grading system with corresponding sonographic cases 4- Sonographic cases of the most common pathologic findings for muscle injuries for the following muscle: rectus femoris, vastus lateralis, vastus medialis, vastus intermedius, adductor, hamstring lesion, tennis leg lesion, DOMS

MK307-ED-SUA10

Through Thick and Thin: Periosteal Reactions and Their Underlying Etiology

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #10

Participants
Jonathan Barclay, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Leanne L. Seeger, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin D. Levine, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. General overview and pathophysiology of periosteal reactions2. Differential Diagnosis for periosteal reaction3. Review the types and various appearances of periosteal reaction4. Determining benign vs. aggressive periosteal reaction (slow vs. fast)5. Characteristics of periosteal reactions in specific diseases6. Identifying complex (mixed) periosteal reaction

TABLE OF CONTENTS/OUTLINE

1. Overview of periosteal reaction2. Differential diagnosis of periosteal reactions3. Aggressive vs nonaggressive periosteal reactions4. Examples of aggressive periosteal reactions5. Examples of benign periosteal reactions6. Examples of periosteal reaction within specific disease processes: a) Primary bone tumors b) Metastases c) Metabolic d) Infection e) Trauma f) Arthritis h) Genetic i) Vascular 7. Complex periosteal reaction (acute on chronic processes)

MK308-ED-SUA11

Osteochondral Lesions of the Talar Dome: An Up-To-Date Approach on Multimodality Imaging and Surgical Techniques

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #11

Awards
Certificate of Merit

Participants
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TEACHING POINTS

*The talus is a unique bone, with no tendon attachment and a distinct morphology and vascularization, supporting several times the weight of the body in a relatively small articular surface.*Talar dome is prone to osteochondral lesions (OCL) secondary to various mechanisms, being the rotational trauma the most frequent causative factor, usually related to inversion stress of the foot.*We aim to review multimodality imaging approach: CR, CT, arthroCT, MRI, arthroMRI and quantitative MRI sequences.*The imaging findings must be well documented in order to allow therapeutical decision, and should include lesion size and depth, location, cartilage status, subchondral bone outline and edema, cystic and degenerative changes, as well as alignment and associated injuries.*New insights on arthroscopic surgery: what radiologists need to know.*Post-therapeutic imaging evaluation of OCL: what orthopedic surgeons want to know.

TABLE OF CONTENTS/OUTLINE

*Anatomy and vascularity*Mechanisms of injury and natural history of osteochondral lesions*Multimodality imaging approach and classification of distal tibial and talus OCL*MRI and arthroscopic correlation*Adapted algorithm from the International Consensus Meeting on Cartilage Repair of the Ankle - AOFAS 2017 *Therapeutic options including orthobiologics*Post-treatment imaging evaluation

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MK349-SD-SUA1

Is the Bone Mineral Density of Necrotic Area Decreased in Pre-Collapse Osteonecrosis of the Femoral Head? A Propensity-Matched Study Using CT Hounsfield Unit Values

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #1

Participants
Shoji Baba, Fukuoka City, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

Osteoporosis is described as one of the radiographic signs of osteonecrosis of the femoral head (ONFH) in the early stage before femoral head collapse. However, no studies have demonstrated the decreased bone mineral density (BMD) of the necrotic area in pre-collapse ONFH probably because dual-energy X-ray absorptiometry (DXA) is inappropriate for the examination of the femoral head. The purpose of this study was to verify the utility of CT Hounsfield unit (HU) values for BMD of the femoral head, and to test the assumption of decreased HU values of the necrotic area in pre-collapse ONFH.

METHOD AND MATERIALS

A proximal one-third area of the coronal section through the anterior part of the femoral head was set as a region of interest (ROI) for the measurement of HU values. In each femoral head, average HU values of three ROIs on the serial CT slices was defined as the HU values of the femoral head. Firstly, the HU values of normal femoral heads in 101 control subjects were assessed for identifying relevant confounding factors. Next, in 25 of 101 control subjects who had undergone DXA around the same time, the correlation strength between BMD of the femoral neck on DXA and the HU values of the femoral head was verified. Finally, the HU values of femoral heads in pre-collapse ONFH subjects were compared with those in propensity-matched control subjects.

RESULTS

Based on the multivariate analysis, both age and BMI were identified as relevant confounding factors for the HU values of the femoral head. Age was negatively correlated with the HU values ($p < 0.01$), and BMI was positively correlated with the HU values ($p < 0.01$). As a result of correlated analysis, a strong correlation was found between BMD of the femoral neck on DXA and the HU values of the femoral head ($r = 0.86$). After adjusting for baseline characteristics with propensity score matching, no significant difference was found in the HU values of the femoral head between 13 pre-collapse ONFH and 13 control subjects ($p = 0.32$).

CONCLUSION

The HU values may be useful for the examination of BMD of the femoral head. The current propensity-matched study demonstrated no significant difference in the HU values between the necrotic area of asymptomatic pre-collapse ONFH and normal femoral head.

CLINICAL RELEVANCE/APPLICATION

The current study supports the opinion that bone resorption inhibitors including bisphosphonate is ineffective for preventing femoral head collapse of ONFH.

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MK350-SD-SUA2

3D Shape Analysis of the Supraspinatus Muscle in Rotator Cuff Tear Patients

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #2

Participants
Marie-Pierre Ingham, BEng, Montreal, QC (*Presenter*) Nothing to Disclose
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Mahsa Shakeri, PhD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Karim Saydy, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Samuel Kadoury, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Rotator cuff tears (RCT) lead to muscle degeneration and atrophy which impacts clinical outcomes negatively. MRI studies have evaluated the 3D volume of the rotator cuff muscles. We sought to characterize supraspinatus muscle 3D shape alterations in patients with full-thickness RCT.

METHOD AND MATERIALS

Retrospective study in 47 patients with RCT (mean age, 57 years; range, 39-67 years) and 30 asymptomatic volunteers (mean age, 56 years; range, 35-64 years). RCT severity was graded according to the Patte classification. The entire supraspinatus muscle length was segmented on large field-of-view coronal oblique T1-weighted MR images by two independent readers using ITK-SNAP tool. Volume, length, surface area and surface-to-volume ratio (S/V) were computed in Matlab from the reconstructed 3D solid representation of the supraspinatus muscle. 3D shape statistical analysis was performed using SPHARM-PDM tool to precisely locate morphological changes between RCT and healthy supraspinatus muscles. ANOVA and a non-parametric permutation testing scheme with covariates (sex, height, weight) and correction for multiple comparisons, were applied to test for significant differences ($p < 0.05$) between patients, volunteers, and RCT severity subgroups as appropriate.

RESULTS

Interobserver reliability for the muscle semi-automated segmentation technique was excellent (ICC = 0.916). Supraspinatus mean volume and surface area were smaller in patients compared to volunteers, whereas mean S/V was greater (all, $p < 0.001$) and no difference in mean length was observed ($p = 0.318$). Similarly, as tendon tear size increased, supraspinatus mean volume and mean surface area decreased, and mean S/V increased significantly. However, there was no statistically significant difference in mean supraspinatus muscle length between volunteers and all RCT severity subgroups ($p>0.05$). Supraspinatus muscle group-wise shape analysis showed predominant muscle loss in the inferior myotendinous region and predominant muscle enlargement at the supero-medial, antero-lateral and postero-lateral regions of the muscle in patients compared to volunteers.

CONCLUSION

RCT lead to supraspinatus muscle size reduction and non-uniform 3D shape alterations with predominant muscle loss occurring at the myotendinous junction and asymmetrical enlargement of the muscle belly, whereas muscle length remains unchanged.

CLINICAL RELEVANCE/APPLICATION

3D shape analysis of the entire supraspinatus muscle length could provide a more precise evaluation of the muscular condition in RCT patients than current 2D assessment techniques, and contribute to improving care management in these patients.

MK351-SD-SUA3

Physician Image Ordering Variability for Low Back Pain in a Single Healthcare System

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #3

Participants
Payal Shah, New York, NY (*Presenter*) Nothing to Disclose
Soterios Gyftopoulos, MD, Scarsdale, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Low back pain (LBP) is one of the most common complaints in the US with imaging playing an important diagnostic role. We aim to describe the variability of both physician and patient factors that associate with guideline concordance for LBP image ordering.

METHOD AND MATERIALS

We performed retrospective review of 10,126 patients with LBP using the electronic clinical quality measure (eCQM 166v6) specification of the Center for Medicare and Medicaid's Merit-Based Incentive Payment System from January 1 to December 31,2017 at one large medical center. We selected the 5 most guideline concordant (GC) and 5 most guideline discordant (GD) outpatient sites of care, leaving a total of 3,306 patients. Sites with fewer than 100 patients were excluded. We evaluated differences in ordering physician medical specialty, patient demographics including age, race and gender, and healthcare insurance status.

RESULTS

Of the 3,306 (33%) records of 2017 LBP patient volume, GC sites had 776 (23%) patients and a concordance rate of 96%. GD sites had 2,530 (77%) patients and a concordance rate of 43%. GC sites were largely composed of internal medicine (65%) and physical medicine and rehabilitation physicians (29%). GD sites were predominately orthopedic surgery (71%) and rheumatology physicians (15%). Compared to GD sites, GC sites had more patients that were 40 years or older (51% vs 39%), male (50% vs. 42%), Black (29% vs. 9%) and publically insured (20% vs. 12%), and fewer that were White (45% vs. 63%) and Asian (7% vs. 14%).

CONCLUSION

Our results demonstrated that there are differences in guideline concordant and guideline discordant physician practices with regards to ordering physician medical specialty, patient age, patient gender, patient race, and patient insurance status.

CLINICAL RELEVANCE/APPLICATION

The differences identified can be used to direct efforts to improve the guideline concordance in LBP imaging. As LBP is common, these efforts have considerable potential to increase value-based care.

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MK387-SD-SUA4

Performance of a Standardized Scanning and Reporting Method for Sonographic Soft Tissue Sarcoma Surgical Resection Bed Surveillance

Sunday, Dec. 1 12:30PM - 1:00PM Room: MK Community, Learning Center Station #4

Participants
Adam D. Singer, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Philip K. Wong, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
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Felix Gonzalez, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Nickolas Reimer, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Shervin Oskouei, Atlanta , GA (*Abstract Co-Author*) Nothing to Disclose
Ken Cardona, Atlanta , GA (*Abstract Co-Author*) Nothing to Disclose
Ty K. Subhawong, MD, Miami, FL (*Abstract Co-Author*) Research Consultant, Arog Pharmaceuticals, Inc

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PURPOSE

Compare MRI to an US scanning and reporting protocol for the detection of recurrent soft tissue sarcomas. Propose a risk profile system with recommendations for subsequent action and validate it using pathological and follow-up MRI data.

METHOD AND MATERIALS

Consecutive patients with previously resected soft tissue sarcomas of the extremities and trunk presenting for MRI surveillance were invited to participate. Blinded to clinical information, one radiologist scanned the surgical site. If a mass was detected, qualitative and quantitative data were recorded and used to create an US risk profile score. A second radiologist, blinded to US findings, independently determined if tumor was present on the same day MRI. Recurrent tumor was defined by positive histology. Negative was defined as either negative histology or no evidence of tumor at the next surveillance MRI. Diagnostic performance of US and MRI were calculated. ICC was performed to compare agreement between US, MRI and follow-up. Pearson correlation was performed to compare the US score and recurrent tumor.

RESULTS

Currently, follow-up information was available for 40% of cases. US and MRI had a sensitivity, specificity, PPV, NPV and accuracy of 0.88,1.0, 1.0, 0.94 and 0.96 and 1.0, 0.87, 0.80, 1.0 and 0.91, respectively. There was excellent agreement between US and follow-up (ICC 0.91 $p < 0.001$) and good agreement between MRI and follow-up (ICC 0.83, $p < 0.001$). There was good agreement between US and MRI (ICC 0.75 $p < 0.001$). There was a strong positive correlation between the US total score and sonographically detected mass being malignant ($r = 0.72$, $p = 0.02$) and between the score and follow-up ($r = 0.87$, $p < 0.001$). A total score of 5.5 appears to be an optimal cut point. Internal flow, when present, was indicative of tumor. The only US false negative was a DFSP just below the skin.

CONCLUSION

In this ongoing pilot study, at this point, US was at least as accurate as MRI in the detection of recurrent soft tissue sarcomas. US performance would likely be improved further if the scanner was aware of tumor histology. While US performed well for high grade sarcomas, detection of ALT/WDL and DFSP can be challenging.

CLINICAL RELEVANCE/APPLICATION

US may perform similar to MRI in the detection of recurrent soft tissue sarcomas. As this patient population may require long term imaging, this finding would address the need to reduce cost and gadolinium exposure.

MS220-ED-SUA1

Side Effects of Molecular Target Drugs and Immune Checkpoint Inhibitors in the Era of Precision Medicine: What Should Radiologists Know?

Sunday, Dec. 1 12:30PM - 1:00PM Room: MS Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Awards
Certificate of Merit

Participants
Mariko Kurokawa, Tokyo , Japan (*Presenter*) Nothing to Disclose
Ryo Kurokawa, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

·Understand the classification and medical action of molecular target drugs and immune checkpoint inhibitors.·Recognize clinical manifestation of side effects caused by these drugs.·Review multimodality imaging features of major and serious side effects for each organ and learn about their differential diagnosis.

TABLE OF CONTENTS/OUTLINE

1. Introduction -the classification and medical action of molecular targeted drugs and immune checkpoint inhibitors.2. Side effects a. Brain - Pseudo-response associated with Bevacizumab, Hypopituitarism associated with Ipilimumab b. Head and neck - Endocrine dysfunction associated with Nivolumab c. Chest - Pseudo-progression associated with Pembrolizumab, Interstitial pneumonia associated with Pembrolizumab, Fluid retention associated with Nivolumab d. Abdominal - Colitis associated with Nivolumab, Liver injury associated with Nivolumab,Bleeding and spontaneous rupture associated with Lenvatinib, Neutropenic colitis associated with Avastin, Intestinal perforationassociated with Pembrolizumab e. Bone and soft tissue -Myelitis associated with Pembrolizumab, Osteomyelitis associated with Denosumab3. Summary

NM121-ED-SUA5

Evaluation of Extrahepatic Shunting with 99mTc-MAA Hepatic Perfusion Before 90Y Radioembolization of HCC: A Concise Review

Sunday, Dec. 1 12:30PM - 1:00PM Room: NM Community, Learning Center Station #5

Participants
Muhammad Alkaphoury, MD, MBBCh, Chicago, IL (*Presenter*) Nothing to Disclose
Jagadeesh Singh, MD, FRCR, Oak Brook, IL (*Abstract Co-Author*) Nothing to Disclose
Sumeet Virmani, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The aim of this work is to stress on the following: Evaluation of shunting before HCC radioembolization is imperative to enhance local treatment efficacy and to avoid its systemic toxicity. 99mTc-MAA particles imaging with SPECT-CT has a better sensitivity than planar imaging in detecting extrahepatic shunting. Portal hypertension and tumor-induced angiogenesis are the main mechanisms of extrahepatic shunting. Lungs are the commonest organs to show extrahepatic shunting. Other potential organs are bowel, gallbladder, veins, spleen, and lymph nodes. Elevated lung shunt fraction may be a sensitive prognostic indicator for local and metastatic HCC progression.

TABLE OF CONTENTS/OUTLINE

Significance of pre-radioembolization shunt mapping using 99mTc-MAA hepatic perfusion in HCC patients. Suggested mechanisms of 99mTc-MAA shunting. Role of SPECT-CT vs planar imaging in detecting extrahepatic shunting. Quantitative vs qualitative measurement of extrahepatic shunting using SPECT-CT. Prognostic values of elevated lung shunt fraction in local and metastatic HCC progression. Example cases of extrahepatic shunting to lungs, spleen, bowel, gallbladder, veins, and lymph nodes.

NM122-ED-SUA6

Targeted Imaging of Gastro-Entero-Pancreatic Neuroendocrine Tumors with 68Ga-DOTATATE PET/CT and Simultaneous 68Ga-DOTATATE Gadoxetate PET/MRI

Sunday, Dec. 1 12:30PM - 1:00PM Room: NM Community, Learning Center Station #6

Participants
Ishan Garg, MBBS, Rochester, MN (*Presenter*) Nothing to Disclose
Chetan Saini, MBBS, Jaipur, India (*Abstract Co-Author*) Nothing to Disclose
Ananya Panda, MD,MBBS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Pfizer Inc
Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Mark Truty, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Thorvardur Halfdanarson, Rochester, MN (*Abstract Co-Author*) Research Consultant, Curium; Research Consultant, Lexicon Pharmaceuticals, Inc; Research Consultant, Advanced Accelerator Applications SA; Research Grant, Ipsen SA; Research Grant, Thermo Fisher Scientific Inc
Ajit H. Goenka, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Review the concepts of somatostatin receptor imaging (SSRI) in gastro-entero-pancreatic (GEP) neuroendocrine tumors (NETs) with somatostatin analog 68Ga-DOTATATE 2. Compare utility of 68Ga-DOTATATE PET with 111In-pentetreotide (Octreoscan) and anatomic imaging (CT/MRI) 3. Highlight the complementary utility of 18F-FDG PET/CT for GEP NETs 4. Review pitfalls in 68Ga-DOTATATE PET imaging of GEP NETs 5. Review technical concepts underlying PET/MRI & highlight potential utility of simultaneous 68Ga- DOTATATE Gadoxetate PET/MRI in GEP NETs

TABLE OF CONTENTS/OUTLINE

1) Conceptual overview of Somatostatin Receptor Imaging (SSRI) with 68Ga DOTATATE 2) Image-based review of indications of 68Ga DOTATATE PET in GEP NETs such as o Diagnosis and Initial Staging o Detection of Recurrent Disease o Identification of unknown primary site o Theranostic applications in the context of peptide receptor radionuclide therapy (PPRT) 3) Combination of 68Ga-DOTATATE PET & 18F-FDG PET for characterizing the known intra-tumoral and intra-patient heterogeneity in GEP NETs 4) Physiologic and pathologic entities that can simulate GEP NETs on 68Ga DOTATATE PET 5) Technical concepts underlying PET/MRI: A Disruptive Imaging Modality 6) Rationale for simultaneous 68Ga- DOTATATE Gadoxetate PET/MRI in GEP NETs, imaging protocol considerations & case examples

Printed on: 10/29/20

NM123-ED-SUA7

Reassessing the Patterns of Response to Immunotherapy with PET Imaging: From Morphology to Metabolism

Sunday, Dec. 1 12:30PM - 1:00PM Room: NM Community, Learning Center Station #7

Awards
Cum Laude
Identified for RadioGraphics

Participants
Larissa B. Costa, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Marcelo A. Queiroz, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rafael F. Nunes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Elaine C. Zaniboni, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Jose F. Marin, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Felipe d. Barbosa, MD, Sao Paulo , Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Buchpiguel, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Discuss the role of metabolic tumor assessment with 18F-FDG PET and review the status of the currently available response assessment criteria - anatomic and functional. 2. Recognize the standard patterns of response to immunotherapy (notably to immune checkpoint) and be aware of the unusual patterns, such as pseudoprogression and hyperprogression.3. Remember the major organs affected by side effects to immunotherapy and distinguish from metastatic disease or treatment failure.

TABLE OF CONTENTS/OUTLINE

1. 1. Why PET/CT for imaging evaluation of immunotherapy?2. 2. Therapy response assessment * A. The biology behind the therapeutic effect of immunotherapy * B. Overview of available immune chekpoint drugs with their mechanism of action * C. Review of the immunotherapy-adapted criteria of response assessment * I. iRECIST * II. irRECIST * III. PECRIT * IV. PERCIMT * D. Standard patterns of response * I. Complete response, partial response, stable disease and progressive disease * E. Unusual patterns of response * I. PseudoPD * II. HyperPD * 3. Immune-related adverse events * A. An organ-guided approach * I. Central nervous system (CNS) * II. Endocrine * III. Thorax * IV. Abdomen * V. MSK

NM201-SD-SUA2

Clinical Follow-Up after Imaging and Dosimetry for Yttrium-90 (90Y) Liver Radioembolization Using a SiPM-Based PET/CT Scanner

Sunday, Dec. 1 12:30PM - 1:00PM Room: NM Community, Learning Center Station #2

Participants
Heying Duan, MD, Stanford, CA (*Presenter*) Nothing to Disclose
Mohamed H. Khalaf, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Lucia Baratto, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Shyam Srinivas, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Daniel Y. Sze, MD, PhD, Stanford, CA (*Abstract Co-Author*) Consultant, Amgen Inc Consultant, AstraZeneca PLC Consultant, Bristol-Myers Squibb Company Consultant, BTG International Ltd Consultant, Eisai Co, Ltd Consultant, Embolx, Inc Consultant, W. L. Gore & Associates, Inc Consultant, Johnson & Johnson Consultant, Terumo Corporation Medical Advisory Board, Boston Scientific Corporation Medical Advisory Board, Koli Medical Medical Advisory Board, Radguard Medical, Inc Shareholder, Confluent Medical Shareholder, Proteus Digital Health
Andrei Iagaru, MD, Emerald Hills, CA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Progenics Pharmaceuticals, Inc Research Grant, Advanced Accelerator Applications SA

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PURPOSE

To evaluate the response rate and survival of patients treated with Yttrium-90 (90Y) radioembolization following personalized dosimetry and high-quality imaging using SiPM-based PET/CT.

METHOD AND MATERIALS

Thirty patients (19 males, 11 females; 47 - 88 years old) with hepatic malignancies were prospectively enrolled. According to their tumor, they were treated with resin or glass microspheres. Pre-therapy 99mTc MAA SPECT/CT and post-therapy 90Y PET/CT images were analyzed. Tumor and normal liver dose was calculated using SurePlan (MIM) software. 90Y PET/CT scans were obtained in a single bed position for 20 minutes using a SiPM-based PET/CT scanner and reconstructed as 10- and 15-min datasets. Image quality was evaluated using the 5-point Likert scale.

RESULTS

The mean administered activity was 2.3 GBq 90Y microspheres. Mean tumor dose estimated from 99mTc MAA SPECT/CT was 99.13 Gy vs. 111.53 Gy from 90Y PET/CT. For normal liver, a mean dose of 28.41 Gy was estimated from 99mTc MAA SPECT/CT and 21.04 Gy from 90Y PET/CT. 99mTc MAA SPECT/CT yielded great accuracy as there was no significant divergent tumor or normal liver dose between 99mTc MAA SPECT/CT and 90Y PET/CT ($p=0.667$ vs. 0.134). Image quality for 90Y PET/CT was similar at 10 min and 15 min scan time (Likert-scale 4.4 ± 0.6 vs. 4.6 ± 0.5).Our preliminary data show 12 (66.7%) patients had partial response, 1 (5.5 %) stable disease and 5 (27.8%) had progressive disease at 3 months follow up. Five patients passed away after a mean of 5 months. Median survival was 11.5 months.In a sub-analysis, patients treated with resin microspheres vs. glass microspheres had a mean survival of 12.6 vs. 10.3 months, respectively.

CONCLUSION

Our preliminary data show a high response rate and median survival of 11.5 months in this cohort. The administered activity may be adjusted to yield the desired 120 Gy in the tumor based on the estimated tumor dose from 99mTc MAA SPECT/CT. The SiPM-based PET/CT scanner showed excellent image quality even at a reduced scan time of 10 min, acquired with only one bed position. That may allow for inclusion of 90Y PET/CT in routine clinical workflow. However, more patients have to be evaluated to confirm these findings.

CLINICAL RELEVANCE/APPLICATION

Pre- and post-treatment imaging allow for a more accurate estimation of tumor and normal liver dose and are essential for personalized dosimetry.

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NM202-SD-SUA3

Spectrum of Autoimmune Limbic Encephalitis on FDG PET/CT

Sunday, Dec. 1 12:30PM - 1:00PM Room: NM Community, Learning Center Station #3

Participants
Ritu Verma, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Rajeev Ranjan, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ethel S. Belho, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Dharmender Malik, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Vanshika Gupta, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Nikhil Seniaray, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
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Harsh Mahajan, MD,MBBS, New Delhi, India (*Presenter*) Director, Mahajan Imaging Pvt Ltd; Research collaboration, General Electric Company; Research collaboration, Koninklijke Philips NV; Research collaboration, Qure.ai; Research collaboration, Predible Health
Vidur Mahajan, MBBS, New Delhi, India (*Abstract Co-Author*) Researcher, CARING; Associate Director, Mahajan Imaging; Research collaboration, General Electric Company ; Research collaboration, Koninklijke Philips NV; Research collaboration, Qure.ai; Research collaboration, Predible Health; Research collaboration, Oxipit.ai; Research collaboration, Synapsica; Research collaboration, Quibim

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PURPOSE

To evaluate the role of FDG PET CT in the diagnosis, treatment response evaluation and follow up of patients with suspected autoimmune limbic encephalitis and correlation with specific antibody sub-type.

METHOD AND MATERIALS

A retrospective analysis of 27 patients of clinically suspected and serologically proven cases of autoimmune encephalitis, who underwent FDG PET CT, was done. Whole body FDG PET CT scans were done in all the patients with separate special brain sequence. The patterns of FDG uptake in different antibody subtypes were recorded and comparison with normalized data was attempted. The areas of hypo/hypermetabolism that were two standard deviations from the mean were considered as abnormal. The patients were also analyzed based on the Z score surface maps of the 3D stereotactic surface projections (SSP) image and regional Z scores were evaluated. Post treatment follow-up scans were also acquired and analyzed.

RESULTS

Focal areas of hypermetabolism involving medial temporal regions, basal ganglia and thalami with relative global hypometabolism in rest of the cortical and subcortical structures was seen, both on visual inspection and on semiquantitative analysis. Serologically, 17 patients had antibodies against Voltage gated potassium channel (VGKC) complex /LGI1 receptors, 2 had antibodies against CRMP-5 (Anti-CV-2) and 1 had had antibodies against PCA-1/Anti-Yo receptor. We could not isolate the antibody in 7 patients. Suspicious mitotic lesions were identified in 10 patients on the whole body scan, which later were biopsied and characterized. No scan evidence of mitotic pathology was identified in 17 patients, thus were labeled as non-paraneoplastic.Depending on the temporal phase of the disease, focal hypermetabolism was found to be a feature of acute phase, whereas hypometabolic areas were seen in sub-acute and chronic phases of the disease. On follow-up, the post-treatment FDG PET CT scans obtained in some of these patients showed reversal to normal metabolism in the corresponding areas.

CONCLUSION

FDG PET/CT may have an important role both in the identification of Autoimmune encephalitis and in the detection of the unknown malignancy that might have caused it.

CLINICAL RELEVANCE/APPLICATION

FDG PET CT scan is a non-invasive diagnostic modality in the early diagnosis and management of patients with clinical suspicion of autoimmune encephalitis

NM234-SD-SUA4

Biochemical Recurrence with Low Values of PSA in Prostate Carcinoma after Radical Therapy: Sensibility of 68Ga-PSMA PET/CT

Sunday, Dec. 1 12:30PM - 1:00PM Room: NM Community, Learning Center Station #4

Participants
Erika S. Fajardo, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Luis Felipe Alva Lopez, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Digna Pachuca Gonzalez, MD, Tlalpan, Mexico (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Hernandez Ramirez, Leon, Mexico (*Abstract Co-Author*) Nothing to Disclose
Juan Pablo Chavez-Torres, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The purpose of this study was to study the sensibility of 68Ga-PSMA PET/CT in patients with prostate cancer with biochemical recurrence with low values of PSA after radical therapy.

METHOD AND MATERIALS

A retrospective, cross-sectional and descriptive study was carried out with the aim of evaluate the sensibility of 68Ga-PSMA in patients with prostate cancer with biochemical recurrence following primary curative treatment. 53 patients with biochemical recurrence were scanned using 68Ga-PSMA during the period of October 2015 to February 2019. We selected 26 patients who had low values of PSA (<2.5ng/ml).

RESULTS

The mean age of the study population was 66 years (range 49-85) with a mean prostate-specific antigen (PSA) level of 1.06 ng/ml (range 0.09-2.23). SUVmax mean found was 12.03 (range 1.9-100). 20 patients (76%) were treated with radical prostatectomy, and 6 (23%) with radiotherapy. 20 scans were positive, 6 were negative with 68Ga-PSMA PET/CT. The disease sites at the moment of the study was locoregional in 17(65%), and distant metastasis 9 (34%),13(50%) had abnormal uptake in prostatic bed. The Sensibility in group one:0.01-0.5 (71%), group two: 0.5-1 (80%), group three:1.01-1.5 (75%), group four: 1.6-2.5(83%). 68Ga-PSMA PET/CT has a high sensibility with levels of PSA as low as <0.5ng/ml, and the sensibility increases with higher levels of PSA.

CONCLUSION

68Ga-PSMA PET/CT have a high sensitivity in patients with biochemical recurrence with values of PSA as low as <0.5ng/ml, to locate disease sites in prostate cancer.

CLINICAL RELEVANCE/APPLICATION

68GA-PSMA PET/CT can demonstrate sites of disease in patients with biochemical recurrence with low values of PSA therefore is recommended as part of the study workup in this patient's population.

NR327-ED-SUA10

Navigation Map for Head and Neck Cancer: Anatomical Routes of Tumor Spread at the Crossroads of the Neck

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #10

Awards
Magna Cum Laude

Participants
Hirofumi Kuno, MD, PhD, Kashiwa, Japan (*Presenter*) Nothing to Disclose
Takashi Hiyama, MD, Kashiwa, Japan (*Abstract Co-Author*) Nothing to Disclose
Kotaro Sekiya, DDS, PhD, Kashiwa, Japan (*Abstract Co-Author*) Nothing to Disclose
Hayato Tomita, Kawasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Shioto Oda, MD, Kashiwa, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsushi Kobayashi, MD, Kashiwa, Japan (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Head and neck squamous cell carcinomas (HNSCCs) are common malignant tumors showing aggressive local invasion along various routes. Many radiologists consider this tumor spreading complicated. However, tumor spreads have certain patterns or high-frequency pathways along well-defined routes, which are associated with barriers or weak points based on various structures. Familiarity with tumor spreading routes can aid in accurate evaluation for appropriate treatment selection. The aims of this exhibit are: To review the anatomical routes with multiple entries and exit points of tumor spreading in the head and neck regions. To provide original illustrations and key computed tomography (CT)/magnetic resonance (MR) imaging features, such that tumor spreading can be easily understood in daily clinical practice.

TABLE OF CONTENTS/OUTLINE

Background Review of the high-frequency anatomical routes of HNSCCs spread and of the related structures using a simple illustration with key CT/MR imaging features. a. Barriers or weak points associated with muscle layers, membranes, and tendons. b. Pathways of the muscles, nerves, and vessels. c. Pathways of the fossa, foramen, sinuses, gaps, and spaces. d. Two-way paths in the same routes for different primary sites. Summary navigation map of HNSCCs.

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NR328-ED-SUA8

A Multimodality Pictorial Essay of Nontraumatic Ocular and Orbital Pathologies

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #8

Participants
Yvonne M. Purcell, MBBCh, Paris, France (*Presenter*) Nothing to Disclose
Elisabeth Nau, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Francois Lafitte, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Patricia Koskas, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Olivier Berges, MD, Paris , France (*Abstract Co-Author*) Nothing to Disclose
Julien Savatovsky, MD, Saint Mande, France (*Abstract Co-Author*) Nothing to Disclose
Augustin Lecler, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The aim of this exhibit is 1. To review the spectrum of nontraumatic ocular and orbital pathologies and to identify their imaging features using multiple modalities including ultrasound, CT and MRI. 2. To familiarise the radiologist with the ocular and orbital manifestations of systemic diseases, with a special emphasis on emergencies that may cause permanent vision loss and other serious consequences. 3. To recognize potential diagnostic pitfalls and important additional findings at diagnostic imaging of nontraumatic orbital emergencies.

TABLE OF CONTENTS/OUTLINE

Each ocular and orbital condition will be introduced by a clinical case, with multimodality illustration including US, CT and MRI, and when available, pathologic correlation. Pathologies will be grouped according to the following headings, inflammation, infection, tumours, vascular pathology. The typical imaging features as demonstrated by the case will be highlighted for each pathology, followed by a more in-depth assessment of the condition with a review of the literature.

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NR329-ED-SUA7

Posterior Third Ventricle Pathologies: Look Through Surgeons' Eyes

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #7

Awards
Certificate of Merit

Participants
Bharath B. Das, MD, MBBS, Bangalore, India (*Presenter*) Nothing to Disclose
Sunitha P Kumaran, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Prashanth Reddy, MBBS,MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Suman T. Prabhakar, MBBS,MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Puneeth K. K N, MD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Jainesh V. Dodia, MBBS,MD, Bangalore , India (*Abstract Co-Author*) Nothing to Disclose
Bhavana Nagabhushana Reddy, MBBS, MD, Bengaluru, India (*Abstract Co-Author*) Nothing to Disclose
Sanjaya Viswamitra, MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

• To describe anatomy of posterior third ventricle • To illustrate the MR imaging appearances of lesions in posterior third ventricle • Describe the reporting syntax essentials for these lesions in Surgeons' perspective • Describe surgical approach for these lesions

TABLE OF CONTENTS/OUTLINE

We retrospectively reviewed 3968 MRI - brain studies in our institute from June 2015 to January 2019. There were 126 cases with posterior third ventricle lesions. Representative cases are illustrated in this exhibit. Cases are broadly classified into 1. Tectum lesions: Tectum dysplasia, pilocytic astrocytoma, GBM 2. Pineal lesions: Pineocytoma, Pineal cyst, Pineoblastoma, Germinoma, Pineal papillary tumor, pineal metastases. Pineal melanoma, Pineal teratoma 3. Vascular lesions: Cavernoma, AVM, vein of Galen malformation, Internal cerebral vein thrombosis 4. Miscellaneous: Epidermoid, Arachnoid cyst, Rhabdomyosarcoma, atypical neurocytoma, atypical choroid plexus papilloma, meningioma, ependymoma, pleomorphic Xanthoastrocytoma, meningioma, fibro-osseous tumor, Velum interpositi cyst.

NR330-ED-SUA9

Cerebral Perfusion Imaging A to Z: Theory, Implementation, and Clinical Cases

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #9

Awards
Magna Cum Laude

Participants
Amit B. Desai, MD , New York, NY (*Presenter*) Institutional research collaboration, Siemens AG

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TEACHING POINTS

The purpose of this exhibit is to teach perfusion imaging from the ground up. After viewing this educational exhibit, the learner should be able to:1. Explain in simple terms, the theoretical basis for perfusion imaging. 2. Know the definitions of the most commonly used perfusion parameters and understand their clinical roles.3. Understand perfusion protocols for CT and MR.4. Have a general understanding of how information is extracted from CT and MR data to calculate perfusion parameters.5. Understand how to interpret perfusion studies in the acute setting and for oncological applications.

TABLE OF CONTENTS/OUTLINE

I. Introduction.II. Cerebral Perfusion Theory.III. CT Perfusion-CT Perfusion Protocols-Converting Hounsfield Units to Perfusion ParametersIV. MR Perfusion-Difference Between DSC and DCE-MR Perfusion Protocols-Leakage Correction-Coverting Signal Intensity To Perfusion ParametersV. Acute Clinical Cases (including but not limited to):-Acute Cerebral Ischemia without infarct-Acute Cerebral Ischemia with infarct-Compensated Hypoperfusion-Post-recanalization Hyperperfusion-Seizure-VasospasmVI. Neuro-oncologic Cases (including but not limited to):-Glioma-Lymphoma-Metastases-Non-neoplastic Tumefactive Lesions (Demyelination, Vasculitis, Cerebritis)VII. Conclusion

NR338-ED-SUA11

Under Construction: Understanding the Post-Operative Temporal Bone

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #11

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Mario Padula, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Hugo Tames, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Louise Bisolo, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rodrigo W. Murakoshi, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The primary goals of this exhibit are: To review and describe the most common surgical approaches for the temporal bone. To propose a practical imaging method to evaluate the post-operative temporal bone. To discuss the role of Computed Tomography (CT) and and Magnetic Resonance (MR) imaging in the follow up of the postoperative temporal bone. To review the most common postsurgical complications

TABLE OF CONTENTS/OUTLINE

A) Introduction B) Brief anatomy review C) Imaging pearls in the assessment of the post-operative temporal bone - Tympanoplasty - Stapedectomy - Mastoidectomy: simple, CWU, CWD, radical - Internal auditory canal: translabyrinthine, retrosigmoid, middle cranial fossa D) Complications / the role of CT and MR in the follow up of the post-operative temporal bone E) Take home messages

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NR365-SD-SUA2

Translaminar and Transforaminal Epidural Steroid Injection (ESI): Efficacy on Immediate and Long-Term Pain Management

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #2

Participants
Hari Kotta, BS, Galveston , TX (*Presenter*) Nothing to Disclose
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PURPOSE

The main purpose of this study is to observe and compare patient reported post-procedural epidural steroid injection (ESI) pain levels between translaminar approaches and transforaminal approaches at various time intervals.

METHOD AND MATERIALS

ESI patients were retrospectively gathered from hospital chart data. Baseline variables included patient demographics, pre-procedural pain levels, weight, radiculopathy, spinal stenosis, and neural foraminal narrowing. Procedural variables included injected medications (steroids +/- local anesthetic). Post-procedural variables included 30-minute post-procedural pain levels, pain upon first follow up, and ESI treatment response duration. Subsequently a multivariate analysis was performed to assess correlation with patient post-procedural pain and responsiveness.

RESULTS

A total of 153 ESI patients were gathered. Our study found that 30 minute post-procedural pain was significantly improved for transforaminal patients compared to translaminar patients (87.1% vs. 63.2%, $p = 0.035$) but that this improvement did not hold at first follow up ($p = 0.56$). The duration of ESI treatment response was not found to be significantly different between translaminar and transforaminal approaches after stratifying treatment response for (1-140 days and >140 days) ($p = 0.996$). The translaminar group had a larger proportion of moderate and severe lumbar stenosis patients than the transforaminal (56% vs. 32%, $p = 0.044$). Patients whose treatment lasted 1-140 days were significantly older (i.e. 68±11.46 years) compared to patients whose treatment lasted greater than 140 days (i.e. 63.35±14.24 years)($p = 0.015$).

CONCLUSION

While our study found that both the duration of ESI treatment response and pain levels upon first follow up did not vary significantly between translaminar and transforaminal approaches, it did find however that patients undergoing transforaminal approaches had significantly improved 30 minute post-procedural pain levels compared to patients undergoing a translaminar approach. Additionally, our study found that patients who had durations of treatment longer than 140 days were significantly younger than patients whose treatment lasted less than 140 days.

CLINICAL RELEVANCE/APPLICATION

While age appeared to be the most predictive factor of long-term response to ESI, the method of ESI, namely translaminar or transforaminal was found to be the most predictive factor in short-term response.

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NR366-SD-SUA4

Microstructural MR Imaging for the Differentiation between Spinal Ependymomas and Astrocytomas

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #4

Participants
Dounia Mettri, Vienna, Austria (*Presenter*) Nothing to Disclose
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Georg Widhalm, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The role of diffusion tensor imaging (DTI) in the differentiation between spinal cord tumors remains controversial. This study aims to evaluate the presence of a difference in diffusion properties between spinal ependymomas and astrocytomas.

METHOD AND MATERIALS

This study was approved by our Medical Ethics Committee. Fifteen patients with spinal ependymoma and 13 patients with spinal astrocytoma who underwent DTI directly before surgical resection or biopsy were retrospectively included. Scalars of diffusion (ADC, AD, RD, RA, FA and EADC) were obtained from regions of interest (ROIs) placed within and around the tumor and in normal-appearing spinal cord. Differences between both tumors were analyzed by using two-sample T-Test to determine significance, and receiver operating characteristic (ROC) analyses to estimate cut-off values of DTI scalars for predicting spinal ependymoma and astrocytoma.

RESULTS

While FA and RA showed no significant difference between ependymoma and astrocytoma, ADC, AD, RD and EADC differed significantly between both tumors. When compared to the peritumoral region, ependyomas showed significant differences in all diffusion scalars apart from RA and FA. On the contrary, all values measured in astrocytomas did not differ significantly from those of peritumoral region. All scalars of peritumoral region showed significant discrepancy to normal-appearing spinal cord. Furthermore, ROC analyses revealed that ADC, AD, RD and EADC are the best parameters to distinguish between an ependymoma and astrocytoma with cut-off values of 1.2, 1.71, 0.99 and 0.33, respectively. Sensitivity and specificity for the determination of cut-off values were 80% and 92% for ADC, 80% and 92% for AD, 80% and 92% for RD and 93.3% and 92.3% for EADC.

CONCLUSION

ADC, AD, RD and EADC can help distinguish between a spinal ependymoma and spinal astrocytoma according to detected microstructural differences in tumor and peritumoral regions.

CLINICAL RELEVANCE/APPLICATION

DTI can be helpful in differentiating spinal ependymoma from spinal astrocytoma.

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NR406-SD-SUA6

Automated Detection of Stroke on Non-Contrast CT at Initial Presentation Using Texture Analysis and Machine Learning

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #6

Participants
Shanker Raja, MD, Bellaire, TX (*Presenter*) Nothing to Disclose
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Sharad P. George, MD, Dhahran, Saudi Arabia (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

PURPOSE Stroke (STR) is a leading cause of neurologic mortality, CT is the lynchpin, and 1st line of imaging, in stroke identification. It plays a crucial role in temporal profiling of evolving stroke (Ac.,subAc.,and Ch.); a prerequisite for early intervention/s. We postulate that accurate, automated recognition and temporal profiling tool of evolving STR in the field (ER etc.) will lead to significant decrease in elapsed time from presentation to intervention, and improved outcomes.

METHOD AND MATERIALS

Retrospective review of 500 pts. with suspected STR undergoing CT. After exclusion criteria (haemoragic stroke, artifacts etc.) 260/360 pts were analyzed with texture analysis and machine learning (TA and ML); we also performed inter & intra-observer variation analysis in 360 & 55 pts. TA and ML were performed in MATLAB using home brewed algorithms. TA Local Binary Pattern (LBP) were obtained on representative whole brain slices -691, slicewise classification between STR (363) vs. non-STR (328); norm. vs. Ac+subAc.(96), and norm.(363) vs. Ch.(207) was performed using support vector machine (SVM).

RESULTS

The results of SVM model accuracy for detection of presence of stroke, and also for temporal classification, is tabulated. SVM model classification results Classes Accuracy TPR TNR AUC Stroke vs. Normal 91.59 87.31 95.56 91.65 Acute-Subacute vs. Normal 93.56 73.57 99.13 86.44 Chronic vs. Normal 94.74 89.08 98.48 93.8 While the Kappa value for inter-observer variation for expert Vs. 2-novices in 340 cases was 0.632 and 0.643. The intra-observer variation against ground truth on 55 cases was significantly better for the expert Vs. novice, 0.969 and 0.643 respectively.

CONCLUSION

CONCLUSION: SVM classifier is better than novice, and on par with the expert to discriminate STR Vs. normal. For temporal classification, the model was best for detection of Ch.infarcts with an acc. and AUC of 92%; and an impressive acc. of 94% for detecting Ac+subAc. STR, but it was only modesly better in the crucial clinically actionable statistic of TPR 74%. Results in our study are optimistic, we have demonstrated automated detection and temporal profiling of STR is possible. We anticipate significantly increasing our sample size as well as attempting additional TA, and ML classifiers.

CLINICAL RELEVANCE/APPLICATION

CLINICAL RELEVANCE: Our results would significantly decrease elapsed time from presentation to intervention, and improve final outcomes.

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NR407-SD-SUA3

Discrimination Between Glioblastoma and Single Brain Metastasis Using Radiomics and Machine Learning: Model Development and External Validation

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
Sung Soo Ahn, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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So Yeon Won, 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
Ho Sung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Eun Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate diagnostic performance and generalizability of radiomics model for discriminating between glioblastoma and single brain metastasis using machine learning.

METHOD AND MATERIALS

Two independent cohorts were used as training (166 patients; 109 glioblastomas and 57 metastases) and validation (82 patients; 50 glioblastomas and 32 metastases) cohorts. A total of 279 radiomics features were extracted from segmented regions [contrast-enhancing (CE) masks on T2- and post-contrast T1-weighted images, peritumoral T2 hyperintense (PT) mask on T2-weighted images]. All the analyses were performed separately with three data sets: CE mask, PT mask, and combined. Most relevant features were selected using five methods and then used to fit seven machine learning models. To find the best estimator for each machine learning model, all the possible combinations of feature selection methods and hyperparameter values were evaluated using 10-fold cross-validation in the training cohort. The diagnostic performance of the best estimators were tested in the external validation cohort along with those of two human readers (neuroradiologists with 3 and 10 years of experiences) using the area under the receiver operating characteristic curve (AUC).

RESULTS

Using CE mask alone, the best estimator was radial basis function support vector machine combined with recursive feature elimination (AUC, 0.808). Using PT mask alone, linear discriminant analysis combined with recursive feature elimination showed the highest AUC of 0.808. The diagnostic performance of the trained model was highest (AUC, 0.881) when both CE and PT masks were utilized, with the best model being a combination of mutual information and linear support vector machine. The diagnostic performances of radiomics models were similar in the external validation with AUCs of 0.835, 0.800, and 0.867 for CE mask, PT mask, and combined, respectively, which were between the performances of two human readers (AUC 0.774 and 0.879, respectively).

CONCLUSION

The radiomics model with machine learning can be useful in discriminating between glioblastoma and single brain metastasis and have good generalizability.

CLINICAL RELEVANCE/APPLICATION

The radiomics model with machine learning could help to discriminate between glioblastoma and single brain metastasis and could be used across centers.

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NR408-SD-SUA5

Survival Analysis of Head and Neck Cancer Patients Treated with Radiotherapy: Prognostic Value of Computed Tomography-Based Volumetric Body Composition Analyses

Sunday, Dec. 1 12:30PM - 1:00PM Room: NR Community, Learning Center Station #5

Participants
Yangsean P. Choi, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

Noticeable weight loss occurs in head and neck cancer (HNC) patients on presentation and during radiotherapy. We aimed to evaluate whether computed tomography (CT)-based volumetric body composition analyses have prognostic value compared with conventional weight-based measures in predicting HNC patient survival.

METHOD AND MATERIALS

This single-center retrospective study included 79 consecutive HNC patients treated with radiotherapy (RT) from March 2009 to September 2018. The patients were assessed for 1) weight-based variables, including weight, body mass index (BMI) and weight loss; and 2) CT-based body composition, including volume and attenuation of cervical skeletal muscle (SM) and fat, fat proportions, cervical SM depletion-all before and after RT-and interscan fat loss. Overall survival (OS) and recurrence-free survival (RFS) analyses were conducted using univariate and multivariate Cox proportional hazards analyses. Kaplan-Meier survival curves with log-rank tests were plotted for OS and RFS.

RESULTS

After RT, the number of patients with cervical SM depletion increased from 11 (13.9%) to 23 (29.1%) (P=0.002); post-RT CT scans showed a reduction in the fat volume (P=0.016) and an increase in fat attenuation (P=0.047). Patients with over 5% weight loss after RT had shorter OS (HR, 2.5; P=0.03) and RFS (HR, 2.8; P=0.02). Depletion of the cervical SM volume prior to RT was significantly associated with poor OS (HR, 3.1; P=0.016) but not with RFS (HR, 1.4; P=0.513). Low fat proportions (<23%) before and after RT were significantly associated with poor OS (HR, 2.5-3.5; P=0.013-0.026). In multivariate Cox analysis, post-RT fat attenuation demonstrated the greatest prognostic value for both OS and RFS (Bayesian criterion reduction of 12.5 and 10.2, respectively).

CONCLUSION

Significant weight loss (>5%) after RT was associated with poor OS and RFS. In addition, CT-based volumetric analysis of body composition revealed that several meaningful factors are associated with OS and RFS, thus suggesting the potential of CT-based body composition analysis for risk assessment in HNC patients who are undergoing RT.

CLINICAL RELEVANCE/APPLICATION

CT-based volumetric body composition analysis demonstrates several clinically significant prognostic parameters in head and neck cancer patients treated with radiotherapy.

OB171-ED-SUA1

Size Matters: What Radiologists Need to Know About Fetal Growth

Sunday, Dec. 1 12:30PM - 1:00PM Room: OB Community, Learning Center Station #1

Awards
Cum Laude
Identified for RadioGraphics

Participants
Anne M. Kennedy, MD, Salt Lake City, UT (*Presenter*) Author with royalties, Reed Elsevier
Shannon Son, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Michelle Debbink, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Paula J. Woodward, MD, Salt Lake City, UT (*Abstract Co-Author*) Editor, Reed Elsevier

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TEACHING POINTS

1: Correct pregnancy dating is critical for identification of abnormal fetal growth both growth restriction and overgrowth syndromes. 2: The best time to date a pregnancy is in the first trimester 3: Early onset growth restriction is often due to an intrinsic fetal abnormality such as aneuploidy. 4: Late onset growth retriction is more frequently related to placental insufficiency. 5: Growth abnormlaities may occur in one of a twin pair. Twins with discordant growth are at increased risk for poor outcome.

TABLE OF CONTENTS/OUTLINE

Methods to determine gestational age: Clinical: Menstrual dates, ovulation tracking, IVF history, palpation, fundal height measurement. Sonographic: Sac size, crown rump length, routine biometry. Additional sonographic observations: Transverse cerebellar diameter, epiphyseal ossification, foot length, cerebral sulcation. Definition of terms used in description of fetal size and growth: Growth restriction, small for gestational age, large for gestational age, macrosomia What are the risks associated with abnormal fetal growth? Iatrogenic prematurity, ischemic injury, postnatal hypoglycemia When is a small fetus in trouble? Umbilical artery and ductus venosus Doppler, fluid volume, NST/BPP. Diagnosis and management of discordant twin growth: Biometry, placental cord insertion, Doppler.

OB172-ED-SUA2

Go with the Flow: Understanding Pathways of Disease Spread in Ovarian Cancer and How to Apply RECIST 1.1

Sunday, Dec. 1 12:30PM - 1:00PM Room: OB Community, Learning Center Station #2

Awards
Certificate of Merit

Participants
Shaun A. Wahab, MD, Mason, OH (*Presenter*) Nothing to Disclose
Tyler G. McCurdy, DO, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Michael S. Newberry, MD, Lackland AFB, TX (*Abstract Co-Author*) Nothing to Disclose
Juliana J. Tobler, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Develop a better understanding of the typical patterns of metastatic spread of ovarian cancer with a focus on peritoneal spread of disease. Examine key points specific to ovarian cancer regarding the application of RECIST 1.1

TABLE OF CONTENTS/OUTLINE

Provide a brief overview of ovarian cancer and standard treatments. Discuss the common types of ovarian cancer and illustrate the patterns of metastatic spread, including: peritoneal spread, lymphatic spread, hematologic spread, and direct invasion. Analyze the flow of peritoneal fluid and how it relates to the spread of tumor cells as well as review peritoneal ligaments that may serve as attachment sites for metastatic disease. Examine pearls and pitfalls when applying RECIST 1.1 in the context of ovarian cancer.

PD167-ED-SUA6

Neuro-Imaging of Neuronal and Mixed Glioneuronal Tumors: Current Status and Future Prospects

Sunday, Dec. 1 12:30PM - 1:00PM Room: PD Community, Learning Center Station #6

Participants
Ahmed Abdel Razek, MD, Mansoura, Egypt (*Presenter*) Nothing to Disclose
Mauricio Castillo, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Nermeen A. El-Sebaie, Alexandria , Egypt (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1- To review basic background and update WHO classification 2016 of neuronal and mixed glioneuronal tumors 2- To present imaging appearance of neuronal tumors at routine MR imaging 3-To discuss role of advanced MR imaging as diffusion tensor imaging, arterial spin labeling and proton MR spectroscopy in characterization, grading and differenetiation of neuronal tumors

TABLE OF CONTENTS/OUTLINE

1-Update WHO classification 2016 of neuronal and mixed glioneuronal tumors 2-Role of routine MR imaging in characterization of neuronal tumors 3-Role of advanced MR imaging as diffusion tensor imaging, arterial spin labeling and proton MR spectroscopy in characterization and grading of neuronal tumors 4-MR Imaging features of dysembryoplastic neuroepithelial tumor 5-MR Imaging features of gangliogliomas 6-Imaging findings suggestive of anaplastic ganglioglioma 7-MR findings suggestive of desmoplastic infantile ganglioglioma 8-Imaging of gangliocytoma 9-MR of dysplastic cerebellar gangliocytoma (Lhermitte-Duclos disease) 10-Imaging of papillary glioneuronal tumor 11-MR of rosette-forming glioneuronal tumor 12-Imaging of diffuse leptomeningal glioneuronal tumor 13-Imaging of central neurocytoma 14-Conclusion and future directions

PD168-ED-SUA7

Contrast-Enhanced Ultrasound (CEUS) Findings in Pediatric Hepatobiliary and Pancreatic Malignancies

Sunday, Dec. 1 12:30PM - 1:00PM Room: PD Community, Learning Center Station #7

FDA Discussions may include off-label uses.

Participants
Annamaria Deganello, MD, London, United Kingdom (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, Koninklijke Philips NV
Gibran Yusuf, MBBS, London, United Kingdom (*Presenter*) Speaker, Bracco Group; Speaker, Siemens AG
Maria E. Sellars, MD, FRCR, London, United Kingdom (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, Samsung Electronics Co, Ltd
Paul S. Sidhu, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Speaker, Bracco Group; Speaker, Hitachi, Ltd; Speaker, Siemens AG; Speaker, Samsung Electronics Co, Ltd; Advisory Board, Samsung Electronics Co, Ltd; Advisory Board, Itreas Ltd

TEACHING POINTS

To understand the role of CEUS in the diagnosis of focal liver lesions in children. To review CEUS features of malignant paediatric hepatobiliary and pancreatic lesions. To appreciate the usefulness of CEUS in the evaluation of extrahepatic tumour spread and follow-up.

TABLE OF CONTENTS/OUTLINE

Primary liver tumours are rare in children, and malignant hepatobiliary tumours account for less than 2% of pediatric malignancies. Even though cross-sectional imaging features of these tumours are well described in the literature, there is still very limited knowledge of their CEUS findings. This is explained by their rare occurrence and also by the relatively recent approval by the FDA of ultrasound contrast agents for the characterization of pediatric focal liver lesions in 2016. We present a pictorial review of CEUS findings in hepatobiliary and pancreatic malignant lesions, which are unique to the pediatric population. We will discuss the practical and potential uses of this imaging modality as a problem-solving tool, both at the time of diagnosis and at follow-up. Given the need for continue surveillance of these children after surgery, CEUS holds a significant role in providing a minimally invasive follow-up tool in these patients, avoiding repeated ionizing radiation exposure or sedation.

PD169-ED-SUA8

Diffusion Weighted Imaging of Pediatric Spine: Technique and Clinical Applications

Sunday, Dec. 1 12:30PM - 1:00PM Room: PD Community, Learning Center Station #8

Awards
Cum Laude

Participants
Tushar Chandra, MD, Orlando, FL (*Presenter*) Nothing to Disclose
Kanika Gupta, MD, Chennai, India (*Abstract Co-Author*) Nothing to Disclose
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Laura L. Hayes, MD, Pensacola, FL (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Fundamental physics of Diffusion imaging 2. Proper technique for acquiring a good DWI study of the spine 3. Clinical applications of DWI imaging in pediatric spinal pathologies - case based format 4. Pitfalls and limitations of DWI of spine 5. Role of DWI in assessing treatment Response 6. Basics of spinal DTI and fiber tracking

TABLE OF CONTENTS/OUTLINE

1. Basic Physics of Diffusion weighted imaging (DWI) 2. Technical considerations for obtaining DWI of Pediatric Spine 3. Pearls and pitfalls of qualitative and quantitative Diffusion imaging methods 4. Illustrate various clinical applications in pediatric spine in a case based format A. Tumors B. Drop Metastases C. Autoimmune/Inflammatory D. Infection E. Cord Infarction F. Trauma 5. Assessment of treatment response 6. Succinct review of Spine Diffusion Tensor Imaging and Fiber tracking 7. Conclusion

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PD200-SD-SUA1

Prognostic Value of CTA-Derived Left Ventricular Mass in Neonate Infants with Congenital Heart Disease

Sunday, Dec. 1 12:30PM - 1:00PM Room: PD Community, Learning Center Station #1

Participants
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PURPOSE

Left ventricular mass (LVM) is an important factor for therapeutic decisions on uni- or biventricular surgical repair in congenital heart disease (CHD). The aim of this retrospective study was to determine the LVM of infants suffering from CHD in thoracic CT angiography and to evaluate its usage as a prognostic parameter.

METHOD AND MATERIALS

Retrospective manual segmentation of the left ventricular endo- and epicardial volumes was performed in thoracic CT angiographies of 132 infants within their first year of life using multiplanar reformations. LVM were determined from these volumes and normalized to body surface area (BSA). LVM differences between different types of CHD and thoracic vascular anomalies were analyzed depending on clinical diagnoses and compared to each other with analyses of variances (ANOVA). A cutoff value for discrimination between uni- and biventricular repair was determined using Receiver Operating Characteristics analysis. Survival rates were calculated using Kaplan-Meier Statistics.

RESULTS

Patients with a clinical diagnosis of a hypoplastic left heart (HLH) had significantly lower mean LVM (21.88 ± 9.90 g/m2 BSA) compared to patients without applicable disease (50.22 ± 11.79 g/m2 BSA; $p < .0001$). Highest mean LVM were found in patients with extracardiac disease (ED; 48 ± 11 g/m2). No significant differences were found compared to patients with a persistent truncus arteriosus (PTA; 49.34 ± 19.96 g/m2), left ventricular outflow tract obstruction (LVOTO; 45.20 ± 25.07 g/m2), transposition of the great arteries (TGA; 41.90 ± 12.95 g/m2), pulmonary artery stenosis or atresia (PS/PA; 40.04 ± 15.52 g/m2) double outlet right ventricle (DORV; 41.45 ± 19.74 g/m2), right ventricular outflow tract obstruction (RVOTO; 37.35 ± 8.54 g/m2) and tetralogy of Fallot (TOF; 36.93 ± 9.81 g/m2; all $p > 0.05$). The cutoff for uni- or biventricular surgery was 33.9 g/m2 with a sensitivity of 82% and a specificity of 74%. Five year survival was high for both, uni- (73.7%) and biventricular patients (89.3%) without statistically significant differences ($p=0.08$). Median radiation exposure was as low as 0.17 mSv.

CONCLUSION

LVM can be measured in chest CTA of newborns with CHD and used as additional parameter in an interdisciplinary multi-modality management. Survival rates are considerably high following this approach.

CLINICAL RELEVANCE/APPLICATION

LVM from CTA of the newborn with CHD can be used as prognostic factor for the surgical approach and outcome.

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PD201-SD-SUA2

Utility of Elbow Radiographs for Pediatric Patients with Torus Fractures of the Wrist

Sunday, Dec. 1 12:30PM - 1:00PM Room: PD Community, Learning Center Station #2

Participants
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Daniel J. Song, MD, Fort Carson, CO (*Abstract Co-Author*) Nothing to Disclose
Duke Yim, MD, Fort Carson, CO (*Abstract Co-Author*) Nothing to Disclose
Michael G. Fazio, DO, Rockville, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

'Joint above and joint below' is the mantra in the evaluation of orthopaedic trauma; additional radiographs are obtained to prevent missing concomitant injuries. With the increasing cost of health care and the risks associated with radiation, we wish to investigate the utility of obtaining elbow radiographs for patients with wrist torus fractures who have no elbow tenderness.

METHOD AND MATERIALS

This is an IRB-approved retrospective review between January 2011 and December 2012. All patients with torus fractures of the wrist were identified and radiographs were interpreted to identify acute elbow pathology.

RESULTS

During the two-year period there were 225 patients that meet inclusion and exclusion criteria. Elbow radiographs occurred for 74 of patients. Of those patients, only two showed positive findings. One was an 8-year old male with a concomitant ipsilateral supracondylar fracture and other patient was a 2-year old male with a positive posterior fat pad, but without elbow tenderness. There were no significant differences between the patients with and without elbow radiographs in regards to gender, treatment, or number of complications. There was a significant difference with regards to age in that those with elbow radiographs were younger (6.70 yrs) than those without elbow radiographs (8.81 yrs).

CONCLUSION

In our study, we found two patients who had positive findings on elbow radiographs. One patient had elbow tenderness and the other patient had no elbow tenderness and on follow-up radiographs, no true elbow pathology. There was no difference in complication rates between those patients with elbow radiographs and those without. There was a significant difference with age and whether elbow radiographs were obtained where younger patients were more likely to receive elbow radiographs. Although larger prospective studies are required, with a thorough physical examination, elbow radiographs may not be necessary for pediatric patients with wrist torus fractures.

CLINICAL RELEVANCE/APPLICATION

In patients with a torus fracture of the wrist, asymptomatic concomitant injuries are rare and a thorough physical examination of the ipsilateral elbow can rule out acute elbow injury. With the risk of cumulative radiation from additional radiographs and the increase in the health care costs associated with medical imaging, additional radiographs should be obtained with caution.

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PD202-SD-SUA3

Resting State Functional MRI Connectivity in Infants with Neonatal Abstinence Syndrome

Sunday, Dec. 1 12:30PM - 1:00PM Room: PD Community, Learning Center Station #3

Participants
Rupa Radhakrishnan, MS,MBBS, Cincinnati, OH (*Presenter*) Nothing to Disclose
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PURPOSE

Exposure to opioids in utero is believed to have lasting consequences on brain development and behavior, including emotional dysregulation. However, little is known about the impact of in utero opioid exposure on brain function in neonates. We investigated functional connectivity (via resting-state functional MRI; rs-fMRI) of the amygdala (Amg; a limbic region pivotal for emotional function) in infants with neonatal abstinence syndrome (NAS) relative to opioid-naïve (ON) infants.

METHOD AND MATERIALS

We recruited 21 NAS and ON neonates. Subjects underwent rs-fMRI on a Siemens PRISMA 3T scanner at <48 weeks of age. After standard preprocessing, independent component analysis (ICA) was performed. The resulting components corresponded to published infant resting state networks (RSNs; see Figure). Regions of interest (ROIs) were created for the left and right Amg. ROIs were applied to the individual ICA maps, and average network coefficient values were extracted to determine the relative participation of the Amg within each RSN. Group differences in Amg RSN weights were compared with independent t-tests. Five subjects were excluded due to incidental findings and motion; data from 8 NAS and 8 ON were analyzed.

RESULTS

There were no differences between NAS and ON in mean gestational age at birth, age at MRI, and 5 min Apgar score. There were significant differences in mean birth weight and length of hospital stay. There were several significant and trend-level group differences in Amg RSN weights. NAS had higher R and L Amg RSN weights in the frontoparietal RSN ($p=0.04$; $p=0.08$) and higher L Amg RSN weights in the sensorimotor RSN ($p=0.09$). NAS had lower L Amg RSN weights in the executive control RSN ($p=0.07$), and lower R Amg RSN weights in the salience RSN ($p=0.07$).

CONCLUSION

The data suggest that in utero exposure to opioids may result in aberrant functional connectivity of the amygdala, a region involved in emotion regulation. This needs further investigation in larger samples.

CLINICAL RELEVANCE/APPLICATION

Understanding brain functional changes in neonatal abstinence syndrome is important in identifying best methods to manage this condition, and improve outcomes in these infants.

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PD234-SD-SUA4

Utility of Fetal Magnetic Resonance Imaging in Assessing Normal and Abnormal Fetal Cardiac Axis

Sunday, Dec. 1 12:30PM - 1:00PM Room: PD Community, Learning Center Station #4

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PURPOSE

The purpose of this study was to investigate the feasibility of fetal magnetic resonance imaging (MRI) in the measurement of normal fetal cardiac axis and the association between cardiac axis and fetal congenital heart defects.

METHOD AND MATERIALS

This retrospective review included 400 pregnant women (18-38 weeks gestation mean 24.5 weeks) referred to a children's hospital for a fetal MRI from January 2017 to December 2018 due to the finding of an anomaly by fetal ultrasound (US) or due to a technically limited US. 400 cases of fetuses included 200 fetuses with normal heart and other organ abnormalities, 150 fetuses with congenital heart diseases and 50 fetuses with the heart which was shifted as a consequence of intrathoracic anomalies. MRI was performed using two 1.5T units. In the four-chamber view MR imaging of the fetal heart, the cardiac axis was measured as the angle of two lines. The first line runs through the interventricular septum and the second line is parallel to the thoracic wall and perpendicular to the anteroposterior line from the spine to the anterior chest wall.

RESULTS

In 200 fetuses which normal heart anatomy, the cardiac axis value ranged from 34.5° to 56.8° (mean 47.6 ± 5.6°). Because the, The 47.6° was equal to 42.4° of US due to MR measurement method is different with US. In the 150 fetuses with CHD, 92 fetuses were with normal cardiac axis (35° to 60°, mean 46°). 58 fetuses with CHD were with an abnormal cardiac axis (less than 35° or over 60°). The corrected transposition of great arteries were the most common diseases with cardiac axis was over 60°. Whereas tetralogy of Fallot were the most common diseases with cardiac axis was less than 35°. Among the 50 fetuses with shifted heart, 17 fetuses had normal cardiac axis (35° to 60°) and 33 fetuses had abnormal cardiac axis. In the 33 fetuses, the cardiac axis was over 60° in 31 cases and less than 35°in 2 fetuses.

CONCLUSION

Fetal MRI can accurately measure fetal cardiac axis. Cardiac axis measurement was helpful for the diagnosis of fetal cardiac malformation, especially conotruncal anomalies and complex CHD.

CLINICAL RELEVANCE/APPLICATION

Fetal MRI can accurately measure fetal cardiac axis and show the association between cardiac axis and fetal CHD and is recommended as an adjunct to fetal US.

PD235-SD-SUA5

Symmetrical Functional Connectivity Strength Between Bilateral Anterior Heschl's Gyri Are Negatively Associated With Receptive Function During Infancy

Sunday, Dec. 1 12:30PM - 1:00PM Room: PD Community, Learning Center Station #5

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PURPOSE

It is generally accepted that the auditory function is lateralized within the brain. However, the temporal progression and specific location within Heschl's gyrus in which lateralization occurs remain elusive. Resting functional connectivity holds great promise to discern early functional development, and bilateral symmetrical functional connection strengths (bi-sfc) have been implicated to reveal lateralization of language function. In this study, we investigated temporal progression of bi-sfc in the auditory cortex and how bi-sfc of the anterior (AHG) and posterior Heschl's gyri (PHG) related to receptive and expressive language functions during infancy.

METHOD AND MATERIALS

A total of 131 normally developing infants (226 scans) enrolled in the Baby Connectome Project were included (age: 354±194 days; 73 girls). An infant-specific pipeline was employed to process fcMRI. The corresponding T1-weighted images were spatially normalized to the Montreal Neurological Institute (MNI) standard template. Regions-of-interest (ROIs) within the AHG, PHG, and planum temporale (PT) were placed on the MNI template. The bi-sfc was determined as the average of connectivity strengths between bilateral pairs of each ROI. One-way ANOVA followed by Bonferroni correction was used to compare bi-sfc among all ROIs. In addition, Pearson's correlation coefficients between bi-sfc of each ROI and T-scores of receptive and expressive languages of Mullen Scale of Early Learning (MSEL) were calculated.

RESULTS

The bi-sfcs of AHG and PHG were negatively correlated with age, but not for the PT. The bi-sfc of the AHG was significantly lower than that of PHG and PT ($p < 0.0001$). A negative correlation was observed between the bi-sfc of the AHG and the MSEL of receptive language ($r = -0.18$, $p < 0.05$), but not between AHG and expressive language. Furthermore, no significant correlation was observed between PHG and PT with MSEL scores.

CONCLUSION

AHG exhibits a statistically lower bi-sfc when compared to that of PHG and PT, suggesting lateralization of the AHG. More importantly, the bi-sfc of AHG is negatively associated with receptive, but not expressive language functions. These results underscore the important functions of AHG.

CLINICAL RELEVANCE/APPLICATION

Our study shows that the anterior Heschl's gyrus may be a predetermined primary auditory cortex in infants. These findings provide informative data to help discerning auditory function non-invasively.

PH003-EB-SUA

Phantom Study of Prone Breast PET/CT Targeted Towards Improving Clinical Applications

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Hardcopy Backboard

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CONCLUSION

While a phantom-based reader study may be a useful addition, and clinical pilot studies are also warranted, prone patient orientation appears to have superior image quality, and better compatibility with MR when bridging the two image sets together for improved diagnoses.

Background

Current PET/CT protocols for breast imaging rely on a supine patient orientation. Meanwhile, MR protocols utilize dedicated coils that dictate a prone patient orientation. The differences between the resulting breast shapes and their positioning causes an obvious lack of compatibility between the two modalities. In a supine orientation, breasts reconfigure due to gravity and are closer to the chest wall. In a prone orientation, breasts are more elongated due to gravity and are distal from the chest wall. The chest wall is a source of background activity and noise, due to attenuation and scatter.

Evaluation

Through anthropomorphic phantom studies (using a fillable torso with inserts, two deformable 750mL breasts each containing 8 uniformly disposed lesions of 8 and 10mm diameters) and use of a customized radiolucent foam support (constructed to resemble a commonly used MRI-breast coil support structure), we acquired PET/CT list-mode data with an 8:1 lesion-to-background concentration ratio. The same filled phantom configuration was imaged by PET/CT in both supine and prone orientations. The acquired data was replayed in both variable and equal 0.5 to 8min time intervals to yield different noise realizations. Image metrics of SNR and local contrast are used for the signal evaluation, along with paired-t-test comparison of the oriented data.

Discussion

The larger lesions always presented higher signal, and better SNR and contrast than the smaller lesions. Raw signal was always better (per lesion) in the prone vs supine orientation. The mean SNR for both lesion sizes was ~2x better for the prone orientation ($p<0.003$ and <0.0003 for the 8 and 10mm); mean local contrast was nearly equal for both lesion sizes ($p<0.3$ and <0.08, respectively). Generally, lesion visualization was easier in the prone orientation, and a reader study would be a useful addition.

PH008-EC-SUA

The Study of the Effect Factors of Radiation Field in Wide-Detector CT

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Custom Application Computer Demonstration

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CONCLUSION

In a wide-detector CT,the selection of different detector widths can significantly influence the distribution and radiation value of radiation field,thus a suitable detector width and relevant parameters shall be chosen according to the specific clinical requirements to reduce the radiation dose for the on-site operating medical staffs and accompanies.

Background

To explore the distribution characteristics of radiation field on Z-axis and X-axis on wide-detector CT with different scan modes,pitch and detector widths to provide the basis for the radiation protection of the chaperone and the operator.

Evaluation

Thermoluminescence dosimeters (TLDs) were placed at the Z-axis and the X-axis on the frame. The CT head standard-dose phantom was scanned by GE Revolution CT under the sequential scan mode (with detector widths of 40 mm,80 mm and 160 mm) and the spiral scan mode (with detector widths of 40 mm and 80 mm). The scan parameters were as follows:tube voltage 120kV,effective mAs 200, pitch (for spiral scan):40 mm/0.516:1,40 mm/0.984:1,80 mm/0.508:1,80 mm/0.992:1. All scans were repeated for 4 times, and all TLDs were measured after exposure for the further analysis.

Discussion

The radiation in the Z-axis was attenuated by exponential function and the scattered radiation in the X-axis showed a bell-shaped with sequential scan mode and spiral scan mode. In the Z-axis, the scattered radiation on the head side of body were all higher than the foot side of body($Z=-2.366,-2.197,-2.366,-2.371,-2.028,-2.236,-2.028$, $P<0.05$). There was no statistically significant difference in scattered radiation in the Z-axis and X-axis with the detector width was 40 mm in sequential scan mode and with the detector pitch of 40 mm/ 0.984:1 in spiral scan mode($Z=-0.345$, -0.863, $P>0.05$). The remaining groups scattered radiation of sequential scan mode were smaller than that of spiral scan mode with same detector width. Under the sequential scan mode,the differences in the distribution of Z-axis and X-axis scattered radiation under different detector widths were statistically significant($^2=28.000,18.500$, $P<0.05$),The maximum increase for detector width of 40 mm and 160 mm was 67.5μGy.Under the spiral scan,the largest distribution of scattered radiation was found to be the largest at the detector width of 80 mm and the smallest at the detector width of 40 mm. The maximum increase for detector width of 80 mm and 40 mm was 97.67μGy($Z=-2.981,-3.233,-2.353,-2.982$, $P<0.05$).

PH126-ED-SUA7

An Update on Multienergy CT: Physics, Principles and Applications

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Station #7

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS

Multienergy CT refers to the acquisition of CT data at multiple energy levels 1. To review the physics of multienergy CT (MECT) 2. To discuss the different implementations of MECT 3. To review the post-processing and image types 4. To illustrate the clinical applications of MECT 5. To evaluate the challenges and pitfalls

TABLE OF CONTENTS/OUTLINE

1. MECT- Basics 2. MECT technologies - Source based (Dual source, rapid kVp switching, Dual spin, split beam) - Detector based (Dual layer, photon counting CT) 3. MECT reconstruction- Projection-based; Image-based 4. Material decomposition algorithms- 2-material/3-material 5. Image types- Iodine map, virtual non contrast, virtual non calcium, uric acid pair, virtual monoenergetic, CT fingerprinting, Effective atomic number, electron density 6. Noise reduction 7. Clinical applications - Material composition- Stones, gout, lesion characterization, perfusion, tumor response evaluation, targeted contrast - Enhanced visualization- Improved lesion visualization; improved contrast signal (salvage of suboptimal enhanced studies, low contrast dose) - Artifact reduction- Beam hardening, metal, blooming - Radiation reduction- Virtual non contrast saving true non-contrast in multiphasic studies; Incidental finding characterization saves additional tests 8. Pitfalls & Challenges 9. Conclusion

PH139-ED-SUA8

Reliability Assessment of CT-based Texture Analysis Metrics

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Station #8

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CONCLUSION

Reliability of CTTA metrics is important when quantitative analysis of studies performed under different conditions are used to assess a single disease process.

Background

To evaluate the intra-, inter- and test-retest variability of CT-based texture analysis (CTTA) metrics.

Evaluation

Using a custom designed texture-phantom, we conducted a series of CT imaging experiments to evaluate the performance of a CTTA panel. The phantom comprises of 3 different regions (ROI) simulating different textures which may be found in tumors. The phantom was scanned on the Philips Brilliance 64 CT and Toshiba Aquilion Prime 160 CT scanners. The intra-scanner variability (robustness) of the CTTA metrics was evaluated across different scan settings such as slice-thickness, field-of-view, post-reconstruction filtering, tube-voltage, and tube-current. For each scanner and scanning parameter combination, we evaluated the performance of 234 different texture metrics extracted using 8 different types of texture quantification techniques on predetermined ROIs within the phantom. For the robustness test, 21 unique image settings were tested on the Philips scanner and 16 unique settings were tested on the Toshiba scanner respectively. A Heatmap was used to plot the percent absolute difference (PAD) between testing scan setting and baseline setting for each of the radiomic metrics. The repeatability test was conducted 15 minutes apart for all the image settings on both scanners under all settings. A Heatmap was used to plot the PAD between 1st and 2nd scan for each radiomic metric. For the reproducibility assessment, we compared PAD of all radiomic metrics between the two scanners using the 1st scan only.

Discussion

Reliable metrics must be robust, repeatable, and reproducible. Literature report a high reliability associated with entropy metrics. Here, we observe entropy of fast Fourier Transform (FFT) magnitude and FFT phase to be reliable. Literature show that these metrics can discriminate between clear cell renal cell carcinoma grades and between benign versus malignant renal masses. The reduced sensitivity of the FFT measures to the scanner and imaging parameters need to be further evaluated.

PH203-SD-SUA1

Impact of Deep-Learning Reconstruction Compared to Iterative Reconstruction: First Use in Cardiac CT in a Stroke Protocol

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Station #1

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PURPOSE

To analyse the radiation dose and the image quality of cardiac CT in an acute stroke protocol using a deep learning reconstruction method compared with a standard iterative reconstruction algorithm.

METHOD AND MATERIALS

296 consecutive patients admitted with a suspicion of stroke in the emergency department of our institution were retrospectively analysed. All patients underwent a stroke CT protocol including a non-enhanced CT, a brain perfusion if necessary, a CTA of the supra aortic vessels, a cardiac CT and a post-contrast brain CT. The cardiac CT was performed with a prospectively ECG gated volume acquisition. 143 CT scans were reconstructed with an iterative reconstruction algorithm (AIDR 3D) and 146 with a deep learning reconstruction algorithm (AiCE). Image noise, signal-to-noise (SNR), contrast-to-noise (CNR) and subjective image quality were assessed. Dose-lenght product (DLP), Volume CT dose index (CTDIvol) and effective dose were obtained.

RESULTS

There was no difference in age and weight between the two groups (all $p>0.05$). The radiation dose was significantly lower with AiCE (DLP 106.4 ± 50 mGy.cm verus 176.1 ± 37.1 mGy.cm, $p<0.0001$) that is a decrease of 39.6 %. The mean SNR and CNR were 10.3 ± 0.29 and 13.17 ± 0.34 respectively with AiCE versus 6.81 ± 2.6 and 8.83 ± 0.27 ($p<0.0001$). SNR and CNR were increased of 51.2 % and 49 % respectively. The image quality was significantly better with AiCE than AIDR 3D.

CONCLUSION

A deep learning reconstruction algorithm for cardiac CT allows both a decrease in radiation dose of 39.6% and an increase in the image quality of around 50% compared to an iterative reconstruction algorithm.

CLINICAL RELEVANCE/APPLICATION

A deep learning reconstruction allows a decrease in radiation dose and a better image quality in cardiac CT included in an acute stroke protocol.

PH204-SD-SUA6

Point-of-Care Cone-Beam CT of Head Injury: Diagnostic Performance Evaluation

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Station #6

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CONCLUSION

POC CBCT may improve safety for ICU patients requiring monitoring via head CT, providing image quality that is adequate for certain indications.

Background

Obtaining a CT in the ICU is a resource-intensive process and poses significant risk to the patient, requiring coordination between staff to ensure safe transport of the patient and support devices. Point-of-care (POC) imaging is a safer, more convenient alternative which is already widely utilized in the form of portable radiography. We developed a portable cone-beam CT (CBCT) unit and compared its diagnostic quality with that of multi-detector CT (MDCT) in a clinical study of patients in the neuro critical care unit.

Evaluation

A prototype CBCT system was developed for head scanning, incorporating artifact reduction and model-based iterative image reconstruction. We consented 92 eligible patients, of whom 54 were imaged using CBCT and MDCT, and 41 were included in the study (13 excluded due to technical factors). Three neuroradiologists compared the diagnostic quality of MDCT and CBCT scans as it pertained to imaging tasks (detection, discrimination, and/or characterization) in CSF spaces, parenchyma, hemorrhage, surgical devices, and osseous structures using a Likert scale from 1-5 (1 not visible, 3 diagnostic, and 5 excellent image quality). Image artifact was also assessed with a Likert scale from 0-5 (0 minimal, 5 critical). Assessment of surgical devices was comparable (e.g., ventricular shunt) between CBCT and MDCT (median Likert = 5). CBCT images were adequate (median Likert >=3) for assessment of CSF spaces, mass effect, osseous structures, and hemorrhage. Image quality was non-diagnostic (median Likert <=2) for assessment of parenchymal infarctions.

Discussion

The diagnostic quality of head CT performed via portable CBCT was adequate, and in some respects comparable to MDCT, for a specific subset of clinical indications in the ICU setting. CBCT appears best suited as a follow-up exam intended to assess changes in hemorrhage, ventricular size and positioning of intracranial support catheters among other common scenarios. POC CBCT has the potential to mitigate risk and resource utilization associated with head CT for ICU patients.

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PH205-SD-SUA5

Training a U-Net Deep Learning Network for Tumor Cell Detection and Segmentation in Pathologic Images Using Incomplete Annotation

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Station #5

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PURPOSE

Automated tumor cell segmentation is a fundamental step in radiomics-pathomics correlation studies. This study developed a U-Net deep learning approach to detect and segment cells in pathologic images using a training set with incomplete annotation.

METHOD AND MATERIALS

Deep learning segmentation requires large annotated data for supervised training. In pathologic images, it is nearly impossible to manually outline every cell. We developed a new strategy using a public dataset of 141 samples of 2000x2000-pixel H&E-stained breast cancer pathologic images with incomplete annotation. The data was split into training, validation and test sets of 89, 22 and 30 images, respectively. The positive training samples were generated by extracting a 32x32 patch at each annotated cell and augmenting it with affine translations, resulting in a total of 60,000 patches. The negative training samples were selected to characterize a wide variety of non-cell regions using a histogram-based semi-automatic method. This resulted in a 1:100 ratio of positive to negative patches in the training set. A U-Net model was then trained with a mini-batch stochastic gradient descent algorithm by minimizing a custom loss function that combined a weighted inverse Dice coefficient and binary cross-entropy with class weights to account for the class imbalance in the training set. Using the annotated cells as reference standard, the 22 validation images were used to evaluate the network performance, tune hyperparameters, and adjust the loss function. The final network performance was evaluated with the held-out test set.

RESULTS

For the 30 test cases with 2365 annotated cells, the U-Net achieved a sensitivity of 99.7% for cell detection. The average true positive fraction of the segmented cell area and Dice coefficient were 88.1% and 82.4%, respectively.

CONCLUSION

Fully-annotated data are uncommon in pathology due to the extensive effort it requires. Our method that selectively chooses positive and negative patches from an incompletely annotated pathologic dataset can detect and segment tumor cells with high accuracy. Further work is underway to conduct the correlation study and evaluate the generalizability of the method to other diseases.

CLINICAL RELEVANCE/APPLICATION

Studies suggest that histopathologic features may be correlated with radiologic features for guiding disease management decisions. Cell segmentation is fundamental for these correlation studies.

PH236-SD-SUA2

An Experimental Study of MRI - Induced Heating in Conductive Loops

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Station #2

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CONCLUSION

This work indicates that size and presence of a gap are factors to consider in the risk assessment of piercings. It has important implication for dermal piercings since there may be unknown gap in the piercing under the skin.

Background

Patients who are unable or reluctant to remove metallic piercings before MRI are at risk of injuries due to magnetic force and radiofrequency (RF) heating. While magnetic force risk can be reduced by screening with a ferromagnetic detector, it is harder to assess the risk of RF burn from piercing. The purpose of this investigation is to conduct experiments to evaluate the relationship of RF heating with the size and configuration of conductive loops to provide a better understanding of the factors related to RF heating in piercings.

Evaluation

The study was conducted on a GE 3T MR system. Circular loops of diameter 5cm, 8cm and 11cm with an air gap of 0, 0.3mm or 2.5mm for each diameter were constructed from copper wire (gauge 10). They were placed one at a time horizontally in a container with the loop touching the skin of a pig knuckle specimen at the loop gap position. The setup was mounted on top of a 27cm spherical phantom and scanned using a fast spin echo sequence for 10:33 minutes. Temperature at the contact point between each loop and the specimen skin was measured with a Philips patient monitor temperature sensor. The results show temperature rise of 1.4 and 1.8 deg C in the 8cm loops with a gap of 0.3mm and 2.5mm respectively, and temperature rise of 5.0 and 5.2 deg C in the 11cm loops with a gap of 0.3mm and 2.5mm respectively. There was no measured temperature increase in all loops with zero gap and in the 5cm loops with a gap.

Discussion

This study shows that RF heating risk increases with the size of conducting loops and with the presence of a gap. The result indicates high induced electric field at the gap of the larger loops causes current to flow in the skin with high resistance leading to the heating. However, this study does not imply MRI safety for piercings smaller than a certain size or without a gap since RF heating depends also on other factors and settings not covered in this study.

PH237-SD-SUA3

Image Quality Evaluation Using a New Low-Dose Fluoroscopy Algorithm Based on a Deep-Learning Approach

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Station #3

Participants
Zhiwei Wang, MD, Beijing, China (*Presenter*) Nothing to Disclose
Zhengyu Jin, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Interventional treatment is widely used in clinical practice and the augmented role of these procedures raises concerns about the radiation dose to patients and operators. Howerer, dose reduction may cause the increased noise, which impacts the image quality. We aim to develop a new low-dose fluoroscopy algorithm based on a deep-learning approach to improve image quality using an in-vitro model and in-vivo patient groups.

METHOD AND MATERIALS

All image acquisitions were performed on a DSA machine (Angio30C, Neusoft, Shenyang, China). The proposed network combined De-noising Convolutional Neural Networks (DnCNN) and Visual Geometry Group (VGG)-19 architecture.The radiation dose of the low dose regimen was half that of the conventional dose. We obtained 200 noisy-free phantom images as label via averaging 100 frames in one stable sequence. Noise was added artificially to these labels with specified range of our fluoroscopy to get noisy images. Thus we used these label and noisy images as our training set. Testing set included 20 phantom images for quantitative analysis and 100 clinical patient images for subjective evaluation. Mean squared error(MSE), peak-to-noise ratio(PSNR) and structural similarity(SSIM) were determined for quantitative analysis. The image quality of subjective evaluation was graded (1, excellent; 3, poor). The results were compared with conventional model-based de-noising approaches (temporal recursive filter,TRF), which is commonly used in fluoroscopic noise reduction.

RESULTS

For the quantitative analysis of 20 phantom images, image quality was significant better based on a deep-learning approach (PSNR, SSIM, MSE) than that based on TRF. For subjective evaluation of 100 clinical patient images, image quality was also significant better based on a deep-learning approach.

CONCLUSION

Compared with traditional method, deep learning based noise reduction method showed great improvement of image quality.

CLINICAL RELEVANCE/APPLICATION

Deep learning based noise reduction method may be used in interventional treatment to reduce radiation dose.

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PH238-SD-SUA4

High-Resolution Knee Arthrography Using Photon-Counting Detector CT for Grading Osteoarthritis

Sunday, Dec. 1 12:30PM - 1:00PM Room: PH Community, Learning Center Station #4

FDA Discussions may include off-label uses.

Participants
Kishore Rajendran, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
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PURPOSE

To grade cartilage loss in a swine model of osteoarthritis (OA) using high resolution photon-counting detector (PCD) CT.

METHOD AND MATERIALS

A Yucatan swine model of knee OA was developed using chondrotoxic monoiodoacetate (MIA, 1.2 mg per 2 mL saline) administered to a randomized knee of anesthetized pigs (N = 8), while the contralateral control knee received 2 mL normal saline under ultrasound (US) guidance in a blinded fashion by a musculoskeletal radiologist. Twenty one days after the MIA injection, all animals received US-guided contrast injections (anionic Gd-DOTA, 4 to 6 mL/knee) on both knees. The knees were flexed and extended for one minute prior to PCD-CT scanning to ensure uniform distribution of contrast. Both knees were scanned in a single acquisition using the high-resolution Sharp mode (48 x 0.25 mm collimation, 120 kV, 342 mAs, CTDIvol = 40mGy) with energy thresholds at 25 and 51 keV. Animals were euthanized immediately after scanning, and the knees were harvested for visual assessment of joint damage. PCD-CT images were reconstructed using a dedicated sharp kernel V71 with SAFIRE (strength 5). For each animal, each knee was reconstructed separately at an image voxel size of 0.15 x 0.15 x 0.5 mm3. A blinded musculoskeletal radiologist evaluated the 25-120 keV images (axial and sagittal planes) and graded the morphological changes. For each knee, the joint was partitioned into 4 regions for assessment (medial and lateral femur, trochlea and patella). Quantitative scores based on the International Cartilage Repair Society (ICRS score) were used to assess cartilage integrity.

RESULTS

Chondromalacia was detected in the MIA knees with ICRS scores ranging from grade 1/grade 2 (cartilage heterogeneity/0 to 50% loss) for n = 4 knees to grade-3 (50% to 100% cartilage loss) for n = 4 knees. The control knees (n = 8) were scored grade 0 (normal cartilage) by the radiologist. Visual examination of the harvested knees confirmed the extent of cartilage damage in the MIA knees.

CONCLUSION

We demonstrated a high-resolution PCD-CT method to assess cartilage loss in a MIA-induced OA swine model, and visual evaluation of the harvested knees for cartilage damage confirmed the image-based findings.

CLINICAL RELEVANCE/APPLICATION

PCD-CT allows grading of OA-induced cartilage loss at 150-micron resolution previously not achievable with other methods. This could facilitate early detection of OA and mitigate disease progression.

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QI005-EB-SUA

Dual-Energy CTA for GI Bleeding: Reducing Patient Radiation Dose and Table Time

Sunday, Dec. 1 12:30PM - 1:00PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
Steven Hang, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Jonathan Chahin, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose
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Klaus D. Hagspiel, MD, Charlottesville, IN (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

Gastrointestinal (GI) bleeding is common in the United States, requiring hospitalization in 223 per 100,000 people each year (Laine 2012). In hemodynamically stable patients, our diagnostic workflow in the Emergency Department typically begins with CTA abdomen and pelvis after physical exam. Previously, our CTA protocol for GI bleeding (GIB CTA) included three separate acquisitions performed at single energy: noncontrast, arterial, and delayed venous images. Dual energy CTA (DE CTA) has been increasingly used in this setting to reduce radiation dose and patient table time because of the ability to create virtual noncontrast (VNC) images and forego the true noncontrast (TNC) acquisition. Furthermore, DE CTA provides additional potentially clinically useful reconstructions such as iodine maps and virtual monoenergetic images.

METHODS

We analyzed the literature to find previously described parameters for performing dual energy CTA for GI bleeding (Wells 2018). The protocols were modified after phantom testing and approved by our departmental medical physicists for clinical use. The new dual energy CTA protocol included only arterial and venous acquisitions with VNC reconstructions. Single energy GIB CTAs from the previous 6 months were analyzed to determine patient table time and effective dose. A total of 67 GIB CTAs spanning from October 2018 through March 2019 were included in this group. Clinical use of the new dual energy GIB CTA protocol began in March 2019. In a similar fashion, patient table time and effective dose were recorded for these studies. As of April 2019, a total of 6 CTAs were included in this group. Patient table time was determined by calculating the time interval from initial scout image to final venous image. Monte-Carlo simulation based software (Radimetrics, Bayer Healthcare) was utilized to calculate effective radiation dose. Stastitical analysis was performed using a two sample T-test.

RESULTS

For scans utilizing single energy GIB CTA with three separate acquisitons, the mean table time was 296 seconds (4 minutes, 56 seconds) and mean effective dose was 39.1 mSv (n=67). Upon implementation of the dual energy GIB CTA protocol with two acquisitions, the mean table time decreased to 217 seconds (3 minutes, 37 seconds) and mean effective dose decreased to 30.2 mSv (n=6). Statistical analysis with two sample t-Test demonstrated a statistically significant decrease in both effective dose ($p<.015$) and table time ($p<.033$).

CONCLUSION

Dual energy CT is a novel CT technique with the potential to improve diagnostic capabilities, decrease radiation dose, and enhance patient experience. After implementation of dual energy GIB CTA protocol into the clinical workflow at our institution, we were able to improve the quality of patient care by decreasing both table time and effective radiation dose.

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QI006-EB-SUA

Improving Reporting of High Radiation Dose Events in Fluoroscopy to Meet Joint Commission Requirements

Sunday, Dec. 1 12:30PM - 1:00PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
Phuong-Anh T. Duong, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
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Rebecca Neill, MS, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Matthew E. Zygmont, MD, Decatur, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Complex procedures in interventional radiology can result in high radiation doses with the potential of harm to patients. Until recently, detection of high dose events were typically self-reported by the operator or revealed after the exam by patient reported skin injury. As of January 2019, the Joint Commission now mandates documentation of all fluoroscopy dose events, establishment of radiation exposure thresholds, and investigation of excessive dose events. Fortunately, many fluoroscopy exams can now be automatically tracked through dose tracking software. However, some older equipment lacks the capability of automatic reporting, necessitating a robust manual process to capture all dose events. The purpose of this project was to improve detection of fluoroscopy exams with excessive radiation dose by implementing automatic dose tracking and a monthly auditing process.

METHODS

The baseline process for detecting excessive radiation dose events relied on technologists to fax a form to the Environmental Health and Safety Office when doses exceeded cumulative air kerma (CAK) threshold of 5 Gy or fluoroscopy time greater than 100 minutes. A medical physicist would then calculate the peak skin dose (PSD). If the PSD exceeded 5 Gy, an email would be sent to the operating radiologist or surgeon with guidance on follow-up. To improve detection of high dose events, capable fluoroscopy equipment was configured to automatically send radiation dose structured reports (RDSR) to dose tracking software (RadimetricsTM, Bayer Healthcare, LLC). Automatic reporting began in April 2016 and was fully configured by December 2017 for 13 fluoroscopy units used in interventional radiology and operating rooms. Dose threshold alerts were triggered if CAK exceeding 5 Gy for a single exam or 15 Gy cumulative CAK over a 6-month period. Historically, doses above the threshold were not encountered for units outside of interventional radiology although some of these units are still tracked by the software and/or manually audited. Starting in January 2019, manual recording of doses for all fluoroscopy procedures was made mandatory in the radiology information system. To ensure that no high dose events were missed, the manually entered doses were also reviewed monthly starting in January 2019. The new process steps are shown in the process map (Figure 1).

RESULTS

In 2015 (baseline), 18 high dose events were detected. In 2018, after all capable units were configured to send to the dose tracking software, 24 high dose events were recorded. 21 cases were already detected in 2019 from January to March (see Figure 2). The high number of events in the first quarter of 2019 indicate annual high dose events several fold higher than reported at baseline in 2015. Two of the cases discovered at the monthly audit revealed an error in sending data to the dose tracking software. Several consecutive high dose alerts originated from one fluoroscopy unit, uncovering equipment malfunction after recent service. As a result of this timely discovery, the unit was decommissioned until it could be repaired, thus avoiding further patient overexposure.

CONCLUSION

Automatic dose tracking of fluoroscopy exams revealed baseline underreporting of excessive dose events using a manual self-reporting process. Automated alerts enabled timely detection of equipment malfunction. A monthly remediation audit process was able to detect dose events that were not captured through the automatically via the dose tracking software. Two additional high dose events were detected though audits of manually recorded doses in the radiology information system. Although automated dose tracking improves event detection, process redundancy is important to ensure all high dose events are captured.

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QI007-EB-SUA

Improving Radioprotection Practices in the Operating Room

Sunday, Dec. 1 12:30PM - 1:00PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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Facundo Diaz, MD, Buenos Aires City, Argentina (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Procedures using ionizing radiation are carried out in the operating room (OR) routinely. Except for radiology technologists, the surgical team, which includes anesthesiologists, anesthetists, instrument (scrub) nurses and surgeons, might not have an adequate radiation protection education and culture. The objective of this project was to objectively quantify the adherence to radiation protection practices in the operating room and establish guidelines for improvement through an observation checklist audit.

METHODS

The use of the following radioprotection items was collected through a direct -observation checklist: • Lead aprons • Thyroid shield • Personal dosimeters • Leaded glasses • Leaded curtains on the operating tables • Warning signs at the door of the operating room For each item, its use was characterized as: • Satisfactory (S). • Partial compliant (PC). • Non-compliant (NC).

RESULTS

In total, direct observation on compliance was obtained from 97 surgical interventions (Table 1) pre and post-improvement plan. After initial observations, a root cause analysis was performed for partial and non-compliant items and a plan for improvement initiatives was developed. The improvement actions identified for implementation included: - Ad hoc radioprotection course for anesthetists, scrub nurses and surgeons - Inclusion of a radioprotection checklist during time-out - Increase the number of thyroid shields and leaded glasses - Increased the number of OR tables with removable curtains and schedule surgeries that require higher radiation exposure times in those ORs.

CONCLUSION

In the operating room, radiology technologists are the most complaint with radioprotection practices. Training ALL surgical staff being exposed to radiation is essential. However, in addition to education, making sufficient gear available and incorporating a radioprotection checklist during time out helps compliance of these important safety measures.

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QI018-EB-SUA

Impact of ABUS Implementation on Workflow in a Small Breast Center

Sunday, Dec. 1 12:30PM - 1:00PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
Serena Tidwell, MD,MBA, Columbus , GA (*Presenter*) Speaker, General Electric Company; Researcher, General Electric Company

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PURPOSE

This work focuses on a small breast center opened in 2012. At the time of opening,breast density laws were gaining traction and the center offered hand held screening ultrasound "HHUS" for dense patients. The decision to offer HHUS was based on limited resources for equipment and lack of clarity on optimal technology. HHUS was time consuming and created challenging operational logistics. The center acquired automated breast ultrasound "ABUS" (GE Invenia) in January 2018. The purpose of this quality improvement report is to describe the center's experience with ABUS versus HHUS.

METHODS

Patients screened using ABUS from February 1 - July 31, 2018 were analyzed for time required in the center (from check-in to check-out) to complete the exam, recall rates to include technical repeats and BIRADS 0 recalls, and pathology in patients who ultimately required biopsy. If the patients had prior HHUS the times for ABUS versus HHUS were analyzed. The center works with all patients to develop a custom screening program, with some patients electing same day MMG + US screening and others electing 6-month interval US. A total of 144 patients underwent ABUS alone during the time period with an additional 124 patients screened with ABUS + MMG. From this total group of 268 patients, 111 patients were identified who had prior HHUS and 82 patients who had prior HHUS + MMG.

RESULTS

Addition of ABUS improved time required to screen dense patients. The attached charts compare the average times for ABUS vs. HHUS and ABUS + MMG vs. HHUS + MMG. Patients undergoing ABUS + MMG same day experienced a 49% reduction in time requirement. ABUS only patients experienced a 35.9% reduction. This reduction is optimal for patients and the center as it frees up time for the hand-held unit to be used for diagnostic exams. Operationally, the reduction in time yields an additional 5 dense patients daily potentially generating an additional $300,736 in revenue annually (average Medicare reimbursement $165.24 per patient). Additional gains in revenue would be recognized given more appointments for diagnostic ultrasound services. Time requirements were analyzed by month of implementation. Time was lowest at months three and four; however, these were also months with high rates of technical repeats. The average BIRADS 0 rate was 34%, with the highest rate of BIRADS 0 during the lowest patient volume month. Technical repeats were also highest in the lowest volume month, with the second highest volume of technical repeats being the months with the lowest time in the center per patient. The data support a learning curve with initial focus on operational efficiency creating lower times per patient in center yielding to awareness of image quality and technical repeats increasing times. The attached charts demonstrate time in the center for ABUS patients and ABUS + MMG for months 1-6. Finally, the results of patients who underwent biopsy based on ABUS findings were reviewed. Eleven patients were identified for whom biopsy was recommended based on findings at time of diagnostic imaging from initial ABUS recall. Of this group, 6/10 (60%) were benign: 1 fibroadenoma, 1 PASH and 4 benign with no further classification. Two of the biopsy patients were positive for CIS - one ALH / LCIS and one DCIS. There were two invasive cancers diagnosed (one infiltrating ductal and one lobular cancer). One patient has not had a biopsy. For the patients who were ultimately BIRADS 4, the positive predictive value of biopsy results was 40%.When this data was analyzed, all available patient follow-up was collected. Two additional cases of LCIS were diagnosed in this group, one at 8 months and one at 11 months. Both cases were women were in the staggered ABUS / MMG group and the biopsies were based off MMG findings at the time of the six-month interval MMG.

CONCLUSION

The reduction in time to screen ABUS patients has been a positive experience in our center. Patients support the new technology and appreciate the shortened time requirements. Yet, implementation was challenging with high recall rates. We believe our experience will be helpful to others implementing ABUS. Specifically, we would recommend initial same-day reads and continuous monitoring of recall rates until work flow is firmly established. We identified two major improvement actions. First, continuously monitor recalls and when necessary implement same-day reads to identify cause. Second, we identified one interpreting Radiologist to be our ABUS 'champion'. Finally, we plan to analyze overall data for second quarter 2019 to compare to our 2018 implementation experience.

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QI100-ED-SUA2

The Effect of a Radiology Nurse Navigator on Improving the Timeliness of Breast Care by Minimizing the Interval Time between Abnormal Breast Imaging and Image Guided Needle Biopsy

Sunday, Dec. 1 12:30PM - 1:00PM Room: QR Community, Learning Center Station #2

Participants
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PURPOSE

Breast Centers incorporate a multidisciplinary team approach to optimize breast care delivery to patients. The National Accreditation Program for Breast Centers (NAPBC), a consortium of professional organizations focused on breast health delivery and improving outcomes, routinely sets out guidelines for accreditation. One of the NAPBC standards regarding diagnosis is 'needle biopsy is the initial diagnostic approcach rather than open biopsy...open surgical biopsy as an initial approach should be avoided, as it does not allow for treatment planning and has a high re-excision rate.' (1, Standard 2.9). One of the National Quality Measures for Breast Centers is the Imaging Timeliness of Care, specifically the 'time between diagnostic imaging and Needle Core biopsy'(2). The purpose of this study is to utilize staffing changes to decrease the interval wait time between abnormal breast imaging findings and needle biopsy, or the time to diagnosis, in order to improve care delivery,improve patient satisfaction and improve patient outcomes.

METHODS

A Nurse Navigator's role is to help patients obtain timely cancer screening, diagnosis and treatment, to optimize patient care and improve patient outcomes.(3,4). A Radiology Nurse Navigator position was created and filled in the summer of 2017, to oversee the breast biopsy program. Her role was envisioned as a facilitator for patients, from their point of entry into the breast care system, when biopsy is recommended, and throughout their course of care to include any advanced imaging, additional biopsies, and initial breast surgery and oncology appointments. Her responsibilities included scheduling biopsies, obtaining referrals, assisting in pre and post biopsy care, and coordinating patient appointments as needed amongst the multidisciplinary breast team.

RESULTS

IRB approval was obtained for this retrospective chart review. Biopsy cases performed at our academic breast imaging center from January 1-June 30, 2017 and January 1-June 30,2018 (pre and post Nurse Navigator) were reviewed. The following data was obtained: the type of biopsy (US, stereotactic, MRI guided biopsy), interval time between the biopsy recommendation and needle biopsy in working days. Press Ganey scores from the time periods (Jan-June 2017 and Jan-June 2018) for OPT-A 'got tests when wanted' were reviewed. The results were analyzed using a standard T test. In 2017, 326 patients underwent 344 biopies, 228 US guided biopsies, 80 stereotactic biopsies, 23 Breast MRI guided biopsies and 13 cyst aspirations. The average interval wait time for US biopsies was 12.86 days (1-145), stereotactic biopsies 18 days (2-64), and MRI guided biopsies 20 days (6-54). In 2018, 370 patients underwent 405 biopsies, 265 US guided biopsies, 95 stereotactic biopsies, 35 MRI guided biopsies, and 10 cyst aspirations. The average interval wait time for US biopsies was 8.67 days (0-63), stereotactic biopsies 10.97 days (1-39), and MRI guided biopsies 18 (2-44). The decrease in interval wait times was significant for stereotactic and ultrasound guided biopsies, with a 31% decrease in wait times for stereotactic biopsies (p= 0.02) and 33% decrease in wait times for ultrasound guided biopsies (p=0.01). Additionally, there was a 10% decrease in interval wait times for MRI guided biopsies. Biopsy volumes increased overall, with the largest relative gains in MRI guided biopsies (152% in 2018 vs. 2017) compared to stereotactic biopsies (118%) and ultrasound guided biopsies (116%). Press Ganey scores increased from an average of 89.85 (82.9 - 93.3) in Jan. to June 2017 for OPT-A, to 93.9 (89.3-97.6) in Jan. to June 2018.

CONCLUSION

The Radiology Nurse Navigator improved timeliness of patient care by decreasing wait times for all biopsies by 10-39%, statistically significant for stereotactic and ultrasound guided biopsies, improved patient satisfaction as demonstrated by a rise in Press Ganey scores on average from 89.85 to 93.9, and increased overall biopsy volumes. Future studies evaluating additional timeliness of patient care delivery (from needle biopsy diagnosis to surgery), patient and physician satisfaction, and cost benefit analysis can be performed to justify the implementation of Radiolgoy Nurse Navigators across all breast centers. References: 1. https://accreditation.facs.org/accreditationdocuments/NAPBC/Portal%20Resources/2018NAPBCStandardsManual.pdf 2.http://www2.nqmbc.org/wp-content/uploads/2014/03/NQMBC-measures.pdf 3.Academy of Oncology & Patient Navigators.Helpful Definitions.www.aonnonline.org/about/helpful-definitions 4.Psooy BJ, Schreuer D, Borgaonkar J, Caines JS. Patient navigation: improving timeliness in the diagnosis of breast abnormalities. *Can Assoc Radiol J.*2004;55:145-150.

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QI101-ED-SUA3

Procedure for Optimal Implementation of Automatic Tube Potential Selection in Pediatric CT to Reduce Radiation Dose and Improve Workflow

Sunday, Dec. 1 12:30PM - 1:00PM Room: QR Community, Learning Center Station #3

Participants
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Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
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PURPOSE

Automatic tube potential (kV) selection is an important dose optimization technique that has been shown to achieve up to 50% dose reduction in adult body CT. However, clinical implementation of automatic kV selection in pediatric CT is not a trivial task; a quantitative approach is required to determine the optimal settings for different clinical tasks. This optimization often requires manual selection of technique factors by the technologist, which can not only delay workflow, but can also lead to increased radiation dose or poorer image quality if the wrong technique is selected. The aim of this report is to describe the procedure used by our institution to clinically implement an automatic kV selection tool (CAREkV, Siemens) for radiation dose reduction in pediatric abdominopelvic CT. The procedure starts with phantom measurements to determine optimal CAREkV parameters as a function of clinical task and patient size, and is followed by clinical implementation, patient case collection, and objective performance evaluation.

METHODS

We introduced CAREkV into our pediatric abdominopelvic CT practice in three steps. (1) Phantom measurements were carried out to determine optimal parameter settings. Six phantoms, representing the sizes of a newborn, 1, 5, 10, 15 year old and young adult, were scanned on a dual-source 128-slice scanner using a routine pediatric abdominopelvic protocol (Flash, Siemens) with CAREkV on and off. The technique chart used for manual technique selection was previously developed as part of a comprehensive clinical study. When CAREkV was on, six of the slider bar settings corresponding to different clinical tasks were evaluated (namely, 2, 3, 5, 6, 8 and 11) for a reference technique of 120 kV and 160 quality reference mAs (QRM). The kVs and corresponding radiation doses (CTDIvol) were recorded for each phantom and each clinical task setting. The optimal CAREkV clinical task setting was chosen by the pediatric radiologists and CT protocol committee based on similarity of the kV settings for different patient sizes and clinical tasks, to the existing technique chart settings. This experimental approach was validated by comparing the kV setting and CTDIvol for different patient sizes and clinical tasks obtained using the manual technique chart with those corresponding to similar phantom sizes and tasks. (2) The optimal CAREkV settings identified in step 1 were programmed into a new pediatric CT protocol, which was used clinically over a 1-month trial. During this evaluation period, various patient data were recorded, including: patient size (as measured by Water-Equivalent-Diameter (WED)), clinical task, the kV and CTDIvol selected by CAREkV and the average subcutaneous fat noise, average liver noise and the aortic iodine CNR as image quality metrics. (3) Following the successful 1-month trial, the new scan protocol was adopted into the clinical practice, and after 3-months of use, the dose performance (in terms of CTDIvol and image quality metrics described above) were compared to that achieved previously in a similar patient cohort using our technique chart.

RESULTS

Using phantoms, we determined that the kVs selected by CAREkV, for clinical task settings of 2 and 5, were optimum for non-contrast and contrast examinations, respectively (Fig1(a-b)), which was in agreement with our manual technique chart. In the 1 month trial, we found that these settings were appropriate for pediatric abdominopelvic CT, as the kV and CTDIvol values selected by the CAREKV tool were similar to those used by the technique chart and the image quality was similar. The CAREKV tool was then implemented into pediatric abdominopelvic CT and it was found that the CTDIvol before and after the implementation of the CAREkV tool were comparable (Fig 1), with a very slight dose reduction ($p<0.05$) for all patient sizes apart from < 15cm.

CONCLUSION

CAREKV was clinically adopted into our pediatric abdominopelvic CT practice with use of a 3 step procedure. This ensured that optimal image quality was maintained relative to our kV/mAs technique chart rigorously-developed in a previous clinical study, and that an appropriate radiation dose reduction was incorporated by the CAREkV tool through the careful selection of the clinical task parameter settings. This tool provides the benefits of potentially radiation dose, streamlined workflow and reduction in human-error in the protocol set-up.

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QI102-ED-SUA1

Our Work is Never Done: Continuous Quality Improvement in the EC

Sunday, Dec. 1 12:30PM - 1:00PM Room: QR Community, Learning Center Station #1

Participants
Susanna C. Spence, MD, Houston, TX (*Presenter*) Nothing to Disclose

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PURPOSE

The pressures on our county EC have not ceased in the last few years, with record setting volumes at our Level III trauma center following closure of two smaller hospitals in our catchment area, with this county EC now the busiest EC in the city. All service lines have been called upon to assist in throughput and flow, with a focus on CT for Radiology, which features prominently as many of our EC patients require imaging. In fact, while imaging utilization across the nation has taken a slight downturn, EC imaging continues to increase. This, and an overall increase in patient visits at our institution, has created continuous pressure on the radiology department to improve turnaround. The measure of EC TAT is set by the voice of the customer, our EC providers. They care little for the tech vs radiologist turnaround time: they place an order, which goes into what they perceive as a 'black box' until some kind of result is returned. Therefore our metric according to the EC: order to 'first actionable' report (whether that be prelim or final).

METHODS

This poster will describe the methods of several different QI projects undertaken around EC CT turnaround time from 2015 to present. Because we are measured from 'order' to 'first actionable report' we are actively encouraged to undertake projects that improve tech turnaroud time and protocolling time in addition to the rendering of the radiology report itself once the exam is completed. Therefore we will describe our analysis of our longest CT exams with the longest TAT (CT A-P with contrast) and our interventions surrounding that (including abandoment of low yield delayed-phase imaging and oral contrast). In addition, this QI report would include description of our workflow changes (shifting of techs from inpt to EC in peak hours, consolidated/streamlined protocolling lists, short 2 hour cross coverage of a second attending during peak hours). The report will also briefly touch on future directions, including clinical decision support to decrease the numbers of changed orders, tech worklist modifications to indication status of pending labs/pregnancy test/IV, and an approved physician order set to bring the orders for labs/pregnancy test to the forefront of the ordering process.

RESULTS

Despite a continued increase in EC CT exams performed per month (increasing from an average of 1474/month in 2016 to a record setting 2209 last month (Mar 2019) we have not only decreased our prior TATs but we have managed to maintain that improvement despite increases in volume year after year. We have had 24/7 faculty coverage since 2012, so we have neither added overnight faculty coverage nor an extra resident or tech. We did not add a CT scanner or upgrade our current scanner. We did add an additiional 2 hour 'swing' shift of a second faculty member during peak evening hours - both to balance neuro coverage and to improve TATs at a time when we were reaching 'critical mass' with a single attending and resident - but the majority of our interventions are workflow related. The attached graph indicates the cumulative impact of our various interventions on our EC CT TATs over this time period.

CONCLUSION

We look at our volume/TAT data continuously, and watch for volume increases in addition to TAT increases, particularly in the evening hours when the EC is under the heaviest pressure. Queuing theory indicates that wait times will continuously increase as patient volumes exceed throughput capacity in the evening hours. We have done (and continue to do) our level best to keep radiology at the center of throughput facilitation as opposed to being a bottleneck during that time period. This has given us strong bargaining power when we have made requests for IV modifications (due to leaks) or EC assistance with lab and pregnancy test values needed for CT throughput. This collegial atmosphere allows us all to move forward in our common goal.

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RO200-SD-SUA1

Smoking History and Cessation Discussions in Cancer Patients Receiving Definitive Radiotherapy: Do We Treat All Patients Equally?

Sunday, Dec. 1 12:30PM - 1:00PM Room: RO Community, Learning Center Station #1

Participants
John M. Holland, MD, Portland, OR (*Presenter*) Nothing to Disclose
Emily Holland, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Tobacco is recognized as a causative agent for head and neck (H&N) and lung cancers, but not for cancers of the prostate or breast. Still, tobacco use during radiotherapy has been associated with poorer outcomes for all four of these commonly treated malignancies. We sought to evaluate if our providers record smoking history and discuss cessation less frequently for prostate and breast cancers than for H&N and lung cancers.

METHOD AND MATERIALS

Initial consultation notes of 592 non-metastatic patients seen from January 2014 through June 2017 were reviewed using the electronic medical record. These notes contained input from residents, attendings and nurses. Descriptive statistics were used to evaluate smoking history and cessation discussions. The Chi-squared test was used to compare frequencies.

RESULTS

We chose two cancer sites commonly associated with tobacco use and causation (H&N and lung) and two sites not commonly associated (prostate and breast). Prostate cancer patients are less likely to have smoking history recorded (65%) than breast (91%), H&N (96%) or lung (97%) patients. ($p<0.0001$). Breast and prostate cancer patients were less likely to be current smokers (10%) than H&N and lung cancer patients (29%). ($p<0.0001$). Discussions regarding smoking cessation were less frequently documented in breast and prostate cancer patients (14%) than in H&N and lung cancer patients (55%). ($p=0.0005$).

CONCLUSION

1. We document smoking history less frequently for prostate cancer patients than H&N, lung or breast cancer patients. 2. Breast and prostate cancer patients have a lower rate of current smoking than H&N and lung cancer patients. 3. We document smoking cessation discussions less frequently in current smoking breast and prostate cancer patients than current smoking H&N and lung cancer patients. 4. As all of these patients have been shown to experience poorer outcomes when smoking during radiotherapy, all should be asked about their smoking history and clinic staff need to be prepared to discuss cessation strategies.

CLINICAL RELEVANCE/APPLICATION

By learning discrepencies in how we discuss smoking and cessation, we can change practice patterns and improve patient outcomes.

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RO201-SD-SUA2

Cost Analysis of Audiovisual-Assisted Therapeutic Ambiance in Radiation Therapy (AVATAR) Aided Omission of Anesthesia in Radiation for Pediatric Malignancies

Sunday, Dec. 1 12:30PM - 1:00PM Room: RO Community, Learning Center Station #2

Awards
Trainee Research Prize - Resident

Participants
Shearwood McClelland III, MD, Indianapolis , IN (*Presenter*) Nothing to Disclose
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Brian Overshiner, RT, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Radiation therapy (RT) is a hallmark of optimal pediatric oncology care. Due to the inability of children to reliably remain immobile while receiving RT for cancer anatomy targeting requiring millimeter precision, daily anesthesia plays a large role. Pediatric RT involves a single-day simulation session followed by multiple consecutive daily treatment sessions ranging from 2-6 weeks in duration. Consequently, pediatric anesthesia for each RT session is a source of financial burden for patient families and the overall healthcare system in addition to being invasive, traumatic, and detrimental to patient quality-of-life. This study attempts to assess the cost-savings benefit of audiovisual-assisted therapeutic ambiance in radiation therapy (AVATAR)-aided omission of pediatric anesthesia in RT.

METHOD AND MATERIALS

The baseline time of anesthesia during RT was derived from documented anesthesia billing time during RT simulation at our institution and in published literature. Current procedural terminology and relative value unit codes encompassing anesthesia-related charges from Radiation Oncology and Anesthesia were analyzed in concert with this value to calculate the total cost of pediatric anesthesia per RT session. The number of RT sessions per patient was derived from the mean sessions of AVATAR-treated patients from the literature and our own institutional experience.

RESULTS

The mean number of RT fractions administered per patient with AVATAR-directed anesthesia omission at our institution was 19.5, similar to the 17.6 previously reported. At a mean anesthesia time exceeding 30 minutes (with mean RT duration of 4 weeks), the cost of pediatric anesthesia per RT fraction in non-AVATAR sessions was $1,950.68, yielding a total anesthesia cost of RT treatment of $38,233.24 per patient (including simulation). Patients at our institution were not billed for AVATAR-assisted RT.

CONCLUSION

The ability of AVATAR to obviate the necessity for daily anesthesia in pediatric RT provides substantial cost-savings. These findings argue for increased utilization of AVATAR as well as long-term analyses of RT targeting accuracy of AVATAR versus conventional anesthesia-guided treatment of pediatric malignancies.

CLINICAL RELEVANCE/APPLICATION

Increasing AVATAR exposure with resultant omission of anesthesia in pediatric radiation oncology has the potential to substantially reduce patient financial burden and decrease overall healthcare costs.

UR174-ED-SUA7

Penile Ultrasound in Trauma

Sunday, Dec. 1 12:30PM - 1:00PM Room: GU/UR Community, Learning Center Station #7

FDA Discussions may include off-label uses.

Participants
Carlos A. Romero, MD, San Luis Potosi, Mexico (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Depict the normal anatomy of the penis and identify such structures unltrasonographically Learn the epidemiology of trauma, the main mechanisms and the usefulness of ultrasound in this pathology

TABLE OF CONTENTS/OUTLINE

Background Anatomy Normal Anatomy Vascular supply Penile fracture Mechanisms of Trauma Ultrasonographic evaluation Ultrasonographic Characteristics of the Penile Body Findings in Penile Rupture

UR176-ED-SUA6

Have You Seen It? Then Take a Glance at These Prostate Lesions!

Sunday, Dec. 1 12:30PM - 1:00PM Room: GU/UR Community, Learning Center Station #6

Awards
Certificate of Merit

Participants
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Andre L. Bordini, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Briefly review prostate MRI protocols and understand its anatomy and relationships on male pelvis. Describe the clinical and imaging features of typical prostate lesions Expand the differential diagnosis of unusual prostate carcinomas subtypes correlated with imaging pearls and histopathology correlation

TABLE OF CONTENTS/OUTLINE

Briefly review prostate anatomy and its relationships on male pelvis Briefly review the MRI protocol used in our institution Clinical and epidemiologic data of usual and unusual prostate lesions A pictorial review with histopathologic correlation Epithelial tumors Adenocarcinoma (acinar) Carcinoma with spindle cell differentiation Ductal adenocarcinoma Uroepithelial carcinoma Squamous cell carcinoma Basal cells tumors 2. Hematolymphoid Lymphoma Leukemia 3. Stromal Tumors Stromal tumor of uncertain malignat potential (STUMP) Stromal sarcoma 4. Mesenchymal tumors Leiomyosarcoma Rhabdomyosarcoma Angiosarcoma Malignant fibrous histiocytoma Hemangiopericytoma Malignant peripheral nerve sheats 5. Miscellaneous tumors 6. Benign lesions

VI128-ED-SUA7

US-Guided Localization and Removal of Soft-Tissue Foreign Bodies: How We Do It

Sunday, Dec. 1 12:30PM - 1:00PM Room: VI Community, Learning Center Station #7

Awards
Identified for RadioGraphics

Participants
Itziar Aza, MD, Bilbao , Spain (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Describe the sonographic findings of different soft-tissue foreign bodies (FB). Describe the technique for US-guided removal. Report a case series of different kind of FB removed with US-guidance.

TABLE OF CONTENTS/OUTLINE

Soft-tissue foreign bodies (FB) are a common reason for medical consultation. Since they can cause acute or late complications such as infection, allergic or inflammatory reaction, detection and removal of FB are necessary. US helps identifying FB regardless of their composition. FB are echogenic independently of their composition, therefore always visible on US. Signs like surrounding hypoecoic rim, posterior acoustic shadowing and reverberation also help in the localization of the FB. Surgical extraction is challenging and frequently fails. It can be helped by US-guided placement of a metallic harpoon to facilitate location of the FB. FB can be also successfully removed using US-guidance. Removal is performed with local anesthesia, making a small incision in the skin through which surgical forceps are inserted and US-guided untill the FB. US-guided FB removal has lower risk of complications, it is inexpensive and it does not rule out surgical removal in case of failure. FB removed up untill now include contraceptive implants, glass, metal and wooden splinters, catheter tips, fishbones, needles and wires.

VI129-ED-SUA8

When There is No Rectum: CT-Guided Targeted and Sextant Prostate Biopsy

Sunday, Dec. 1 12:30PM - 1:00PM Room: VI Community, Learning Center Station #8

Participants
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TEACHING POINTS

Elevated PSA occurs not infrequently in men who have had proctocolectomy and poses a diagnostic challenge. Radiologists, experts in image-guided biopsy, are well equipped to perform this minimally invasive procedure on men without rectal access to the prostate.

TABLE OF CONTENTS/OUTLINE

Existing data/frequency of the problem Description of the CT prostate sextant biopsy technique (bilateral vs.unilateral approach) How to target a lesion seen on multiparametric prostate MRI Brief review of our own institutional data Selected case-based presentation to highlight biopsy concepts, pathology results.

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VI200-SD-SUA1

Assessment of Semiquantitative Parameters of Dynamic Contrast-Enhanced Perfusion MR Imaging in Predicting the Nonperfused Volume Ratio of at Least 80%: High-Intensity Focused Ultrasound Ablation of Uterine Fibroids

Sunday, Dec. 1 12:30PM - 1:00PM Room: VI Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To investigate the role of semiquantitative T1 perfusion parameters in predicting the uterine fibroid treatment outcome of magnetic resonance-guided high-intensity focused ultrasound (MRgHIFU) ablation with an immediate nonperfused volume (NPV) ratio of at least 80%.

METHOD AND MATERIALS

This study protocol was designed as a prospective study. 90 women (mean age, 39.9±5.5 years with a range of 22-53 years) underwent volumetric MRgHIFU ablation during a period of 15 months beginning June 2015 were divided into two groups: group 1 (n = 56, NPV ratio of at least 80%) and group 2 (n = 34, NPV ratio less than 80%). The software automatically generated time-SI curves and then calculated the semiquantitative perfusion parameters of each region of interest of uterine fibroids on perfusion axial MR imaging data. The receiver operating characteristic (ROC) curve was further analyzed to determine the area under the curve (AUC) of each semiquantitative parameter.

RESULTS

The mean NPV ratio for groups I and II was 96.1% ±5.8 (80-100 %) and 50.7% ±26.9 (4.3-79.7%), respectively. The semiquantitative perfusion parameters were significantly different in both groups. The ROC curve analyses revealed that the AUC for relative enhancement, maximum enhancement, maximum relative enhancement, time to peak, wash-in rate and the area under the time-signal intensity curve of uterine fibroids for predicting the immediate NPV ratio of at least 80% was 0.746, 0.851, 0.777, 0.204, 0.911 and 0.720, respectively.

CONCLUSION

Our findings revealed that semi-quantitative perfusion parameters were effective factors in predicting the NPV ratio of at least 80%. Wash-in rate parameter was the highest AUC in predicting the treatment success defined as NPV ratio of at least 80%.

CLINICAL RELEVANCE/APPLICATION

MRgHIFU ablation for uterine fibroids is a noninvasive therapeutic treatment to preserve the uterus. The achievement of NPV ratio of at least 80% in HIFU treatment of uterine fibroids based on significant semi-quantitative perfusion parameters as a measure of technical success appears to be clinically possible without sacrificing the safety.

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VI202-SD-SUA3

Magnetic Resonance Angiography Derived Predictors of Aortic Root Dilation in Marfan Syndrome

Sunday, Dec. 1 12:30PM - 1:00PM Room: VI Community, Learning Center Station #3

Participants
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Peter Bannas, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To identify predictors of aortic root dilation derived from magnetic resonance angiography (MR-angiography) in patients with Marfan syndrome.

METHOD AND MATERIALS

Material and Methods: We retrospectively included 160 Marfan patients (average age: 33 ± 17 years; 64 male) with a total of 496 MR-angiographies who underwent a median of four MR-angiographies (range: 2-11) in annual intervals. Based on the absolute diameter, age and body surface we calculated Z-scores for each patient. Aortic root morphology was subdivided into three different types: 1: no dilatation, 2: localized anulo-aortic dilatation, 3: generalized aortic root dilatation. Aortic root morphology, age, as well as baseline diameter and Z-score were tested for prediction of aortic root dilatation using a random-coefficient model.

RESULTS

40/160 patients (25%) had normal aortic root diameters, 75/160 patients (47%) had a localized anulo-aortic dilatation, and 45/160 patients (28%) had a generalized aortic root dilatation. Average growth of the aortic root for all patients was 0.6 ± 0.3 mm/y (Z-score: 0.06 ± 0.01/y). Both baseline diameter and Z-score were predictors for rapid growth: a higher diameter or Z-score indicated a faster growth of the aortic root (both $p<0.001$) . Age was a predictor for the increase of absolute aortic root diameters: younger patients showed a faster diameter growth than older patients ($p<0.001$). However, age was no significant predictor with regard to Z-scores ($p=0.2$), taking into account ongoing body growth in younger patients. Different aortic root morphologies (normal vs. localized vs. generalized dilatation) did not predict growth of the aortic root (diameter: $p=0.8$; Z-score: $p=0.5$).

CONCLUSION

Age and type of aortic root morphology do not predict aortic growth, while a larger baseline aortic root diameter predicts progressive aortic root dilatation in Marfan patients.

CLINICAL RELEVANCE/APPLICATION

Aortic root diameter is a predictor for rapid growth and may allow to improve the risk stratification in Marfan patients: patients with smaller aortic diameters could be screened less frequently.

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VI238-SD-SUA4

Percutaneous Laser Ablation under Ultrasound-Guidance of Normal Thyroid Gland in a Swine Model

Sunday, Dec. 1 12:30PM - 1:00PM Room: VI Community, Learning Center Station #4

Participants
Fourat Ridouani, MD, New York, NY (*Presenter*) Nothing to Disclose
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Juan C. Camacho, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, El.en.

PURPOSE

The aim of this study was to evaluate the safety and feasibility of percutaneous ultrasound-guided ablation using a laser source applicator, as well as to provide insights about the correlation between energy parameters and ablation margin of normal thyroid tissue of a swine model

METHOD AND MATERIALS

An interstitial thyroid laser application (Echolaser X4, Nd: YAG 1064nm) was performed on 8 pigs under ultrasound guidance (US). Computed tomography (CT) was used before and after procedure to assess the ablation zone and any adverse events. Hydrodissection with saline was performed before the procedure to protect the trachea and the surrounding vascular structures.Under US guidance, a 21-gauge needle was inserted into the thyroid gland. The distal tip of the fiber was then placed in the middle of the gland. For 4 animals, ablation was applied at 3 W and 1400 J and for the other 4 at 3 W and 1800 J. Histological evaluation was obtained after the procedure on necroscopy tissue.

RESULTS

There were no technical limitations to the performance of the procedure and no major complications were recorded. The mean volume of the thyroid gland was 3±2 mL. The mean volume of ablation tissue measured on gross pathologic images was 0.58±0.05 mL at a laser power of 3 W and 1400 J and closely matched measurements from CT. Thermal damage on collagen was observed in all animals on histological examination. Results are still pending for the second group whose ablation energy was 3 W and 1800 J.

CONCLUSION

PLA of thyroid gland is safe and feasible in a swine model. Moreover, PLA induces well-defined tissue ablation correlated with energy parameters in normal thyroid tissue.

CLINICAL RELEVANCE/APPLICATION

Patients with Papillary Thyroid Microcarcinoma (PTMC) opting for therapeutic intervention rather than active surveillance can be considered for PLA. Given the small size of these tumors (<= 10 mm), a balance between the optimal ablation margins and the risks of thermal damage to the thyroid and surrounding structures is important. Therefore, this animal study provides insights on correlation between the energy parameters and the ablation zone.

VI239-SD-SUA5

Hepatic Pseudoaneurysm Formation After Blunt and Penetrating Traumatic Liver Injury: A Level 1 Trauma Center Experience

Sunday, Dec. 1 12:30PM - 1:00PM Room: VI Community, Learning Center Station #5

Participants
Neeral R. Patel, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose
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Amandeep Sandhu, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

At our institution, we have developed an imaging protocol for liver injury patients which involves repeat computed tomographic (CT) angiography of the liver at 48-72 hours to assess specifically for HPAs. The purpose of this study was to evaluate the utility of our imaging pathway in liver trauma with a focus on detection of hepatic pseudoaneurysms (HPAs).

METHOD AND MATERIALS

A retrospective analysis was performed on patients who were admitted to St Mary's Hospital, London over a four-year period found to have either blunt or penetrating liver injury on initial CT imagining. Data collection included initial and follow-up CT findings, mechanism of injury, injury severity score (ISS), American Association for the Surgery of Trauma (AAST) liver injury score and further intervention.

RESULTS

Between January 2014 and January 2018, 149 major trauma patients were admitted with liver injuries (mean age 35.6 years; 72% male, 28% female). 72% patients suffered blunt (mean ISS=27.2; mean AAST=2.89) and 28% patients suffered penetrating injuries (mean ISS=26.9; mean AAST=2.88). Mean time to follow up CT was 46.05 hours. Follow-up CT identified 8 HPAs (62.5% blunt vs 37.5% penetrating injuries) and 1 (0.671%) arteriovenous malformation. 6 (4.03%) of these patients were treated with embolisation. ISS and AAST did not predict pseudoaneurysm formation according to logistic regression analysis. ISS (OR 1.06 [1.02, 1.09; p=0.002]) and AAST (OR 2.24, [1.31, 3.83; p=0.003]) were predictors of requirement for embolisation.

CONCLUSION

Our experience indicates a role for early detection of HPAs using a dedicated trauma imaging pathway. Interestingly, ISS and AAST are predictors for patients who will undergo interventional radiology procedures and could be used to stratify patients who should be planned for interventional procedures.

CLINICAL RELEVANCE/APPLICATION

Hepatic pseudoaneurysm (HPA) is a rare but potentially life-threatening sequelae of blunt or penetrating liver trauma.

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VI240-SD-SUA6

Ablation Therapy of Non-Colorectal Cancer Lung Metastases: Retrospective Analysis of Tumor Response Post-Radiofrequency Ablation (RFA) and Microwave Ablation (MWA)

Sunday, Dec. 1 12:30PM - 1:00PM Room: VI Community, Learning Center Station #6

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PURPOSE

To retrospectively compare the local tumour response and survival rates in patients with non-colorectal cancer lung metastases post-ablation using radiofrequency ablation (RFA) and microwave ablation (MWA).

METHOD AND MATERIALS

Retrospective analysis of 153 computed tomography (CT)-guided ablation sessions performed on 92 patients (38 males and 54 females, mean age: 56.6 years). 29 patients with 49 lesions underwent RFA (tumour size: 0.8-4.5?cm) and 63 patients with 104 lesions underwent MWA treatment (tumour size: 0.6-5?cm). CT scans were performed 24-h post-therapy and on follow-up at 3, 6, 12, 18 and 24 months.

RESULTS

The overall-survival rates at 1-, 2-, 3- and 4-year were 81.5, 50.0, 45.5 and 24.2% for patients treated with RFA and 97.6, 79.9, 62.3 and 45.4% for patients treated with MWA, respectively. The mean survival time was 34.14 months for MWA and 34.79 months for RFA. In paired comparison, a significant difference could be detected between MWA versus RFA (p?=?0.032). The progression-free survival showed a median of 23.49?±?0.62 months for MWA and 16.66?±?0.66 months for RFA (p?=?0.048). The lowest recurrence rate was detected in lesions ablated with MWA (7.7%; 8 of 104 lesions) followed by RFA (20.4%; 10 of 49 lesions) p value of 0.012. Pneumothorax was detected in 22.16% of MWA ablations and 14.23% of RFA ablations.

CONCLUSION

RFA and MWA may provide an effective therapeutic option for non-colorectal cancer lung metastases with an advantage for MWA regarding local tumour control and progression-free survival rate.

CLINICAL RELEVANCE/APPLICATION

RFA and MWA have a therapeutic potential for local tumor control and progrssion free surival rates in patients with lung metastases.

AI003-EC-SUB

Content-Based Image Retrieval for Searching Similar Chest CT with Diffuse Interstitial Lung Disease and Chronic Obstructive Lung Disease with Quantitative and CNN Features

Sunday, Dec. 1 1:00PM - 1:30PM Room: AI Community, Learning Center Custom Application Computer Demonstration

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Conclusion

We developed CBIR system for searching similar chest CT with DILD and COPD with reasonable accuracy, which could be useful in real clinical application.

Background

Chronic obstructive pulmonary disease (COPD) and diffuse interstitial lung disease (DILD) is becoming more important due to its persistently increasing prevalence, mortality, and disease burden in society. CT is commonly used for the assessment of various kinds of disease patterns such as normal, ground-glass opacity, reticular opacity, emphysema, consolidation and honeycomb which is an important tool for the measurement of disease extent and distribution. Furthermore, parenchymal, airway and vascular changes in COPD can be quantitative assessed with CT. Comparison of confirmed cases with similar CT pattern may be helpful in clinical practice, particularly for unusual cases. However, in practice, the retrieval of the cases with similar CT pattern is based on the memory of radiologists, and the current visual inspection can take too much time and effort.

Evaluation

We have developed fully-automated content-based image retrieval (CBIR) system by incorporating deep convolutional neural nets based image pattern classification for DILD CT. In addition, quantification methodologies such as lung densitometry, analysis of LAA cluster sizes, airway wall thickness, air-trapping calculated by registration of inspiration / expiration CT and assessment of vasculatures have been proposed. Our CBIR system achieves robust and efficient retrieval of similar diseased cases. The clinical similarity of searched images was evaluated by expert radiologists. In addition, rate of retrieving same patients' images which were obtained within one year and stability of the disease were confirmed by radiologist was assessed. For DILD and COPD, qualitative assessment showed good performance with average grade of 3.88 ± 0.96 and 2.84 ± 0.53 by 5-scale grading system, respectively. The rates of retrieving same patient's image were 76.7% and 81.7% for DILD, and 60.0% and 68.0% for COPD, respectively, when 3 and 5 cases were retrieved for each case.

Discussion

Visual scoring and retrieval rate of same patient's CT scan shows the reasonable accuracies of CBIR system

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AI209-SD-SUB3

Repeatability of Machine Learning Classification of Prostate Cancer Using Diffusion Weighted Imaging: Short-Term Repeatability Study of 112 Men Who Underwent Two Prostate MR Examinations Before Prostatectomy

Sunday, Dec. 1 1:00PM - 1:30PM Room: AI Community, Learning Center Station #3

Participants
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PURPOSE

Machine learning (ML) methods are increasingly being used in prostate MRI quantification. However, evaluation of short-term repeatability of these methods have not been performed.

METHOD AND MATERIALS

In total, 112 patients with diagnosed PCa scheduled for prostatectomy underwent 2 prostate MR examinations at different time points (T1 and T2) on the same day. Diffusion weighted imaging (DWI) was performed using 12 b-values (0-2000 s/mm2) and cancer areas were annotated by radiologist and pathologist working in consensus using whole mounts prostatectomy sections as reference. DWI data were fitted using monoexponential function, ADCm were obtained on voxel level. The data from each time point (T1 and T2) was randomly divided into training set , N = 78, (Train1 and Train2) and test set N = 34, (Test1 and Test2). Regularized least squares fitting was trained on Train1 and Train2, respectively, to distinguish between Gleason Grade Groups (GGG) 1 vs GGG>1 using the same parameters. In total, 392 features (edge detectors, Gabor filter, 2D contour feature) were used. Six (2%) features with best repeatability from their feature families were selected. The trained models were tested on Test1 and Test2 and the accuracy was evaluated using ROC AUC. Test-retest stability was evaluated using intraclass correlation coefficient ICC(3,1).

RESULTS

ICC(3,1) and AUC values for T1 and T2 time points with machine learning on Test1 and Test2 were, ICC 0.683 (95% CI: 0.678-0.687), 0.895 (99% CI: 0.877-0.928), 0.802 (99% CI: 0.779-0.854), respectively.

CONCLUSION

Regularized least squares fitting using radiomics based texture methods of prostate DWI fitted using monoexponential function were found to be moderately repeatable in test-retest scans obtained on the same day. The classification performance was good but changed between test and retest sessions.

CLINICAL RELEVANCE/APPLICATION

Radiomics and corresponding performance measurements using prostate DWI for predicting prostate cancer Gleason Grade Group need to be assessed with caution due to variability from scanning events.

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AI217-SD-SUB1

Fully Automatic Deep-Learning System to Select L3 Slice and Measure Abdominal Muscle Area on CT

Sunday, Dec. 1 1:00PM - 1:30PM Room: AI Community, Learning Center Station #1

Participants
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PURPOSE

The sarcopenia researches have been expanding rapidly. The case numbers requiring abdominal muscle measurement in each research have also been rapidly increasing, requiring human resources and time. One of the big hurdles to automate such measurement process is to select L3 vertebrae level. We aim to develop and validate a fully automatic system to select L3 level and measure muscle mass.

METHOD AND MATERIALS

A residual learning-based deep learning model (DLM) was developed by supervised learning from a training data set (500 CT scans). A residual network with 50 layers was adopted for developing deep learning system. A radiologist provided L3 slice level as the ground truth. The developed DLM automatically spotted the CT slice of L3 inferior endplate level. In the validation data set (n=500), validation was done at 496 CT scans after excluding four patient CT scans who underwent lumbar interbody fusion surgery. The difference in millimeter between the ground truth and DLM-derived CT slice was calculated by multiplying slice thickness and the difference of CT slice number between the ground truth and DLM-derived CT slice. Technical success was evaluated based on 10 mm cut-off value in the slice difference. Subgroup analysis was performed according to the vertebral anatomic variation.

RESULTS

The mean differences between ground truth and DLM-derived slice were 3.6 mm ± 8.3 in whole validation set (n=496), 2.5 mm ± 6.1 in subgroup with normal anatomy (n=438), and 12.1 mm ± 15.1 in subgroup with anatomic variation (n=58). Technical success rates were 93.3% (463/496) in whole validation set, 96.3% (422/438) in subgroup with normal anatomy, and 67.2% (39/58) in subgroup with anatomic variation.

CONCLUSION

The residual network-based DLM system exhibited a high performance in the automatic selection of L3 inferior endplate level, which enables fully automated measurement of abdominal muscle area on CT.

CLINICAL RELEVANCE/APPLICATION

Fully-automatic L3 level spotting system can be used to identify optimal CT slice for body composition segmentation in a consistent manner.

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AI261-SD-SUB2

Getting AI Ready for Deployment: Tuning Algorithms to Specific Sites Using a Single Chest X-Ray Image

Sunday, Dec. 1 1:00PM - 1:30PM Room: AI Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Lack of generalisation of deep neural networks, due to equipment and geographic variability, is a known problem facing the radiology community today. We propose a novel method to get algorithms 'deployment ready' by using a single reference Chest X-Ray(CXR) image from a potential deployment site, with the intention of automatically reading all 'normal' CXRs.

METHOD AND MATERIALS

A deep learning model based on DenseNet-121 (M1) was trained on ~250,000 CXRs from Chexpert Dataset and ~50,000 CXRs from NIH CXR14 dataset to predict a 'normal' or 'abnormal' label. The model was evaluated on 3 datasets - E1(n=3587), E2(n=200) and E3(n=212). E1 and E3 were 2 separate datasets obtained from 3 outpatient imaging centres and 3 hospital imaging departments. E2 is Chexpert validation dataset. M2, a Siamese variation of M1 uses a reference image (to capture site / scanner specific variation) for every site and was evaluated on E1, E2 and E3. A comparison between specificity of M1 and M2 was done by choosing a definite sensitivity threshold (97%) to determine their capability to correctly identify normal CXRs.

RESULTS

Area Under Receiver Operator Curve (AUROC) increased from 0.92, 0.87 and 0.84 on M1 to 0.95, 0.89 and 0.89 for M2 for E1, E2 and E3 respectively. At 97% sensitivity, M1 had a specificity of 0.41, 0.29 and 0.02 on E1, E2 and E3 respectively, which, after tuning M1 with a single reference image (M2), increased to 0.63, 0.29, 0.45.

CONCLUSION

Our results indicate that deep learning models can be generalised across equipment, institutions and countries by simply using a single reference image to tune the functioning of the model, hence showing potential to improve the functioning of deep learning algorithms in general. In this case, we observe drastic improvement in results of a model that distinguishes normal from abnormal images with a high degree of confidence.

CLINICAL RELEVANCE/APPLICATION

More than 50% of all CXRs done across the world are reported as 'normal'. We demonstrate a novel method where a single algorithm can be deployed across sites to automate reading of normal CXRs while having high sensitivity saving radiologists' time and improving speed of reporting.

BR193-ED-SUB6

Beyond BI RADS: Non-Mass Lesions (NMLs) on Breast Ultrasonography -Concept and Clinical Relevance

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #6

Awards
Certificate of Merit

Participants
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TEACHING POINTS

The purpose of this exhibit is: To conceptualize NMLs. To recognize and illustrate the main etiological causes of NMLs. To review the features to describe NMLs on breast ultrasound. To understand most important predictors of malignancy. To correlate NMLs with other breast imaging methods (mammography and MRI) To discuss practical clinical management and follow up.

TABLE OF CONTENTS/OUTLINE

ULTRASOUND CRITERIA FOR NMLs. ETIOLOGY OF NMLs: physiological, benign (Fibrocystic change, gynecomastia, adenosis, diabetic mastophaty, PASH, papillomatosis, atypical hyperplasia and post-surgical changes), inflammatory (mastitis) and malignant changes (DCIS, inflammatory carcinoma, pleomorphic lobular carcinoma, lymphoma, leucemia, IDC with extensive DCIS). IMAGING FEATURES AND PREDICTORS OF MALIGNANCY - (MORFOLOGY): hypoechoic area (indistint, mottled and geographic), ductal changes (dilatation, wall thickening, irregularity of the caliber, internal echoes or tiny cysts and ductal stacking), a multiple vesicular pattern (small cysts), focal shadowing. (DISTRIBUTION): focal, linear, segmental or regional. ADDITIONAL FINDINGS AND OTHER METHODS: Mammography (calcifications, asymmetry, architectural) and MRI (mass and non-mass enhancement). CLINICAL CASES WITH PRACTICAL GUIDELINE FOR INTERPRETATION AND FOLLOW UP

BR194-ED-SUB7

Radiological Findings After Breast Lipofilling: What Radiologists Need to Know

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #7

Awards
Cum Laude

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TEACHING POINTS

To describe the radiological appearance of normal and pathological findings resulting from mammary autologous fat injections. To describe the indications and technique of breast remodeling with autologous fat. To analyze the safety of the use of lipofilling in patients with previous diagnosis of breast cancer.

TABLE OF CONTENTS/OUTLINE

Introduction Background and History Indications and Patient Selection Description of the surgical technique Role of imaging after breast lipomodelling Remodelling of the mammary volume after conservative treatment of breast cancers, clinical and radiological considerations Appearance: mammographic, ultrasonography and magnetic resonance imaging Clinical cases Follow up Conclusion: This technique is best performed with a multidisciplinary team: it is key for the radiologist to be familiar with the technique and to recognise radiological features of the breast after lipofilling.

BR195-ED-SUB8

Missteps in Mammography and Approaches to Avoid Them

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #8

Participants
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TEACHING POINTS

1. Importance of direct comparison of all prior imaging in determining the significance of a finding (new versus stable) 2. Significance of reviewing breast tissue across all available modalities, including non-breast dedicated studies 3. Correct localization of lesions using triangulation techniques 4. Necessity of complete and accurate documentation to ensure appropriate patient follow-up (biopsy versus watchful waiting) 5. Case-based review of potential missteps including inaccurate localization of lesions, lack of trending findings across prior examinations including non-breast dedicated studies (e.g. PET/CT), and inappropriate follow-up of breast lesions

TABLE OF CONTENTS/OUTLINE

• Breast findings suggestive of malignancy on cross-sectional imaging • Breast lesion localization techniques, including the use of the digital breast tomosynthesis scroll bar • Interpretation strategies including looking for new/growing masses, areas of asymmetry, and subtle architectural distortion • Effective strategies to communicate mammogram results to referring healthcare providers and patients • Case based review of breast findings including findings on non-dedicated breast examinations and changes across sequential mammograms

BR196-ED-SUB9

Everything but BRCA: Imaging Hereditary Breast Cancer Genes

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #9

Awards
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TEACHING POINTS

Discuss the gene mutations associated with breast cancer outside of BRCA Review the current literature about the genetics and molecular biology that increases the risk of breast cancer in these gene mutations Understand the multimodality imaging approach to evaluation of hereditary breast cancer genetic mutations Explain the lifetime risk and breast imaging screening recommendations Recognize the differences in treatment and management in genetically driven breast cancers

TABLE OF CONTENTS/OUTLINE

Overview of genetics and molecular biology of the common hereditary breast cancer genes Screening recommendations Imaging cases and specific considerations ATM BARD1 BRIP1 CDH1 CHEK2 MLH1/MSH6 NBN NF1 PALB2 PTEN STK11 TP55 Treatment and management considerations

Printed on: 10/29/20

BR221-SD-SUB1

Combined Use of Automated Volumetric Analysis of Breast Cancer Vascularization, Machine Learning and MRI: A Perfect Trio to Predict Survival Outcome in Breast Cancer Patients?

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #1

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Matthias S. May, MD, Erlangen, Germany (*Presenter*) Speakers Bureau, Siemens AG

PURPOSE

To investigate whether combined use of automated volumetric analysis of breast cancer vascularization (VAV), machine learning (ML) and MRI (1) improves survival prediction in breast cancer patients and hereby (2) provides actionable information.

METHOD AND MATERIALS

Within this retrospective, IRB-approved study, 314 consecutive patients with primary invasive breast cancer received standard MRI (14 minutes) before the initiation of treatment. Diagnostic work-up, treatment, and follow-up was done at one tertiary care, academic breast-center (disease specific survival/DSS=279; death from breast cancer=35). The Nottingham Prognostic Index (NPI) was used as the reference method with which to predict survival of breast cancer. Based on the raw MRI enhancement data, automated analysis of VAV was accomplished by commercially available, FDA-cleared software. Based on VAV, ML was used to identify PHENOTYPES that provided a specificity >99% for DSS (classification and regression trees). Results of ML were 10-fold cross-validated. Predictions of survival based on PHENOTYPES NPI PHENOTYPES plus the NPI in combination (NPI+) were investigated (Cox-regression and Kaplan-Meier statistics).

RESULTS

In 42.7% (134/314) of the patients ML identified PHENOTYPES. If a PHENOTYPE was present, occurrence of disease related death could be practically ruled out in this patient. 21.6 % (29/134) of these patients showing a PHENOTYPE, would have been falsely predicted by NPI as at-risk for disease-specific death. Inclusion of PHENOTYPES into the NPI significantly improved the prediction of survival by 31.5% (29/92). This gave a hazard ratio/HR of 8.5 for NPI+ compared to the standard NPI (HRNPI = 5.4; P=0.03). The improvement of prediction of survival by breast MRI was verified for all molecular subtypes.

CONCLUSION

Combined use of automated ML, VAV and MRI improved the survival prediction in breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

The proposed method provides PHENOTYPES suggestive of a favorable outcome: These actionable information could be applied in the management of breast cancer. First of all they can be used as a 'Gatekeeper', in order to decide whether a more aggressive therapy (chemotherapy) is actually warranted. Another application is the combination with further prognostic data (genetic analysis, pathology etc.). This creates synergistic effects and further optimizes outcome prediction.

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BR225-SD-SUB2

Mammographic Mean Glandular Dose in the Implant Displaced View: Proceed with Caution

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #2

Participants
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Hannah Gilroy, Wellington, New Zealand (*Abstract Co-Author*) Employee, Volpara Health Technologies Limited
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PURPOSE

The potential for relatively high mean glandular dose (MGD) for women with breast implants compared to women without is well known in digital mammography (DM). Exams may include up to 8 routine views; 4 implant displaced (ID), and 4 with the implant in full view (IF). Given an increasing fraction of the screening population with breast implants, and a question of whether to apply breast tomosynthesis, conventional mammography, or both for these women, the topic of radiation dose is timely for this sub-population. While other researchers have reported that IF view MGD can be higher than in conventional views (CV), the ID view MGD has received little attention. Here we study ID view MGD in clinical practice.

METHOD AND MATERIALS

In a retrospective survey of 70 North American and Australasian sites, DM exam data from 155,000 women with implants and 310,000 women without were reviewed. Images represent four vendors (Fuji, Siemens, Hologic, and GE) and six machine types. The CV and ID view MGD was calculated using Volpara software, which applies the Dance model with a glandularity factor determined according to patient volumetric breast density. Since compressed breast thickness (CBT) has a large influence on MGD, each ID view was matched to a CV view on CBT to within 1 mm. The CV and ID views were grouped into CBT categories for statistical comparison.

RESULTS

A total of 120,474 CV and ID view pairs were included for analysis. For some vendor systems, ID view MGD was significantly greater than CV MGD, and especially at low CBT. Sampling ID views with high doses revealed two main causes; (1) inappropriate manual technique factor selection, and (2) use of automatic exposure control when the implant was partially in view. As such, local exposure practices and machine-specific exposure control features are believed to influence the relative differences between CV and ID view MGD, and will be the topic of future work.

CONCLUSION

In routine clinical practice the MGD of ID views is often higher than the CV MGD for women without implants. Care should be taken when acquiring ID views as inappropriate technique factor selection and implant/breast positioning can have substantial implications for patient MGD.

CLINICAL RELEVANCE/APPLICATION

We demonstrate that implant displaced view dose is frequently high at low compressed breast thickness. Caution when imaging women with breast implants is recommended to avoid unnecessary exposure.

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BR226-SD-SUB3

Assessment of Perfusion Parameters and Enhancing Characteristics of Breast Cancer on Dynamic Contrast Enhanced Magnetic Resonance Imaging (DCE-MRI)

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate the value of dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) parameters as an imaging biomarker for predicting angiogenesis in the breast cancer.

METHOD AND MATERIALS

A total of 102 invasive ductal carcinomas (IDCs) in 102 women who underwent preoperative breast DCE-MRI on a 3T scanner were enrolled in this study. Twenty-fifth, 50th, 75th percentile and coefficient of variation (CV) of each perfusion parameter (Ktrans, Kep, Ve and Vp) were calculated within each tumor. Tumor size, shape, margin, internal enhancement and background parenchymal enhancement (BPE) were assessed based on breast imaging reporting and data system (BI-RADS) 5th edition. We evaluated the kinetic features of the tumors including delayed enhancement and percent of curve peak using computer-aided detection (CAD) system. Presence of adjacent vessel sign and ipsilateral whole breast vascularity were also evaluated. The student's t-test or Mann-Whitney U test were used for comparison of two groups and ANOVA or Kruskal-Wallis test for multiple groups. Pearson or Spearman correlation analysis was performed for numerical variables.

RESULTS

Rim enhancing breast cancers showed lower Vpmedian, Vp75 and VpCV than non-rim enhancing tumors ($p<.05$). Tumors with washout kinetic pattern presented higher Ktrans25, Ktransmean, Ktransmedian, Ktrans75, Kep25, Kepmean, Kepmedian and Kep75 than tumors with persistent and plateau pattern ($p<.01$). The percent of curve peak of tumor showed moderate positive correlation with Ktrans25, Ktransmean, Ktransmedian and Ktrans75 ($r>.600$, $p=.000$). Tumors with positive adjacent vessel sign exhibited higher Kep25, Kepmean, Kepmedian and Kep75 than tumors with negative adjacent vessel sign ($p<.03$). On the other hand, tumor size, shape, margin, BPE and ipsilateral whole breast vascularity showed no significant correlation.

CONCLUSION

We identified enhancing features of breast cancer, regarded to reflect tumor angiogenesis, tend to have a better correlation with perfusion parameters than morphologic features do. Therefore, DCE-MRI perfusion parameters of breast cancer can be useful imaging biomarkers for prediction of tumor angiogenesis.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI may be used to anticipate the treatment response and their prognosis as they reflect the tumor angiogenesis which decides the tumor characteristics.

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BR259-SD-SUB4

In the National Mammography Database (NMD), BI-RADS 3 Lesions Are Suspicious in Women with a Personal History of Breast Cancer

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #4

Participants
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PURPOSE

Specific mammographic findings with <= 2% malignancy rate can be safely followed with imaging surveillance. However, this approach may not apply to women with a personal history of breast cancer (PHBC). This study assesses the cancer yield of BI-RADS 3 (BR3) assessments among women with personal history of breast cancer in the National Mammography Database (NMD).

METHOD AND MATERIALS

This retrospective cohort HIPAA-compliant study included all women recalled from screening mammography followed by BR3 assessment at additional evaluation from 2009 to 2018, from 471 NMD facilities. We included only the first BR3 occurrence, for women who underwent biopsy or >= 2-year imaging follow-up or downgrade to BI-RADS 1 or 2 with >= 1-year follow-up. PHBC was determined by patient-report, facility-provided indication, or history of biopsy proven malignancy in the NMD. PPV3 = number of cancers over biopsies performed. Cancer yield (CY) = number of breast cancers per the number of women.

RESULTS

Among 67,995 women with BR3 findings, 2087 (3.1%) women had PHBC (median age 65 yrs; range 32-90). For women with PHBC, overall biopsy rate of BR3 lesions was 26.1% (545/2087), yielding 339 cancers, PPV3 62.2%, CY 16.2% (339/2087; 95%CI 14.7 to 17.8%). 850 women with PHBC were downgraded to BI-RADS 1 or 2 at follow-up visits, and 38 (4.5%) of those underwent biopsy, yielding 25 (65.8%) cancers, CY 2.9%. In comparison, for 65,908 women without PHBC, overall biopsy rate was 10.06% yielding 885 cancers, PPV3 13.3%, CY 1.34%. 44,358 women without PHBC were downgraded to BI-RADS 1 or 2 at follow-up visits, 111 of which were malignant, CY 0.25% ($p<0.0001$ vs. those without PHBC, both comparisons).

CONCLUSION

In the NMD, overall cancer yield for BI-RADS 3 findings in women with PHBC was 16.2%, far exceeding the acceptable rate of 2% and far exceeding the observed 1.34% rate among women without PHBC ($p<0.0001$). PPV3 in this group was also significantly greater than in women without PHBC, at 62.2% vs. 13.3% ($p<0.0001$), respectively. Even among lesions downgraded to BI-RADS 1 or 2 at follow-up, malignancy rate exceeded 2% among women with PHBC.

CLINICAL RELEVANCE/APPLICATION

Imaging findings that would otherwise be considered BI-RADS 3 in average-risk women should generally prompt biopsy in woman with personal history of breast cancer.

BR260-SD-SUB5

Unenhanced Breast Cancer Screening with Diffusion Weighted MRI: Increased Image Quality and Lesion Visibility Using Synthetic b-Values

Sunday, Dec. 1 1:00PM - 1:30PM Room: BR Community, Learning Center Station #5

Participants
Hubert Bickel, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
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PURPOSE

High b-value images from diffusion weighted magnetic resonance imaging (DWI) should enable better unenhanced visibility of malignant breast tumors, but are prone to artifacts and prolonged measurement times. The purpose of this study was to evaluate, whether image quality and visibility of malignant breast lesions on can be increased by using synthetic b-values.

METHOD AND MATERIALS

For this IRB-approved, retrospective study, DWI images obtained at 3T from 52 patients with histopathologically verified malignant breast tumors were evaluated by 4 independent readers. From original acquisitions at b=50 and 850s/mm^2, synthetic images were calculated at b=1000, 1200, 1400, 1600, 1800 and 2000s/mm^2. Image quality and lesion visibility were rated using visual grading characteristics (1-5, 5 as the best score). Scores were compared using Friedman and post-hoc by pair-by-pair Wilcoxon signed rank tests. Reproducibility was evaluated using intra class correlation (ICC).

RESULTS

Synthetic images with b-values of 1400-1800s/mm^2 were given the best ratings for image quality (mean ranks 4.49-4.84), with mostly significant differences to the other b-values (p=<.001 to .069), while lesion visibility was rated best at b-values of 1200-1600s/mm^2 (mean ranks 4.65-5.37) with significant differences to the other b-values (p=<.001 to .049). Interreader agreement was moderate concerning image quality (ICC .50-.67) and high concerning lesion visibility (.70-.93).

CONCLUSION

Synthetically increased b-values provide increased image quality and lesion visibility of malignant breast tumors compared to images obtained at usual b-values, while avoiding the disadvantages of performing DWI at such high b-values.

CLINICAL RELEVANCE/APPLICATION

Synthetic b-valus increase the value of DWI for non-invasive and radiation-free breast evaluation and are one step towards optimizing DWI as a tool for unenhanced breast cancer screening.

CA004-EB-SUB

Strain Analysis: A Comparison of Tagging, DENSE, SENC and Feature Tracking

Sunday, Dec. 1 1:00PM - 1:30PM Room: CA Community, Learning Center Hardcopy Backboard

Participants
Pui Min Yap, MBBS, Hong Kong, Hong Kong (*Presenter*) Nothing to Disclose
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TEACHING POINTS

1. Understand the concepts of different CMR techniques in analyzing myocardial strain 2. Highlight the strengths and weaknesses of these CMR techniques 3. Review the literature on CMR strain utilization.

TABLE OF CONTENTS/OUTLINE

1. Introduction of myocardial strain 2. Explain the methodology of tagging, DENSE and SENC and Feature Tracking 3. Explore the significance of the techniques in heart diseases; Abstract: Myocardial strain is a direct measure of myocardial deformation, unlike the frequently utilized ejection fraction parameter. Strain has recently been included in clinical echocardiography guidelines and is increasingly quoted in radiology literature. This abstract aims to explain the concept of myocardial strain and strain rate as well as the different directions (eg. circumferential, radial, longitudinal directions) which are involved in calculations. Different strain acquisition methods using cardiac magnetic resonance (CMR) techniques, including tagging, displacement encoding with stimulated echoes (DENSE) and strain encoded imaging (SENC) will be discussed. Feature-tracking (FT) which utilizes a different concept of measuring strain by utilizing CMR cine images will also be discussed. The different FT approaches by vendors to measure strain will be explained and reviewed to provide readers a comprehensive understanding of this emerging tool.

CA157-ED-SUB6

Utility of Computed Tomography in the Evaluation of Transcatheter Mitral Valve Replacement

Sunday, Dec. 1 1:00PM - 1:30PM Room: CA Community, Learning Center Station #6

Awards
Cum Laude
Identified for RadioGraphics

Participants
Praveen Ranganath, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Transcatheter mitral valve replacement (TMVR) is a rapidly emerging interventional therapy for patients with severe mitral disease who are poor surgical candidates and ineligible for transcatheter valve repair. 1. To review the role of CT in the evaluation of TMVR 2. To evaluate the optimal CT protocol 3. To illustrate the important measurements & significance 4. To discuss common post-procedural complications

TABLE OF CONTENTS/OUTLINE

1. Mitral valve disease & treatment 2. TMVR- Rationale, indications, evidence 3. Device delivery principles 4. TMVR devices- e.g. CardiAQ-Edwards, Cardioband, Tendyne, etc 5. Role of echo 6. Role of CT in TMVR planning 7. CT protocol- Technique, contrast bolus 8. CT anatomy - mitral valve apparatus & annulus (D-shape/saddle) 9. Definition of mitral annulus plane 10. Annulus measurements-diameter, area, perimeter; trigone-trigone, septo-lateral distance, inter-commissural distances 11. Neo-LVOT-Definition and measurement 12. Measurements with virtual TMVR prosthesis- Neo-LVOT diameter & area; aortomitral angle; basal septal thickness 13. Fluoroscopic angles- Septo-lateral, compromise, en-face views 14. Fluoroscopic landmarks- Coronary sinus, LCX 15. Planning transapical approach 16. Post-procedural complications- neo-LVOT obstruction; leak; thrombosis; dislodgment

CA162-ED-SUB7

Non-Invasive Modalities to Detect Coronary Complications After Heart Transplant

Sunday, Dec. 1 1:00PM - 1:30PM Room: CA Community, Learning Center Station #7

Participants
Fay Nous, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose
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TEACHING POINTS

- To become familiar with the possible coronary complications in heart transplant recipients - Explain the concept of cardiac allograft vasculopathy (CAV) - Illustrate the role and potential of coronary CT and stress myocardial perfusion imaging with SPECT, PET or MRI in screening for CAV - Explain alterations in heart transplant patients that affect imaging acquisitions - Demonstrate finding of non-invasive cardiac imaging after coronary interventions in transplant patients

TABLE OF CONTENTS/OUTLINE

- Heart transplantation: short overview of indications, procedure, post-transplant follow-up and treatment as well as outcomes - CAV: classification, guidelines for routine screening - How to scan heart transplant recipients: tips and tricks for optimal acquisition, optimal patient preparation - CAV: role of calcium scoring, coronary CTA, CT-FFR, SPECT, PET and MRI. - Overview of potential coronary complications that can be seen on non-invasive imaging modalities after heart transplantation: CAV, fistula, complications after treatment - Coronary fistula: why do they occur, how to recognize fistula on CT, post treatment findings - Pathology outside the heart but inside the field of view of non-invasive cardiac imaging

CA203-SD-SUB1

Deep-Learning-Based Technology for Eliminating Gadolinium Contrast Agents in Myocardial Infarction MR Imaging

Sunday, Dec. 1 1:00PM - 1:30PM Room: CA Community, Learning Center Station #1

Participants
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PURPOSE

The potential toxicity of gadolinium contrast agents (CA) leads to the CA-based late gadolinium enhancement (LGE) imaging being inapplicable for myocardial infarction (MI) patients with renal impairment, but renal impairment is common in coronary artery disease. In this work, we developed a deep-learning (DL) method that synthesizes images comparable to the real-LGE image from corresponding non-enhanced cine MR images without CA, and validated this synthesized-LGE image to maintain the same diagnostic quality of real-LGE images.

METHOD AND MATERIALS

Dataset: All 280 patients (230 MI and 50 normal control) underwent short-axis cine MR and LGE imaging scans. Cine MR imaging was performed using a 3T MR system (25 phases). LGE imaging was performed ten minutes after the injection of CA (0.2 m mol/kg). Method: Both cine MR images and LGE image from the same patient were cropped (including the whole Left ventricle only) and co-registered. A new framework of DL technique, Generative Adversarial Net, was trained to learn a non-linear mapping from the cine MR images and LGE image. Training and independent validation ratio is 8/2. Evaluation: Three clinical validation (1. MI diagnosis, 2. MI localization (16-segment model) and 3. MI size (cm2)) were evaluated by three radiologists. The results of the real-CA images are the ground truth.

RESULTS

Clinical validation indicated that the synthesized-LGE images are comparable to real-LGE images. It achieved 1) 89% accuracy (256 of 280 subjects) when diagnosing whether the patient is with MI or not. 2) A sensitivity of 80.67% and specificity of 96.32% compared to manually locating the MI following the 16-segment model in real CA images. 3) A correlation coefficient of 0.94 and a corresponding bias (limits of agreement) of - 0.71 (0.97, -2.4) cm2 for the manual segmentation MI area between the synthetic and real images (P>0.05).

CONCLUSION

This paper reports for the first time, a DL-based CA-free imaging method that generates outputs comparable to traditional LGE imaging in real clinical diagnosis.

CLINICAL RELEVANCE/APPLICATION

DL technique would eliminate the need of CA and subsequently eliminate their associated health risks.

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CA204-SD-SUB2

Reproducibility of Cardiac Magnetic Resonance Imaging Methods in Patients With or Without Pacemakers and/or Implantable Cardioverter-Defibrillators in the CONCERT-HF Trial

Sunday, Dec. 1 1:00PM - 1:30PM Room: CA Community, Learning Center Station #2

Participants
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PURPOSE

CONCERT-HF is a trial currently conducted to evaluate the efficacy of cardiac and mesenchymal stem cell therapy for chronic ischemic cardiomyopathy. Many participants have implantable cardiac devices (PM/ICD), requiring adjustments in cardiac magnetic resonance (CMR) methods for endpoint assessment to avoid PM/ICD induced artifacts. The purpose of this study was to quantify the inter- and intra-reader reproducibility of the CMR techniques used in CONCERT-HF trial.

METHOD AND MATERIALS

In the CONCERT-HF trial, methods used to improve CMR image quality involved: image acquisition at total lung capacity, moving the cardiac device superiorly to increase the distance to the heart, using FGRE versus SSFP sequences, using wide-band late gadolinium enhancement sequence, and manual increase of pixel bandwidths. Images were analyzed by two readers and the intra- and inter-reader reproducibility was tested using the Concordance Correlation Coefficient (CCC) for those with PM/ICD and compared to those without PM/ICD.

RESULTS

The study included 30 participants from the CONCERT-HF trial (21 and 9 with and without PM/ICD, respectively). The mean age of participants with and without PM/ICD was 61.5(7.9) and 60.9(9.7); and 0 and 3(14.3%) were females, respectively. The CCC for CMR endpoints in patients without PM/ICD was high (0.6-0.99) except for inter-reader CCC for wall thickening (0.46) and longitudinal strain (0.43). The CCC of CMR endpoints in patients with PM/ICD was also high (0.71-0.99), except for inter-reader CCC for wall thickening (-0.01), longitudinal strain (0.51), and intra-reader value for wall thickening (0.47).

CONCLUSION

By implementing standardized CMR protocols with certain adjustments, rigorous technologist training, and continuous quality control by a core laboratory, the reproducibility of CMR endpoints in clinical trials of patients with PM/ICD is good to excellent, and comparable to patients without PM/ICD.

CLINICAL RELEVANCE/APPLICATION

These standardized CMR imaging methods can be used on patients with PM/ICD, alleviating safety concerns and metallic artifact associated with acquiring the images.

CA205-SD-SUB3

Instantaneous Wave-Free Ratio Derived from Dynamic Coronary CT Angiography with Dose Modulation: Influence of Plaque Characteristics on Coronary Hemodynamics

Sunday, Dec. 1 1:00PM - 1:30PM Room: CA Community, Learning Center Station #3

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PURPOSE

Coronary computed tomography angiography (CCTA)-verified positive remodeling and low attenuation plaques are considered morphological characteristics of high-risk plaque (HRP), which are independent predictors of acute coronary syndrome. However, the influence of HRP on coronary hemodynamics in vivo has not been elucidated. Instantaneous wave-free ratio (iFR) is coronary pressure ratio measured by pressure wire during invasive coronary angiography, which is based on linear correlation between coronary pressure and flow under diastolic blood pressure. We propose a CT-iFR from dynamic CCTA combined low dose and boost scan, and investigate the influence of HRP on coronary flow using CT-iFR.

METHOD AND MATERIALS

Data of 105 consecutive patients (mean age; 66 years-old) who had undergone whole heart dynamic scan with 320-row CT scanner for assessment of coronary artery disease was analyzed. Based on the maximum upslope and motion coherence analysis, the maximum enhancement rate of the ostial left coronary artery and the distal portion of left anterior descending artery (LAD) calculated from their time-density curves at mid-diastole for 10-15 cardiac cycle. CT-iFR was defined as the ratio of the latter to the former. Plaque characteristics and the severity of stenosis (moderate, 40-69% stenosis; severe, 70%> stenosis) at LAD were evaluated using the boost scan in CCTA data.

RESULTS

CT-iFR for arteries with HRP (n=21) was significantly lower than those for arteries with calcified plaque (n=39) and non-plaque (n=45) (0.71±0.17 vs. 0.94±0.20 vs. 0.93±0.21, $p<0.0001$). In moderate and severe stenotic arteries (n=33), CT-iFR for arteries with HRP (n=18) was significantly lower than that for arteries without HRP (n=15) (0.72±0.18 vs. 0.81±0.13, $p<0.05$). No difference in CT-iFR between moderate stenosis (n=21) and severe stenosis (n=12) was observed (0.77±0.18 vs. 0.74±0.13).

CONCLUSION

CT-iFR is associated with plaque characteristics. The presence of HRP reduces blood flow at the distal coronary arteries with intermediate stenosis, which may trigger an ischemic attack.

CLINICAL RELEVANCE/APPLICATION

CT-iFR brings new value of functional assessment of coronary arteries, and is a useful index for risk stratification of coronary artery disease and determination of revascularization.

CA240-SD-SUB4

Modification of Left Ventricle Myocardial Perfusion Reserve After the Implantation of Coronary Sinus Stent: A Stress-Rest CMR Study

Sunday, Dec. 1 1:00PM - 1:30PM Room: CA Community, Learning Center Station #4

Participants
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PURPOSE

The treatment of refractory angina is a clinical challenge. The implantation of a hourglass shaped stent (Reducer) in the coronary sinus showed to improve patient' symptoms, but objective data demonstrating the mechanism of action on myocardial perfusion reserve are lacking and discordant. Aim of the study was to evaluate the modification in myocardial perfusion reserve occurring after Reducer implantation through stress-rest CMR.

METHOD AND MATERIALS

15 patients eligible for implantation of the "Reducer" underwent 1.5 T CMR studies and clinical evaluation [Canadian Cardiovascular Society grading of angina pectoris (CCSA Class) and six minutes walking test (6minWT)] before and 3 months after Reducer implantation. CMR examinations included first-pass perfusion sequences acquired during pharmacological stress (Dypiridamole) and at rest, followed by LGE assessment. Segmental and global Myocardial Perfusion Reserve index (MPRi) was measured, also accounting for myocardial layer.

RESULTS

Thirteen out of 15 patients reported an improvement of >= 2 CCSA class ($p < 0.0001$) and a 60% increase in the average distance during the 6minWT ($p=0,004$). Stress-CMR demonstrated an improvement of myocardial perfusion reserve [ischemic burden per patient from 13% (IQR) to 10.88% (IQR), $p=0.0092$; median MPRI from 1.2 (0.9-1.5) to 1.3 (1.1-1.7), $p<0.0001$; number of segments with inducible perfusion defects (IPDs) from 92/240 (38%) to 69/240 (29%); $p<0.001$]. MPRI improvement was largely greater in more ischemic segments at baseline: segments with IPDs vs without IPDs (ΔMPRI: 0.432 vs 0.183; $p=0.0051$) and with baseline MPRI <1.3 vs ³1.3 (ΔMPRI: 0.355 vs -0.036, $p<0.001$). Moreover, MPRIimproved according with a transmural gradient from epicardium to endocardium (ΔMPRI 0.4057 vs 0.3156, $p=0.0282$).

CONCLUSION

Clinical benefit from CS Reducer implantation was associated with a significant improvement in myocardial perfusion reserve driven by the more ischemic segments, according to a transmural gradient.

CLINICAL RELEVANCE/APPLICATION

CMR provides a new insight in the effect of Reducer on myocardial perfusion, that could be useful for guide patient selection.

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CA241-SD-SUB5

Diagnostic Value of Stress Dynamic Myocardial CT Perfusion for Symptomatic Patients with Intermediate to High Risk of Coronary Artery Disease: Absolute Versus Relative Myocardial Blood Flow

Sunday, Dec. 1 1:00PM - 1:30PM Room: CA Community, Learning Center Station #5

Participants
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PURPOSE

To compare the diagnostic efficiency of absolute and relative myocardial blood flow (MBF) on dynamic myocardial CT perfusion (CTP) in detecting hemodynamically significant coronary artery disease (CAD) for intermediate- to high-risk symptomatic patients.

METHOD AND MATERIALS

Sixty consecutive symptomatic patients (43 men and 17 women; 61.38±8.01 years old) who met the criteria for intermediate to high CAD risk were prospectively recruited. All patients underwent adenosine triphosphate-stress dynamic myocardial CTP examinations using third-generation dual-source CT. Polar maps with data of the endocardial layer, based on the 17-segment American Heart Association (AHA) myocardial model, were used for ischemia evaluation. Absolute and relative parameters were generated and compared through a semiautomatic quantitative analysis of the MBF value. Invasive coronary angiography and fractional flow reserve (ICA/FFR) was used as the reference standard for myocardial ischemia. Areas under the receiver operating characteristic (ROC) curves and cutoff values were calculated and compared.

RESULTS

There were 151 vessels in 60 patients finally enrolled for analysis. The sensitivity, specificity, PPV, NPV and diagnostic accuracy for the absolute MBF value and relative MBF ratio were 82.76%, 98.92%, 97.96%, 90.20%, and 92.72% and 74.14%, 93.56%, 87.76%, 85.29%, and 86.09%, respectively. The absolute MBF value was better than the relative MBF ratio in detecting ischemia (AUC, 0.955 [95% CI: 0.919-0.990] vs. 0.906 [95% CI: 0.857-0.954]) (P=0.02). For territories with both sensitivity and specificity <=90%, the diagnostic accuracy increased from 79.1% to 88.4% when the specific data were assessed using the absolute MBF value instead of the relative MBF ratio.

CONCLUSION

A semiautomatic, quantitative assessment using the absolute MBF value from the endocardial myocardium on stress dynamic myocardial CTP showed superior diagnostic performance compared with the relative MBF ratio on the detection of myocardial ischemia for intermediate- to high-risk, symptomatic patients. The absolute MBF value provides an incremental benefit toward diagnostic performance compared with the relative MBF ratio evaluation.

CLINICAL RELEVANCE/APPLICATION

The optimization of absolute and relative MBF analysis for myocardial perfusion remains inconsistent. This study helps improving the diagnostic accuracy and standardization of the CTP technology.

CH215-ED-SUB7

Handbook of 3D Printing for Cardiothoracic Radiologists: The Ultimate Guide

Sunday, Dec. 1 1:00PM - 1:30PM Room: CH Community, Learning Center Station #7

Awards
Identified for RadioGraphics

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TEACHING POINTS

1. To review the principles of 3D printing, technical aspects, segmentation tools and fusion algorithms for 3D segmentation. 2. To review the up-to-date evidence and clinical applications in cardiothoracic imaging as well as the steps to initiate a 3D printing lab in the radiology department.

TABLE OF CONTENTS/OUTLINE

3D printing is referred to the generation of a physical 3D model based on acquired images, from CT and/or MRI. Its application in medicine has been growing exponentially, with multiple potential indications. Throughout the exhibit, the following learning points will be discussed and illustrated with real cases and pre-surgical models. We include CT and MR based segmentation as well as advanced imaging and hybrid 3D CT and MR models: 1. 3D printing: definition and basic concepts 2. Anatomy of the printing machine 3. Printing procedures and materials 3. CT acquisition and post - processing 4. MR acquisition and post - processing 5. Mesh archive post-processing: Improving the printing 7. 3D printing in the chest: surgical impact and applications. 8. 3D printing in the heart *8.1. Pediatric congenital heart disease 8.2. Aortic and vascular disease 8.3. Cardiac valves and percutaneous treatment. 8.4. Adult congenital heart disease. 8.5. Cardiac masses* 9. Tips and tricks: How to start a 3D printing lab 10. Conclusions

CH217-ED-SUB5

Thoracic Imaging Manifestations of Treated Lymphoma: Response Evaluation, Post-Therapeutic Sequelae and Complications

Sunday, Dec. 1 1:00PM - 1:30PM Room: CH Community, Learning Center Station #5

Participants
Justin Stowell, MD, Boston, MA (*Presenter*) Nothing to Disclose
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Carol C. Wu, MD, Houston, TX (*Abstract Co-Author*) Author, Reed Elsevier
Milena Petranovic, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Imaging has a central role in the diagnosis, staging, and response assessment for Hodgkin and non-Hodgkin lymphomas. 2. FDG-PET/CT is a key modality for management and determination of prognosis after treatment (response assessment, relapse/recurrence) using updated systems and assessment criteria for standardization of image interpretation and reporting. 3. Interim PET, although controversial, may stratify prognosis and inform de-escalation of treatment regimens to prevent toxicities. 4. Thoracic imagers should be aware of the manifestations of treated lymphoma, treatment complications and the role of imaging in surveillance of patients after treatment.

TABLE OF CONTENTS/OUTLINE

1. Modern treatments, associated imaging findings: a. Standard chemo, Rituximab b. Targeted agents, Immunotherapy (PD-1, CTLA-4) c. Radiotherapy d. Relapsed/refractory: High-dose chemo, autologous stem cell transplant 2. Timing of imaging a. Baseline PET/CT: define extent, FDG avidity b. Interim PET/CT (iPET) c. End-of-treatment PET/CT d. Unique thoracic manifestations of treated lymphoma (residual mass, calcified lymph nodes, thymic cysts, paramediastinal radiation fibrosis, bronchiectasis, radiation-associated sarcoma) 3. Post-treatment surveillance a. CT vs. PET/CT b. Adults vs. pediatrics c. Imaging signs of recurrent disease

CH218-ED-SUB6

Radiomics and Radiogenomics in Thoracic Imaging: Techniques and Clinical Applications

Sunday, Dec. 1 1:00PM - 1:30PM Room: CH Community, Learning Center Station #6

Awards
Certificate of Merit

Participants
Jose de Arimateia B. Araujo Filho, MD,PhD, Sao Paulo, NY (*Presenter*) Nothing to Disclose
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Rocio Perez Johnston, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

- Understand the definition and general concepts of textural analysis (TA), radiomics, radiogenomics and precision medicine - Comprehend the workflow process in performing TA, radiomics and radiogenomics - Recognize the most common difficulties and how to overcome them during the workflow process - Know the most relevant applications of TA on CT and MRI in thoracic imaging, including oncologic, non-oncologic, cardiac and functional imaging - Familiarization with the limitations and challenges prior to TA implementation into clinical routine

TABLE OF CONTENTS/OUTLINE

1. Radiomics and radiogenomics concepts in the era of precision medicine 2. Methodology of CT radiomics - Image acquisition - Segmentation: a practical guide - Feature extraction and selection - Quantitative data analysis and validation 3. Clinical application of radiomics in lung cancer - TA for tumor characterization - Prediction of postoperative lung function or postoperative morbidity 4. Radiomics in cardiac imaging: new tools beyond oncologic imaging 5. Radiogenomics in lung cancer: from diagnosis to therapeutic response 6. Data interpretation: a systematic approach to evaluate the results published in the literature 7. Limitations and challenges 8. Summary and future directions

CH245-SD-SUB1

Versatile CT Pulmonary Angiography Protocol Performed at Maximum Inspiration

Sunday, Dec. 1 1:00PM - 1:30PM Room: CH Community, Learning Center Station #1

Participants
Samih E. Elakkad, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Gilbert E. Boswell, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate the efficacy of a novel contrast enhanced chest CT protocol to provide a diagnostic CT pulmonary angiography (CTPA) examination at maximum inspiration while eliminating the need for suspended respiration and bolus tracking. At the same time, we test the hypothesis that the protocol can provide sufficient opacification of the left side of the heart, aorta and mediastinum while also minimizing steak artifact from dense contrast in the superior vena cava.

METHOD AND MATERIALS

Using the Siemens Somatom Force, 2 X 192 detector row scanner, we developed a CT Pulmonary Angiography protocol consisting of four phases of contrast injection. A fixed Scan Delay of 40 seconds was standard to all patient. High pitch spiral caudo-cranial acquisition is performed with 1mm reconstruction using Br 40 Kernel with level 5 ADMIRE iterative reconstruction. We reviewed 54 scans on sequential patients with the above technique. The threshold for sufficient opacification of the main pulmonary artery was considered 200 Hounsfield Units (HU).

RESULTS

The mean enhancement for the main pulmonary artery was 318 HU or an interquartile range of 224. The mean enhancement for the ascending aorta was 423 or an interquartile range of 334. Of the 54 studies, 96% of them were above the enhancement threshold and deemed diagnostic for pulmonary emboli evaluation. All studies were performed at full inspiration which allowed for evaluation of the lung parenchyma. The protocol also allowed for evaluation of the opacified heart and aorta and successfully minimized streak artifact from mixing in the superior vena cava.

CONCLUSION

In the past, we typically suspended respiration during pulmonary arterial evaluation to prevent the influx of unopacified blood from the inferior vena cava into the pulmonary circulation during pulmonary angiography protocols. However, our new later phase fixed timing contrast technique provides sufficient inferior vena cava opacification from the returning renal and hepatic veins and allows for pulmonary arterial imaging at maximum inspiration. This affords the opportunistic finding of other conditions in the chest, in particular the heart and aorta, during routine scanning.

CLINICAL RELEVANCE/APPLICATION

CT pulmonary angiography protocol performed at maximum inspiration can be diagnostic for pulmonary emboli while allowing for evaluation of the lung parenchyma, heart, and aorta.

CH246-SD-SUB2

CT-Based Quantification of Emphysema Correlates with Vertebral Fracture: Data from CT Lung Cancer Screening Beyond 10 Years

Sunday, Dec. 1 1:00PM - 1:30PM Room: CH Community, Learning Center Station #2

Participants
Takatoshi Aoki, MD, PhD, Kitakyusyu, Japan (*Presenter*) Nothing to Disclose
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Akitaka Fujisaki, MD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Vertebral fractures due to osteoporosis is now recognized as a major comorbidity of chronic obstructive pulmonary disease (COPD), and have previously been shown to predict all-cause mortality in general population. Although screening chest CTs are considered for evaluation of pulmonary emphysema as well as for early lung cancer detection, further benefit for fracture risk assessment has not been clarified. The purpose of this study is to investigate whether vertebral fracture can be predicted by CT-based quantification of emphysema in lung cancer screening participants.

METHOD AND MATERIALS

Seven hundred and fifty-nine male participants who underwent baseline low-dose CT in 2007 and subsequent CT in 2018 were included in this study. Baseline demographic and clinical data, visceral adipose tissue (VAT), and pulmonary functional test parameter (FEV%) in 2007 were evaluated. Severity of emphysema (areas with attenuation of -950 HU or less) was also automatically evaluated according to the Goddard scoring system using baseline low-dose CT in 2007. Vertebral compression fractures of the thoracic and upper lumbar spine were defined, applying the Genant visual semiquantitative method for conventional radiography to subsequent CT in 2018. Baseline age, body mass index (BMI), smoking index, HbA1c, VAT, FEV%, and the Goddard score were evaluated with univariate and multivariate logistic regression analyses to find the independent factors predictive of the vertebral fracture.

RESULTS

Results of univariate and multivariate logistic regression analyses indicated that age and Goddard score were predictors of vertebral fracture ($p < 0.001$). The respective odds ratios for age and Goddard score were 1.064 (95% CI: 1.032, 1.097) and 1.441 (95% CI: 1.265, 1.642) on univariate analysis, and 1.064 (95% CI: 1.064, 1.030) and 1.467 (95% CI: 1.277, 1.685) on multivariate analysis.

CONCLUSION

CT-based quantification of emphysema would help the discrimination of patients at risk for vertebral fracture in lung cancer screening participants.

CLINICAL RELEVANCE/APPLICATION

Quantitative lung CT assessment of emphysema can be used as a prediction tool of vertebral fracture without additional radiation exposure in lung cancer screening participants.

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CH247-SD-SUB3

Clinical Utility of Measuring Tumor Respiratory Displacement Distance to Detect Parietal Pleura Invasion in Patients with Primary Lung Cancer

Sunday, Dec. 1 1:00PM - 1:30PM Room: CH Community, Learning Center Station #3

Participants
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Hiroshi Kodama, MD, Nishinomiya , Japan (*Abstract Co-Author*) Nothing to Disclose
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Takashi Kijima, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate whether measuring respiratory displacement distance (TRDD) of primary lung cancer is useful to detect parietal pleural invasion.

METHOD AND MATERIALS

Out of 607 patients underwent surgery for primary lung cancer from April 2014 to December 2018, 114 patients (18.8%) who had tumors contacting to the pleura and received both CT and FDG-PET/CT 60 days within surgery were included in this study. There were 35 females and 79 males with their median age of 72 years (range, 41-89). Parietal pleural invasion was pathologically proven in 10 patients (8.8%, 10/114). CT images were acquired during maximum inspiration breath-holding and PET/CT images with expiration breath-holding. After creating registered images of both studies, TRDD was measured and compared between patients with and without parietal pleural invasion. Each area under curve (AUC) of TRDD and reportedly useful factors to detect pleural invasion such as a) CT finding criteria, b) tumor SUV, c) tumor diameter, d) pathological subtype, e) age, and f) gender was calculated in receiver operator characteristics (ROC) analysis, and diagnostic performance to detect parietal pleural invasion was compared between TRDD and other factors by using DeLong's test.

RESULTS

There was a significant difference in TRDD between patients with pleural invasion (median, 0.6cm; range, 0.2-1.7) and those without it (median, 1.6cm; range, 0.2-7.1, p=0.0003). AUC of TRDD (0.83, 95% confidence interval [CI], 0.72-0.94) was higher than other factors; CT finding criteria [0.58 (95%CI, 0.41-0.75), p=0.04], tumor SUV [0.57 (95%CI, 0.40-0.74), p=0.01], tumor diameter [0.56 (95%CI, 0.43-0.68), p=0.0003], pathological subtypes [0.58 (95%CI, 0.42-0.73), p=0.0005], gender [0.50 (95%CI, 0.34-0.65), p=0.001], and age [0.58 (95%CI, 0.37-0.80), p=0.053)].

CONCLUSION

TRDD is a useful index to detect parietal pleura invasion in lung cancer patients.

CLINICAL RELEVANCE/APPLICATION

Measuring tumor respiratory displacement distance can be an alternative method for diagnosis of tumor invasion beyond the pleura.

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CH277-SD-SUB4

Visual and Quantitative Assessment of Regional Xenon-Ventilation Using Dual-Energy Computed Tomography in Asthma-COPD Overlap Syndrome: A Comparison with COPD

Sunday, Dec. 1 1:00PM - 1:30PM Room: CH Community, Learning Center Station #4

Participants
Hye Jeon Hwang, MD,PhD, Anyang, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

To assess the regional ventilation status in patients with Asthma-COPD Overlap Syndrome (ACOS) using combined xenon-ventilation dual-energy CT (DECT) and to compare them in patients with COPD.

METHOD AND MATERIALS

Twelve patients with ACOS and forty-seven patients with COPD underwent xenon-ventilation DECT. For visual analysis, the ventilation abnormality patterns were visually determined to be (1) peripheral wedge or diffuse defect, (2) diffuse heterogeneous defect, (3) segmental/lobar defect, and (4) no defect on ventilation map. Mean ventilation values in the whole lung, peripheral lung and central lung areas, emphysema index, air-trapping index, and airway wall thickness were quantified and compared between patients with ACOS and COPD. Peripheral and central lung areas were divided at the 1.5cm depth from the lung surface for the quantitative analysis.

RESULTS

Most of patients with ACOS showed a peripheral wedge or diffuse defect pattern (n = 14, 70%) on ventilation maps, whereas a diffuse heterogeneous defect or segmental/lobar defect patterns were common in the patients with COPD (n = 21, 44.7%, both) ($p < 0.001$). The quantified ventilation values in the peripheral lung areas were significantly lower in the patients with ACOS than in the patients with COPD ($p = 0.015$), while the ventilation values in the whole lung areas were not significantly different between two groups. The quantified emphysema index, air-trapping index and airway wall thickness were not significantly different between two groups.

CONCLUSION

Xenon-ventilation DECT showed the different ventilation defect patterns and the different distribution of ventilation in the patients with ACOS compared to the patients with COPD. Xenon-ventilation DECT may demonstrate the different physiologic changes of ventilation in the patients with ACOS and COPD.

CLINICAL RELEVANCE/APPLICATION

Xenon-ventilation DECT imaging can be applied to the assessment of physiologic changes of ventilation in the patients with ACOS compared to the patients with COPD.

ER159-ED-SUB6

Key Findings that Influence the Management of Head and Neck Infectious Emergencies: What the Radiologist Must Tell the ER

Sunday, Dec. 1 1:00PM - 1:30PM Room: ER Community, Learning Center Station #6

Awards
Certificate of Merit

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TEACHING POINTS

1. Head and neck infecions that radiologists see in the emergency department include those of the orbits, sinuses, temporal bone, oral cavity and the pharynx. 2. The radiologist's interpretation of imaging studies for these infections guides clinical management by informing emergency physicians of the extent and severity of an infection. 3. There are key imaging findnigs and diagnoses that the radiologist must report that can prompt an emergency physician to admit a patient for inpatient management or consult a surgical subspecialist. The absence of these findings are also pertinent negatives that enable clinicians to proceed with treatment in the ED or to discharge a patient with outpatient follow-up.

TABLE OF CONTENTS/OUTLINE

1. Orbital: a) Postseptal cellulitis b) Postseptal cellutlitis + orbital compartment syndrome c) Subperiosteal abscess d) Dacryocystitis 2. Temporal bone: a) Coalescent mastoiditis b) Bezold abscess c) Mastoiditis + intracranial abscess and venous sinus thrombosis d) Malignant otitis externa 3. Sinuses: a) Acute invasive sinusitis 4. Odontogenic: a) Masticator space odontogenic abscess b) Floor of the mouth/submandibular odontogenic abscess / Ludwig's Angina c) Cavernous sinus thrombosis 5. Pharyngeal/Retropharyngeal: a) Peritonsillar abscess + parapharyngeal extension b) Peritonsillar absces + retropharyngeal extension

ER160-ED-SUB5

CT in Diagnosis of Post-Colonoscopy Complications: What the Radiologist Must Know

Sunday, Dec. 1 1:00PM - 1:30PM Room: ER Community, Learning Center Station #5

Awards
Cum Laude

Participants
Abhishek R. Keraliya, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc

TEACHING POINTS

1. Fiberoptic colonoscopy has become a routine investigation in the diagnosis and treatment of many colonic diseases and is the standard method for routine screening of colorectal cancer in healthy individuals. As the use of colonoscopy has increased in recent years, awareness and early diagnosis of the associated complications has become increasingly important to prevent morbidity and mortality. 2. Common complications of colonoscopy include bowel perforation, postprocedural hemorrhage, splenic injury, and postpolypectomy syndrome. Unusual complications of colonoscopy include appendicitis, diverticulitis, mesenteric tears, pneumothorax, septicemia, and colonic volvulus. 3. CT is the imaging modality of choice to assess for the possible complications of colonoscopy in patients presenting to emergency department with postprocedural abdominal pain. CT is more sensitive and specific compared to abdominal radiographs in detecting and localizing various post-colonoscopy complications.

TABLE OF CONTENTS/OUTLINE

Case-based illustration of the utility of CT to detect complications of colonoscopy including bowel perforation, postprocedural hemorrhage, splenic injury, and postpolypectomy syndrome.

ER202-SD-SUB2

Differentiation of Drowning in Seawater and Freshwater with Pleural Effusion: A Phantom Study Using Dual-Layer Spectral CT

Sunday, Dec. 1 1:00PM - 1:30PM Room: ER Community, Learning Center Station #2

Participants
Norihiro Shinkawa, MD, Miyazaki, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

Forensic medicine identifies drowning and whether it occurred in salt- or fresh water. The sodium chloride (NaCl) concentration in pleural fluid differentiates between fresh water- and salt water drowning (FWD, SWD). As dual-layer spectral CT (DLSCT) acquires low- and high-energy data simultaneously, dual-energy analysis is possible. We used a phantom to determine whether DLSCT is useful for evaluating the NaCl concentration in fluid.

METHOD AND MATERIALS

Based on the reported NaCl concentration in pleural effusion, we estimated the most appropriate cut-off value to be 110 mEq/l. An NaCl concentration < 110 mEq/l was defined as FWD; a concentration > 110 mEq/l as SWD. Plastic tubes filled with 50-ml solutions containing NaCl concentrations ranging from 101 -120 mEq/l and increased in one-mEq/l steps were scanned using DLSCT. The attenuation value on 120-kVp scans and on virtual monoenergic images (VMIs) acquired at 70-, 60-, 50-, and 40-keV was calculated using the region-of-interest method. The area under the receiver operating characteristics curve (AUC) was used to compare the ability of the imaging modalities to differentiate between fresh- and salt water. Differences in their AUCs were assessed by pair-wise comparisons. A p-value < 0.05 was considered to indicate a significant difference.

RESULTS

For fresh water, the mean attenuation value was 9.9 ± 0.18 HU at 120-kVp, 9.6 ± 0.11 HU at 70-keV, 9.8 ± 0.14 HU at 60-keV, 10.4 ± 0.27 at 50-keV, and 10.9 ± 0.40 HU at 40-keV. For salt water these values were 10.0 ± 0.20, 9.5 ± 0.20, 9.7 ± 0.10, 10.5 ± 0.20, and 11.4 ± 0.20, respectively. The AUC was 0.690 at 120-kVp; for VMIs at 70-, 60-, 50-, and 40-keV it was 0.675, 0.540, 0.595, and 0.935, respectively. It was significantly higher at 40-keV than at 120-kVp (p=0.034), 60-keV (p=0.012), and 50-keV (p=0.0009). There was no significant difference in the AUC between VMIs acquired at 40- and 70-keV.

CONCLUSION

Dual-energy imaging using DLSCT, especially 40-keV VMI, is useful for evaluating the NaCl concentration in fluid. Dual-energy analysis of pleural fluid may help to distinguish between FWD and SWD.

CLINICAL RELEVANCE/APPLICATION

Dual-energy analysis of pleural fluid using DLSCT may be useful for forensic medicine as it helps to distinguish FWD from SWD.

ER203-SD-SUB3

Ruling Out Pneumothorax Via Ultrasound Using B-Flow Imaging

Sunday, Dec. 1 1:00PM - 1:30PM Room: ER Community, Learning Center Station #3

Participants
Martin Fasshauer, MD, Goettingen, Germany (*Presenter*) Nothing to Disclose
Lorenz Biggemann, Goettingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Joachim Lotz, MD, Gottingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

After trauma a first and quick evaluation with ultrasound (extended focused assessment with sonography in trauma; eFAST) is often the first imaging procedure for internal injuries such as bleeding, pericardial effusion or pneumothorax. While a contrast enhanced whole body CT scan remains the gold standard for assessment of trauma related injuries, some patients require urgent care due to hemodynamic instability. The most important disadvantage of eFAST however is the low sensitivity and consequentially high number of underdiagnosed injuries. One of the reasons for aforementioned low sensitivity is inexperience of the examiner. With focus on pneumothorax, pleural adhesions as well as decreased mobility of the lung further impair evaluation of ultrasound findings. We therefore investigated the use of ultrasound B-Flow imaging (GE Healthcare) to assess pleural movement in order to rule out pneumothorax.

METHOD AND MATERIALS

20 healthy male volunteers were examined to prove non-inferiority of M-Mode and B-Mode compared to B-Flow. We used a 6-8 MHz linear-array transducer (ML6-15, Logiq S8 XDclear, GE Healthcare, Chicago, IL, USA) with standard recommended views for eFAST. Written consent was obtained from each volunteer.

RESULTS

B-Flow imaging was visually superior to M-Mode as well as B-Mode in healthy male volunteers for detection of pleural movement. Especially in few obese volunteers where pleural movement was subjectively markedly decreased in M-Mode, confidence of existent pleural movement was preserved in B-Flow imaging.

CONCLUSION

Assessment for sonographic pleural movement to rule out pneumothorax is often difficult in inexperienced examiners, especially while performing eFAST. While further investigation including trauma patients will be needed, B-Flow imaging might serve as a superior tool for detection of pleural movement.

CLINICAL RELEVANCE/APPLICATION

Ultrasound B-Flow imaging is non-inferior to M-Mode in detection of pleural movement.

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ER231-SD-SUB4

Performance Analysis of Deep Learning Algorithm for Emergency Chest CT Reading

Sunday, Dec. 1 1:00PM - 1:30PM Room: ER Community, Learning Center Station #4

Participants
Yu Ziting, Yinchuan, China (*Presenter*) Nothing to Disclose
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Ruoshui Ha, BA, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose
Yun Shen, PhD, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company Researcher, General Electric Company
Xuejun Ping, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess the performance of deep learning algorithm through reading time and diagnostic accuracy for emergency chest CT images.

METHOD AND MATERIALS

A total of 30 patients underwent emergency chest CT were retrospectively collected and randomly divided into two groups and each group consisted of 15 people. In the first week, one resident independently read the images of group A and recorded the total reading time and the number of nodules in the lungs, position, the number of fractures and position. Group B images were firstly read by AI and then the second reading was conducted by the resident on the basis of AI reading. Reading time and results were recorded. After one week, image reading mode in group A and group B were interchanged. Group B images were read by the resident. Group A images were read by AI first, then the second reading was conducted on the basis of AI with reading time and results recorded. The consensus results of two senior imaging diagnostic radiologist combined with AI diagnosis were used as the gold standard conditions of nodules and fractures in patients. Detection time and efficiency of the resident only and the resident with AI assisted to diagnose nodules and fractures were compared

RESULTS

A total of 72 pulmonary nodules and 172 fractures were determined as gold standard. The reading time of the resident assisted by AI (55±35s) was faster than that of the resident alone (154±46 s) ($P<0.01$). Resident alone detected 35 nodules and 72 fractures while the resident detected 96 nodules and 139 fractures with AI assisted. For the resident reading alone, the sensitivity of the nodule detected by the resident was 27.78% and the sensitivity of the fracture detected was 41.86%. For the resident reading with AI assisted, the sensitivity of nodule detection was 80.55% and the sensitivity of fracture detection was 80.81%. There were statistically significant differences between the two groups ($P<0.05$).

CONCLUSION

AI can significantly reduce the reading time of emergency chest CT by residents, improve the sensitivity of residents in identifying pulmonary nodules and fractures.

CLINICAL RELEVANCE/APPLICATION

The emergency chest CT report always requires high accuracy and has stringent timeline. AI can not only significantly improve the diagnostic speed of residents but also effectively improve the detection efficiency of nodules and fractures.

GI277-ED-SUB10

Between the Duodenum and the Pancreas - What do We Know about Groove Pancreatitis?

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #10

Participants
Sharif Darwish, MD, Worcester, MA (*Presenter*) Nothing to Disclose
Shams Jubouri, MBChB, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose
Brian D. Midkiff, MD, MPH, Hopkinton, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is to: 1. Educate the reader of this rare form of chronic pancreatitis including its subtypes, proposed etiology, and pathogenesis. 2. Show characteristic diagnostic CT and MRI imaging findings and discuss potential complications. 3. Identify key differentiators from its mimics including pancreatic adenocarcinoma, ampullary/duodenal adenocarcinoma, duodenitis, and conventional/paraduodenal pancreatitis. 4. Briefly discuss current treatment and management, and explain how a prospective radiologic diagnosis could potentially save a patient from major abdominal surgery, particularly with high false positive and false negative cytology results.

TABLE OF CONTENTS/OUTLINE

• Anatomy of the pancreaticoduodenal 'groove'. • Etiology, pathogenesis, subtypes and clinical presentation of groove pancreatitis. • Review key imaging findings of groove pancreatitis, its complications and mimics on: - CT. - Conventional MRI. • Current treatment and management options.

GI278-ED-SUB11

Pelvic Nodal Anatomy and Patterns of Nodal Spread in Rectal Cancer

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #11

Participants
Harmeet Kaur, MD, Houston, TX (*Presenter*) Nothing to Disclose
George J. Chang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Tsuyoshi Konishi, MD,PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Y. N. You, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Gaiane M. Rauch, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Randy D. Ernst, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Anatomic atlas of pelvic nodal groups and subgroups with clarification of existing misconceptions Discuss patterns of lymphatic spread in rectal cancer as an important determinant of nodal invovlement Defintion of anatomic compartments in the pelvis with specific regard to nodal localization

TABLE OF CONTENTS/OUTLINE

A detailed description of the anatomic nodal groups and subgroups with in the pelvis is provided, this covers pelvic sidewall and mesenteric nodes. The rectum and different regions of the rectum are defined along with the patterns of lymphatic spread from these different nodal regions. Practical examples of how this applies to determining nodal invovlment in rectal cancer along with relevant reserach papers are presented Anatomic compartments in the pelvis are reviewed with regard to accurate localization of nodes. The significance of accurate localization from the perspective of staging and surgical resection is reviewed.

GI279-ED-SUB12

Pancreas in Hereditary Syndromes: Cross-Sectional Imaging Spectrum

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #12

Awards
Magna Cum Laude
Identified for RadioGraphics

Participants
Suryakala Buddha, MD, DMRD, San Antonio, TX (*Presenter*) Nothing to Disclose
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Alia Nazarullah, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Christine O. Menias, MD, Chicago, IL (*Abstract Co-Author*) Royalties, Reed Elsevier
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Meghan G. Lubner, MD, Madison, WI (*Abstract Co-Author*) Grant, Koninklijke Philips NV; Grant, Johnson & Johnson;
Srinivasa R. Prasad, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Describe genetics, pathology & clinical features of hereditary syndromes with pancreatic manifestations Review cross-sectional imaging spectrum of pancreatic & extra-pancreatic findings in these syndromes Discuss current updates in early pancreatic cancer Review screening & surveillance guidelines with special emphasis on role of imaging

TABLE OF CONTENTS/OUTLINE

Introduction Hereditary syndromes: Genetics & Pathology a) Pancreatitis: Cystic Fibrosis [CFTR] & Hereditary Pancreatitis [PRSS1 or SPINK1] b) Adenocarcinoma: Familial pancreatic cancer syndrome, Lynch, FAP , Peutz-Jeghers [STK11], FAMMM [CDKN2A], HBOC [BRCA1 & BRCA2] & hereditary pancreatitis. c) Neuroendocrine tumors: MEN type1, VHL, NF type1&TS. d) Pancreatic cystic lesions: Mccune-Albright syndrome [GNAS1], VHL & Peutz-Jeghers e) Pancreatoblastoma: Beckwidth-weideman syndrome. f)Primary Hemochromatosis. Cross-sectional Imaging: US, CT, MRI & EUS Early pancreatic cancer: Role of Imaging Treatment & Prognosis Imaging in Screening & Surveillance Future Directions Conclusion Summary: Imaging plays an important role in detection of pancreatic manifestations in genetic syndromes. Identifying pancreatic cancer precursors helps in early diagnosis and imaging-based screening & surveillance guidelines are pivotal in detecting pancreatic manifestations of hereditary cancer syndromes.

GI280-ED-SUB7

Multimodality Imaging of the Transplant Liver: A Primer

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #7

Participants
Amit Pandya, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
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Carolina M. Ramirez Vizcarrondo, BA, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Ronald O. Bude, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Ashish P. Wasnik, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Review indications and surgical techniques of cadaveric and living split liver transplant 2. Review multimodal imaging of normal liver transplant as well as vascular and non-vascular complications that can help timely diagnosis and appropriate management 3. Present structured templates in liver transplants that can help communicate relevant findings related to the surgical team

TABLE OF CONTENTS/OUTLINE

Overview of indications and surgical techniques in liver transplant (cadaveric, living donor and split) with schematic illustrations Role of various imaging modalities (Ultrasound, CT, MR, nuclear medicine, DSA) in liver transplant evaluation Multimodality imaging of normal post-transplant liver appearance, and vascular and non-vascular complications Review of following complications with illustrated examples: Vascular : Hepatic artery stenosis/thrombosis, arterial pseudoaneurysm, arteriovenous fistula Portal vein, Hepatic vein, IVC stenosis/thrombosis Biliary: Biliary obstruction, leak Parenchymal: Infarct, rejection, abscess Perigraft hematoma, abscess Structured reporting template for liver transplant evaluation

GI281-ED-SUB8

Where's the Leak? Radiographic Evaluation of Common Gastrointestinal Post-Operative Procedures

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #8

Participants
Joshua I. Katz, DO, Morristown, NJ (*Presenter*) Nothing to Disclose
Michael C. Prasad Jr, MD, South Orange, NJ (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

TEACHING POINTS 1. Review anatomy of common gastrointestinal surgical procedures 2. Describe the surgical approach to multiple GI interventions and radiographic evaluation of the post-operative patient utilizing imaging modalities including fluoroscopy and computed tomography. 3. Review the potential complications of common GI surgical procedures and identify them on imaging studies.

TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS/OUTLINE Surgery and radiology often collaborate to assess a patient in a post-operative state from a gastrointestinal procedure to evaluate for potential complications. It is critical for a radiologist to understand the surgical approach of the procedure and potential complications to provide an adequate post-operative evaluation. This educational review of common GI surgical procedures will evaluate the imaging characteristic of normal post-operative states and their potential post-operative complications. After completing this educational exhibit, the reader will be able to evaluate multiple common gastrointestinal post-operative states and their potential complications. Outline Esophagectomy Sleeve gastrectomy Roux-en-Y gastric bypass Whipple procedure Ileoanal Anastomosis (J-Pouch)

GI282-ED-SUB9

MR Cholangiopancreatography: What Every Radiology Resident Must Know

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #9

Awards
Identified for RadioGraphics

Participants
Bruno P. Vidal, MD, Campinas, Brazil (*Presenter*) Nothing to Disclose
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Marco A. Rodstein, MD, Campinas, Brazil (*Abstract Co-Author*) Nothing to Disclose
Thiago J. Penachim, MD, Campinas, Brazil (*Abstract Co-Author*) Nothing to Disclose
Patricia P. Cardia, MD,PhD, Campinas, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Magnetic resonance (MR) cholangiopancreatography (MRCP) is a widely used noninvasive method in the evaluation of pancreatobiliary disorders. As opposed to endoscopic retrograde cholangiopancreatography (ERCP) it allows evaluation of biliary ducts proximal and distal to injury, as well as extra ductal lesions. It's technique and protocols may vary, but there are some key points that every radiologist must know in order to perform and extract the best out of this method. After reviewing this exhibit, specially aimed for residents, trainees, and their tutors, the learner should be able to: 1. Understand how an MRCP is performed, including contrast enhanced MR cholangiography (CE-MRC), focusing on current techniques, advantages, artifacts, pitfalls and how to avoid them. 2. Discuss the indications of MRCP in correlation to ERCP. 3. Access normal/variant biliary anatomy, and 4. Identify common biliary pathology such as stones, benign/malignant stricture, leaks, iatrogenic and others.

TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Techniques and Protocols of MRCP. 3. Indications of MRCP. 4. Artifacts, Pitfalls and how to avoid them. 5. Normal/Variant Biliary Anatomy. 5.Biliary Pathology. 6. Conclusion.

GI311-ED-SUB13

Bariatric Surgery Reduced to Simple Terms

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #13

Awards
Magna Cum Laude

Participants
Luisa L. Faria, MD , Juiz de Fora, Brazil (*Presenter*) Nothing to Disclose
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Marco Aurelio S. Filho, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Thiago M. Baraviera, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Anna Carolina B. Dantas, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marco Aurelio Santo, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Cinthia D. Ortega, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Speaker, Johnson & Johnson
Manoel S. Rocha, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Obesity is a chronic and multifactorial disease which prevalence has been growing in recent years at an alarming rate. Concomitantly, the number of bariatric surgeries performed has dramatically increased. As a consequence, it is expected that a number of patients will have a recurrent/persistent disease or surgical complications. Imaging may play a key role in evaluating the scenario of post-bariatric surgery patients. The purpose of this exhibit is: (1) to understand the indications for bariatric surgery and the types of surgery, (2) to review surgical techniques and the expected CT postsurgical appearance, (3) to systematize the main complications of bariatric surgery using a case-based approach and (4) to discuss the role of imaging for post bariatric insufficient weight loss or weight regain evaluation.

TABLE OF CONTENTS/OUTLINE

Who is a candidate for bariatric surgery? Guide to types of bariatric surgery and surgical techniques. Surgical and radiological anatomy correlation and postoperative normal appearances. Fluoroscopic gastrointestinal studies and CT protocols for early and late postoperative evaluation. Case-based approach to the main complications of bariatric surgery (fluoroscopic and tomographic findings with surgical/endoscopic correlation). Case-based discussion of insufficient weight loss or weight regain.

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GI334-SD-SUB1

Non-Invasive MR Assessment of the Microstructure and Microcirculation in Regional Lymph Nodes for Rectal Cancer: A Study of Intravoxel Incoherent Motion Imaging

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Participants
Xinyue Yang, Guangzhou, China (*Presenter*) Nothing to Disclose
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Ziqiang Wen, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The aim of this study is to evaluate the microstructure and microcirculation of regional lymph nodes (LNs) in rectal cancer by using non-invasive intravoxel incoherent motion MRI (IVIM-MRI), and to distinguish metastatic from non-metastatic LNs by quantitative parameters.

METHOD AND MATERIALS

All recruited patients underwent IVIM-MRI (b=0, 5, 10, 20, 30, 40, 60, 80, 100, 150, 200, 400, 600, 1000, 1500 and 2000 s/mm2) on a 3.0 T MRI system. 168 regional LNs with a short-axis diameter equal to or greater than 5 millimetres from 116 patients were evaluated by two radiologists independently, including 78 malignant LNs and 90 benign LNs. The following parameters were assessed: the short-axis diameter (S), long-axis diameter (L), short- to long-axis diameter ratio (S/L), pure diffusion coefficient (D), pseudo-diffusion coefficient (D*), and perfusion factor (f). Intraclass correlation coefficients (ICCs) were calculated to assess the interobserver agreement between two readers. Receiver operating characteristic (ROC) curves were applied for analyzing statistically significant parameters.

RESULTS

Interobserver agreement of IVIM-MRI parameters between two readers was excellent (ICCs>0.75). The metastatic group exhibited higher S, L and D (P<0.001), but lower f (P<0.001) than the non-metastatic group. The AUC (95% CI, sensitivity, specificity) of the multi-parameter combined equation for D, f and S was 0.811 (0.744~0.868, 62.82%, 87.78%). The diagnostic performance of the multi-parameter model was better than that of an individual parameter (P<0.05).

CONCLUSION

IVIM-MRI parameters provided information about the microstructure and microcirculation of regional LNs in rectal cancer, also improved diagnostic performance in identifying metastatic LNs.

CLINICAL RELEVANCE/APPLICATION

Nodal status is a key point in determining the therapeutic strategy of rectal cancer patients. The multi-parameter model comprising D, f and S improved performance in diagnosing nodal status.

GI335-SD-SUB2

Hepatocellular Carcinoma Screening Patterns with Imaging: Experience Form a Tertiary Care Transplant Center

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #2

Participants
Gabriela Herandez-Meza, New York, NY (*Presenter*) Nothing to Disclose
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Bachir Taouli, MD, New York, NY (*Abstract Co-Author*) Research Grant, Bayer AG; Research Grant, Takeda Pharmaceutical Company Limited; Research Grant, Regeneron Pharmaceuticals, Inc; Consultant, Alexion Pharmaceuticals, Inc; Consultant, Bayer AG; ;

PURPOSE

Hepatocellular carcinoma (HCC) screening is an effective method for early detection and effective treatment. Our purpose was to investigate the patterns of HCC screening with imaging at a tertiary care transplant center.

METHOD AND MATERIALS

This is a retrospective IRB approved study where referrals for HCC screening during the year 2017 were identified via RIS system. The first imaging event for each patient was identified. Inclusion included criteria: chronic liver disease, cirrhosis, HBV non cirrhotic, age >18y. Exclusion criteria included: prior history of HCC, liver transplant, metastasis screening, non-cirrhotic HCV and acute disease. Demographic information, medical history and imaging results were recorded. Association between imaging methods (US, CT, MRI) and race/ethnicity, BMI, etiology and referring physician were analyzed by Chi-Square test. Imaging preferences of referring physicians (N=28) were assessed by a survey.

RESULTS

1374 patients were identified with mean age of 59±12y, 59% male, 23% Caucasian (C), 23% Hispanic (H), 12% Asian (A) and 7% African American (AA), 34% unknow/other race/ethnicity, mean BMI 28.4±6.1, mean AFP 28.1±576.2. Liver disease etiology was as follows: HCV 35%, HBV 18%, alcohol 16%, NAFLD 14% and other 17%. 82% had cirrhosis. Imaging method utilization for MRI/US/CT was 51%/ 33%/ 16%. Imaging modality was associated with race/ethnicity ($p<0.001$), BMI ($p=0.019$), etiology ($p<0.001$) and type of referral (transplant hepatologist) ($p<0.001$). Our survey of physicians cited preference for MRI in 44%, US alternating with CT or MRI in 31%, US alone in 13% and CT alone in 12%. Factors cited as relevant for imaging selection included: etiology (38%), Child-Pugh class (63%), weight/BMI (44%) and insurance coverage (44%). Positive observations were found in 222 patients with 56 patients with HCC (mean size 2.2 ± 1.2 cm), providing a cumulative incidence of 4%.

CONCLUSION

MRI was the most frequently used modality (51%) for HCC screening, while only 33% received US, in contrast with the current AASLD guidelines. Race/ethnicity, BMI, etiology and referral by transplant hepatologist were associated with the preferred imaging method for HCC screening.

CLINICAL RELEVANCE/APPLICATION

Our clinical practice demonstrate that MRI is preferentially used for HCC screening (>50% of cases), in contrast to AASLD guidelines. Imaging method selection was associated with race, BMI, etiology and referring physician.

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GI336-SD-SUB3

Deep Learning Reconstruction Can Improve Image Quality and Subjective Acceptance in Low Radiation Dose Abdominal CT: Comparison with Iterative Reconstruction Algorithm

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #3

Participants
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Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

This study aimed to assess the effect of deep learning reconstruction (DLR) on image quality and subjective acceptance of low radiation dose abdominal CT in comparison with iterative reconstruction (IR) algorithm.

METHOD AND MATERIALS

This study included 21 patients who underwent low radiation dose abdominal CT. The CT data was post-processed using filtered back projection (FBP), IR (AIDR-3D body standard), and DLR (AiCE body standard). Objective and subjective image quality parameters were compared among the three different methods. Objective parameters included image noise and CT attenuation. Subjective image quality parameters, i.e. depiction of the upper abdominal organs, pelvic organs, bone, and soft tissue were scored on a 5-point scale. For images reconstructed with both IR and DLR, subjective acceptance of image appearance was evaluated using a 5-point scale.

RESULTS

The mean CTDIvol and estimated effective dose were 1.2 ± 0.4 mGy and 1.1 ± 0.7 mSv for the low dose abdominal CT. There was no significant difference in CT attenuation among the 3 reconstruction methods. The mean image noise on FBP, IR, and DLR images was 35.8 ± 3.5, 14.0 ± 0.9, and 11.9 ± 1.3 HU, respectively. The difference among all reconstruction combinations was significant ($P < 0.01$). The subjective image quality scores were significantly higher for DLR than the other images for all parameters ($p < 0.01$). The scores for subjective acceptance of image appearance were significantly higher for DLR than for IR ($P < 0.01$).

CONCLUSION

DLR can yield significantly improved image quality and subjective acceptance in low radiation dose abdominal CT.

CLINICAL RELEVANCE/APPLICATION

Compared to IR algorithm, DLR can present a higher image quality and provide images improved subjective acceptance in low radiation dose abdominal CT.

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GI381-SD-SUB4

Assessment of Aggressiveness of Rectal Cancer Using Quantitative Parameters Derived from Dual-Energy Spectral Computed Tomography

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #4

Participants
Yi Li, Tianjin , China (*Presenter*) Nothing to Disclose

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PURPOSE

To evaluate the value of quantitative parameters derived from DESCT in the assessment of aggressiveness of rectal cancer.

METHOD AND MATERIALS

Seventy-eight patients with rectal cancers confirmed by pathology underwent contrasted DESCT scans. The normalized iodine concentration (NIC) and normalized water concentration (NWC) of the tumor against artery were measured. The quantitative parameters were compared and statistically analyzed between subgroups based on the following prognostic factors: pretreatment carcinoembryonic antigen (CEA) levels, mesorectal fascia (MRF) status, T stage (T1,2 and T3,4), N stage (N0 and N1,2), differentiation grade (poorly differentiated, poorly-moderately differentiated, moderately differentiated, moderately-well differentiated, well differentiated), and lymphangiovascular invasion. The independent two-sample t test was performed to assess differences between means of the subgroups.

RESULTS

The differences of NICs between MRF-free and MRF-invaded groups (P=0.042), between T2 and T3-4 stage groups (P=0.044), between N0 and N+ (N1, 2) groups (P=0.036), between poorly differentiated group and other differentiated groups (P<0.05)were significant, respectively. For CEA levels and lymphangiovascular invasion, no significant differences existed between subgroups. For NWCs, there were no significant differences between subgroups based on the prognostic factors above all.

CONCLUSION

Higher NIC value is associated with a more aggressive tumor character. NIC may have the potential to become an imaging biomarker of tumor aggressiveness character.

CLINICAL RELEVANCE/APPLICATION

Quantitative parameters derived from dual-energy spectral computed tomography may have the potential to become an imaging biomarker of tumor aggressiveness character.

GI382-SD-SUB5

Radiogenomics of Colorectal Adenocarcinoma: Quantitative and Quantitative Analysis of the Hepatic Metastases on CT for Prediction of KRAS Mutation -Preliminary Results

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #5

Participants
Gabriela R. Camerin, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate if qualitative and quantitative textural features on contrast-enhanced CT of the hepatic metastasis at primary staging can predict KRAS mutation in patients with colorectal adenocarcinoma.

METHOD AND MATERIALS

In this IRB-approved study we retrospectively evaluated consecutive patients with colorectal adenocarcinoma treated at our institution from January 2016 to March 2019. The exclusion criteria were (a) pre-treatment contrast-enhanced CT unavailable and (b) no genetic profile available. Our final study population was 15 patients. One experienced oncologist with 5 years of experience reviewed the medical record of patients. One experienced radiologist evaluated qualitative characteristics of the liver metastasis based on a subjective evaluation. The radiologist also manually segmented all the liver metastases in all slices on venous phase of CT using a free open-source software package ITK-SNAP version 3.4.0 in order to provide the volume of interest (VOI) of the tumor for extraction of the quantitative textural features - radiomics signature. Statistical analysis was performed to evaluate associations between qualitative features and quantitative textural features and KRAS mutation.

RESULTS

The mean age of the patients was 57 years (range, 32-85), 7/15 (47%) were men, 13/15 (87%) had the primary tumor in the right colon, 8/15 (53%) had distant metastases only within the liver. The quantitative textural features on CT using the VOI of the liver metastases demonstrated that contrast, contrast 135, dissimilarity, dissimilarity 90, and dissimilarity 135 were significantly different between patients with wild-type and mutated KRAS (p-values = 0.04, 0.02, 0.02, 0.01, and 0.02, respectively). Qualitative features demonstrated no significant difference between these two groups.

CONCLUSION

In our population, some texture features of the liver metastases on CT predicted the presence of KRAS mutation.

CLINICAL RELEVANCE/APPLICATION

The biology of colorectal cancer tumor has evolved over the last decade, guiding patient's treatment. Radiomics and radiogenomics have the potential of providing a genetic profile based on conventional imaging modalities. However, it still lacks robustness before widespread use.

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GI383-SD-SUB6

Clinical Significance of the Differences between the CT/MRI LI-RADS 5 and the OPTN Class 5 Classifications for Small 10-19mm Hepatic Nodules with Non-Rim Arterial Phase Hyper-Enhancement (APHE)

Sunday, Dec. 1 1:00PM - 1:30PM Room: GI Community, Learning Center Station #6

Participants
Mauro M. Hanaoka, MD, Lexington, KY (*Presenter*) Nothing to Disclose
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PURPOSE

The rationale of the LI-RADS v2018 is to simplify and achieve concordance with definitions advocated by AASLD and OPTN. LI-RADS and OPTN criteria for HCC are similar, except for 10-19 mm observations with arterial phase hyper-enhancement (APHE) and non-peripheral "washout" (NPW). The purpose of this study is to determine the clinical significance of this exception.

METHOD AND MATERIALS

IRB approval was obtained. HIPAA-compliant. We searched our retrospectively maintained database for consecutive patients who underwent performed CT and/or MRI, from January 1, 2016 to July 1, 2018, with reported LR-4 and LR-5 with observations 10-19 mm in size with non-rim APHE. These nodules were subsequently classified according to the CT/MRI LI-RADS v2018 and the OPTN criteria. Our final study population consisted of 23 of 501 patients. Statistical analyses were performed with software package R and SAS (version 9.4; SAS Institute, Cary, NC).

RESULTS

Overall, 23 of 768 (2.9%) patients with LR-5 with observations 10-19 mm in size with non-rim APHE were identified. 12 patients (1.5%) had observations with NPW and EC. These met criteria for OPTN 5A. 2 patients (0.2%) had observations with TG and met OPTN 5A-g criteria. 9 patients (1.1%) with only NPW could be classified as LR-5 but are not assigned to any OPTN Class (Yates' chi-square 8.841, p-value 0.0029).

CONCLUSION

LI-RADS, AASLD and OPTN criteria as overall similiar. In 2018, LI-RADS and AASLD have achieve complete concordance. The only discordance between the LI-RADS and the OPTN criteria is the classification of observations 10-19 mm in size with APHE and NPW. Although relatively infrequent, ocurring in 1.1% of the cases, it is nevertheless statistically significant.

CLINICAL RELEVANCE/APPLICATION

Although CT/MRI LI-RADS v2018 is a new and powerful tool that should be use in the evaluation of hepatocellular carcinoma (HCC), further investigation is required obtain a unified LIRADS, AASLD and OPTN criteria.

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GU203-SD-SUB1

Preoperative Identification of Low-Risk Endometrial Cancer Patients by Preoperative Endometrial Biopsy and MRI Compared with Intraoperative Findings Including Frozen Sections

Sunday, Dec. 1 1:00PM - 1:30PM Room: GU/UR Community, Learning Center Station #1

Participants
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Mai Funakoshi, Osaka Takatsuki, Japan (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To compare the utility of preoperative endometrial biopsy (pre-B) and magnetic resonance imaging (MRI) data against intraoperative findings including frozen section histology (FS) in the detection of low-risk patients.

METHOD AND MATERIALS

A total of 172 patients who underwent surgery between January 2013 and September 2016 were included. In this study, low-risk patients are defined as those with a histological low-grade tumor (LGT), namely, atypical endometrial hyperplasia (AEH) or grade 1 or 2 endometrioid (G1 or G2) cancer invading less than half of the uterine myometrium. A low-stage tumor (LST) is defined as a tumor invading less than half of the uterine myometrium. The MRI protocol included T2-weighted, contrast-enhanced, and diffusion-weighted imaging. The postoperative histology was considered as the reference standard. We compared (1) detection of LGT using pre-B versus FS, (2) detection of LST using MRI versus FS, (3) detection of low-risk patients using MRI + pre-B versus FS including intraoperative biopsy (FS + B), and (4) number of patients with lymph node metastasis (LM) in the low-risk group diagnosed by MRI + pre-B versus FS + B. McNemar's test was used to compare paired proportions. All P values less than 0.05 were considered significant.

RESULTS

(1) The sensitivity, specificity, positive predictive value, and negative predictive value for detecting LGT were 98.4%, 59.6%, 86.6%, and 93.3% for pre-B versus 99.2%, 55.3%, 85.5%, and 96.3% for FS respectively (P=0.44). (2) These figures for detecting LST were 82.5 %, 69.6 %, 88.1 %, and 59.3 % for MRI versus 99.2 %, 39.1 %, 81.7 %, and 94.7 % for FS (P<0.0001). (3) These figures for detecting low-risk patients were 85.2 %, 76.1 %, 83.5 %, and 78.3 % for MRI + pre-B versus 99.0 %, 57.8 %, 76.9 %, and 97.6 % for FS + B (P<0.0001). Positive likelihood ratios for MRI + pre-B and FS + B were 3.56 and 2.35. (4) No patient diagnosed as low-risk by postoperative histology or MRI + pre-B had LM, whereas 3 patients diagnosed by FS + B had LM.

CONCLUSION

The positive likelihood ratio for MRI + pre-B for detection of low-risk patients with endometrial cancer was significantly higher than that for FS due to its higher specificity for detection of low-stage tumors.

CLINICAL RELEVANCE/APPLICATION

The higher number of false positive cases diagnosed by FS might lead to unnecessary lymph node dissection in patients with low-risk endometrial cancer.

GU204-SD-SUB2

The Utility of Multiparametric Magnetic Resonance Imaging at Re-Assessment to Predict Pathological Progression on Active Surveillance for Gleason Score 3+3 Prostate Cancer

Sunday, Dec. 1 1:00PM - 1:30PM Room: GU/UR Community, Learning Center Station #2

Participants
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Andre de Castro Abreu, Los Angeles , CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The role of multiparametric magnetic resonance imaging (mpMRI) is not fully understood when used for monitoring patients on active surveillance (AS) with low risk prostate cancer. The purpose of this study is to investigate the utility of mpMRI in the re-assessment of patients on AS for prostate cancer.

METHOD AND MATERIALS

All men were enrolled in AS between November 2001 and December 2018. Men were included if they underwent confirmatory biopsy and mpMRI within 6 months prior to any biopsy. Men evaluated with 1.5 Tesla MRI or with Gleason score (GS) 3+4 were excluded. A subset analysis was performed among patients who underwent serial MRI during AS. A lesion with score of >= 3 on Prostate Imaging Reporting and Data System version 2.0 was considered an MRI-positive lesion. MRI progression was defined as an increase in PIRADS score in patients with PIRADS >= 3, or the appearance of any new lesion with PIRADS >= 3, or lesion enlargement detected on follow up MRI compared to previous MRI imaging. Pathological progression was defined as the increase of Gleason score to 3+4 or more at confirmatory or follow up biopsy. Multivariate logistic regression analysis was performed to evaluate predictors of pathological progression.

RESULTS

54 out of 181 (30%) patients with pathological progression were identified. Higher PSA density (p=0.00013) and positive MRI (p=0.00029) at last biopsy were significantly associated with pathological progression. 70 patients who underwent serial MRI were examined as a subset analysis. Only MRI progression was significantly associated with pathological progression (p=0.0003). The major limitation of this study is its retrospective nature and its relatively small sample size.

CONCLUSION

We demonstrated that the utility of mpMRI as an imaging modality for re-assessment of patients on AS for GS 3+3 prostate cancer is significant. MRI progression was a strong predictor for pathological progression.

CLINICAL RELEVANCE/APPLICATION

We investigated the utility of magnetic resonance imaging (MRI) on active surveillance for prostate cancer. MRI progression was closely associated with disease progression.

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GU205-SD-SUB3

Cluster Analysis Using Gaussian Mixture Model for Apparent Diffusion Coefficient Value: A Novel Approach to Evaluate the Grades of Uterine Endometrioid Adenocarcinoma

Sunday, Dec. 1 1:00PM - 1:30PM Room: GU/UR Community, Learning Center Station #3

Participants
Sakiko Kageyama, MD, Sendai, Japan (*Presenter*) Nothing to Disclose
Naoko Mori, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Kei Takase, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Preoperative histological grade of endometrioid adenocarcinoma plays an important role in deciding the management such as surgical procedure or fertility preservation option. The purpose of our study was to perform cluster analysis of voxel-based apparent diffusion coefficient (ADC) data using Gaussian mixture model (GMM) algorism and evaluate the relationship between the ratio of clusters and the grades.

METHOD AND MATERIALS

Between May 2015 and July 2018, 63 patients with endometrioid adenocarcinoma were underwent IRB approved magnetic resonance imaging including diffusion-weighted imaging with b values of 0 and 800 sec/mm2 before surgical treatment. The ADC data of entire lesion were obtained retrospectively by manual segmentation on each slice of ADC map for all patients. The ADC data of all patients were summed and fitted using GMM algorism to classify them into three Gaussian distributions. The ADC range of each cluster (C1, C2 and C3) was defined by the Maharabinos distance between the mean ADC values of each Gaussian distribution. The ratio of each cluster to the entire lesion volume per patient was calculated and correlated with the postoperative histological grades. A value of $p<0.05$ was considered statically significant.

RESULTS

The postoperative histological grades of 63 patients were Grade 1 (n=34), Grade 2 (n=19) and Grade 3 (n=10). The ADC range of each cluster was calculated as follows: C1 (0.49-0.69×10-3mm2/sec), C2 (0.70-0.93×10-3mm2/sec) and C3 (over 0.94×10-3mm2/sec). There was a significant correlation between the grades and the ratio of C1 or C3 ($\rho=0.34$, $p=0.005$; $\rho=-0.25$, $p=0.042$). In the ratio of C1, there was a significant difference between high-grade (Grade 3) and low-grade (Grade 1 and 2) lesions ($p=0.008$) and receiver operating characteristic curve analysis revealed that the area under the curve of the ratio of C1 was 0.77, with sensitivity, specificity, positive predictive value and negative predictive value of 70%, 76%, 35% and 93%, respectively.

CONCLUSION

Cluster analysis of voxel-based ADC data using GMM algorism was effective for grading of endometrioid adenocarcinoma. The ratio of C1, which included low ADC data, was significantly correlated with the grades.

CLINICAL RELEVANCE/APPLICATION

Cluster analysis of voxel-based ADC data using GMM algorism was effective for grading of endometrioid adenocarcinoma and might improve preoperative diagnosis of the grades.

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GU239-SD-SUB5

Role of Sonosalpinogography in Female Subfertility: Diagnostic or Therapeutic Tool?

Sunday, Dec. 1 1:00PM - 1:30PM Room: GU/UR Community, Learning Center Station #5

Participants
Neha Jain, MD, New Delhi, India (*Presenter*) Nothing to Disclose
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PURPOSE

Sonosalpingography (SSG) has long been in radiology as a less commonly used tool for assessing the patency of fallopian tubes in subfertile females. It's significance is undermined by laparoscopic evaluation (LE) of tubal patency as latter also allows simultaneous therapeutic procedures to restore its patency, if the obstruction exists. But LE is invasive and expensive. Hence, we evaluated the role of SSG not only in diagnosis of tubal obstruction but also its role in diagnosing the cause and if possible relieving the obstruction.

METHOD AND MATERIALS

Fifty subfertile females with normal appearing uterus and ovaries on transvaginal ultrasonography were included in our study. SSG was performed to evaluate tubal patency by recording free peritoneal spill. If peritoneal spill was absent bilaterally then the patient underwent laparoscopic evaluation. However, if unilateral or bilateral peritoneal spill was noted, then patient was recruited for assisted reproductive techniques (ART) and the results were correlated with pregnancy.

RESULTS

Out of 50 patients, SSG was able to demonstrate free peritoneal spill at least unilaterally in 46 patients who conceived with ART. In rest of the four patient, with lack of bilateral spill on SSG, two revealed unilateral partial block while other two revealed bilateral tubal block. In all patients SSG correctly depicted the site of obstruction. In nine, patient it revealed PID (tubercular) by demonstrating flimsy peritubal adhesions and in 14 patients, higher pressure exerted during SSG restored the patency with sharp abdominal pain.

CONCLUSION

Our study reveals that SSG is not only a diagnostic Golden Old Tool but a New Therapeutic Platinum tool as well. Hence, SSG should be used more often and can be used to segregate patients who prudently need laparoscopic evaluation

CLINICAL RELEVANCE/APPLICATION

The study demonstrates the clinical relevance of sonosalpingography before more invasive hysterolaparoscopy in subfertile females especially in developing countries like India given the ease of procedure and comfort of the patient.

HP129-ED-SUB4

Interactive, Up-to-Date Meta-Analysis [iu-ma]: A Novel, Personalized Format to Bring the Latest High-Level Evidence to All Stakeholders Involved in Patient Care

Sunday, Dec. 1 1:00PM - 1:30PM Room: HP Community, Learning Center Station #4

Participants
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Soleen Ghafoor, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Chong Hyun Suh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Hebert Alberto Vargas, MD, Cambridge, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Meta-analyses/systematic reviews of randomized controlled trials (RCTs) are the highest level of evidence in clinical, evidence-based medicine The fundamental principles and most important metrics of meta analyses are reviewed on the example of MR-guided pathway vs. systematic prostate biopsy for cancer detection The reader will become familiar with the new format 'iu-ma', which allows for: continuous updating of the meta-analysis as new eligible studies are published personalized selection of study characteristics included in the analysis and interactive display of results tailored the individual treatment center or patient

TABLE OF CONTENTS/OUTLINE

Systematic review explained on the example of 'MR-guided pathway vs. systematic prostate biopsy for cancer detection' Systematic search Study exclusion/inclusion Study characteristics (biopsy naïve/MRI field strength/reporting etc.) Target metrics: Risk ratio Introduction to R/shiny Examples of use-cases for the interactive analysis (live demo or video/screencap) Ex1: a radiology department with a 3T MRI scanner, not using endorectal coils and reporting according to the PI-RADS v2 guideline. Ex2: a biopsy-naïve patient who received a 1.5T MRI without the use of PI-RADS in the report

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HP203-SD-SUB1

The Impact of Sociodemographic Factors in Breast, Prostate and Lung Cancer in the Patterns of Care Related to the Availability of Radiation Therapy (RT) in a Rural Mountain West State

Sunday, Dec. 1 1:00PM - 1:30PM Room: HP Community, Learning Center Station #1

Participants
Chad Cross, PhD, Las Vegas, NV (*Abstract Co-Author*) Nothing to Disclose
Parvesh Kumar, MD,BSC, Las Vegas, NV (*Presenter*) Nothing to Disclose
Karen Gutierrez, BS, Las Vegas, NV (*Abstract Co-Author*) Nothing to Disclose
Sheniz Moonie, PhD, Las Vegas, NV (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Access to cancer therapy is essential to its optimal management, and is often a function of many variables, including availability of facilities and oncologists. In states with large rural areas, many counties lack radiotherapy facilities and radiation oncologists. The objective of our study was to analyze the delivery of radiotherapy patterns in outpatient clinics in largely rural state as a function of sociodemographic factors.

METHOD AND MATERIALS

Data for years 2013-2017 were obtained from the Center for Health Information Analysis (CHIA). All cancer patients receiving RT were selected using CPT codes (final N=9578; 279,000 patients). Odds ratios were calculated using logistic regression to compare receipt of radiation therapy as a function of sociodemographic factors across all cancer types, and specifically for female breast, prostate, lung cancers.

RESULTS

Asian, Black, and Hispanic patients were more likely to receive RT than Whites for all major cancer types; most payer types were more likely than Medicare to receive RT; urban/rural patients were less likely to receive RT compared to metro areas for all major cancers ($p < .01$). Blacks were 3.5 times more likely than whites to receive RT for prostate cancer, and non-whites were generally at least 1.3 times more likely than whites to receive treatment for breast cancer. Lung cancer treatment was least likely among Hispanics (OR=0.25).

CONCLUSION

Disparities in delivery of RT treatments are linked with access to care in metro areas with more radiation oncologists and radiotherapy facilities. Patterns in the delivery of RT are related to both race and payer type. It is likely that more non-organ preservation treatments such as mastectomies (vs. lumpectomies) or radical prostatectomies may be more common in some groups, specifically for breast and prostate cancer, respectively, due to the lack of available radiotherapy facilities and/or radiation oncologists. The large relative OR for black prostate cancer patients requires further analysis. Our analysis demonstrates that access to optimal cancer therapy in our state is affected by sociodemographic factors related to the availability of RT.

CLINICAL RELEVANCE/APPLICATION

Patterns of care related to access has important implications, highlighting potential disparities based on race, payer type, and geography that can inform gap strategies for clinical care.

HP204-SD-SUB2

Improving Radiology Residents' Radiological Interpretation Through Formative Feedback with Eye Tracking

Sunday, Dec. 1 1:00PM - 1:30PM Room: HP Community, Learning Center Station #2

Participants
Ying Liang Low, MBBS, Singapore, Singapore (*Presenter*) Nothing to Disclose
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Sarah Mun Yee Koh, BS, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose
Swee T. Quek, MBBS, FRCR, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

While eye tracking has been applied extensively for the assessment of radiological performance, few studies have investigated its effect on radiological education, in which formative feedback is imperative. Augmenting an instructional approach with formative feedback supported with eye tracking should enable instructors to visualise how residents read X-rays, and provide customised feedback to the learner. This study aims to investigate the effectiveness of formative feedback, supported with eye tracking, in increasing accuracy and efficiency of X-ray interpretation among radiology residents.

METHOD AND MATERIALS

A computer-based eye tracking study simulating the Rapid Reporting component of the FRCR 2B examinations was designed to assess the longitudinal improvements in diagnostic performance. Radiology residents (n=12) were split into 3 groups and tasked to diagnose 4 sets of 30 X-rays (n=120) from different body parts that could either be normal or diseased, over the course of four months. Two experimental groups, consisting of junior residents (n=8), were given the answers and different forms of feedbacks after each set, while the control group of senior residents were only given the answers. Eye gaze patterns and eye tracking data were collected for all participants.

RESULTS

While preliminary analysis shows improvements in three metrics, (i) time taken to clear a normal x-ray, (ii) total fixation duration, and (iii) time to first mouse click, it is clear that both experimental groups recorded more prominent improvements than the control group. Similarly, accuracy in x-ray interpretation also improved. A multiple regression was run to predict accuracy of interpreting x-rays from the above three variables. $F(3,8) = 2.971$, $p = .097$, $R2 = .527$. While non-statistical significance can be attributed to small sample size (n=12), it is interesting to note that all three variables contribute to the prediction of accuracy of interpreting x-rays.

CONCLUSION

Formative feedback given with eye gaze pattern suggests an increase in accuracy and efficiency in X-ray reading by radiology residents compared to control subjects.

CLINICAL RELEVANCE/APPLICATION

Formative feedback with eye gaze pattern analysis may prove an effective tool for the radiological teacher to enhance the learning experience and efficiency of novice practitioners and has the potential to be included as part of routine radiological education.

HP205-SD-SUB3

Burnout, Professional Fulfillment and Intent-to-Leave amongst Radiologists in the United States (US): An Epidemiologic Study

Sunday, Dec. 1 1:00PM - 1:30PM Room: HP Community, Learning Center Station #3

Participants
Tova Kosowsky, Brighton, MA (*Abstract Co-Author*) Nothing to Disclose
Susannah Rowe, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Daniel Marchalik, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Mickey Trockel, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Mikhail Higgins, MD, Boston, MA (*Presenter*) Nothing to Disclose

PURPOSE

Burnout is highly prevalent among Radiologists,i,ii and is a well-documented threat to healthcare.iii To our knowledge, this study represents the first multicenter validated survey examining rates of burnout, professional fulfillment and intent-to-leave amongst Radiologists in the US. We compare our findings to survey results of overall benchmarks from the same study. iZha, N. et al. Prevalence of burnout among Canadian radiologists and radiology trainees. Canadian Assoc of Rad Jour, 69(4), 367-372. iiMcNeeley et al. (2013). The emotional wellness of radiology trainees: prevalence and predictors of burnout. Academic Rad, 20(5), 647-655. iiiHalbesleben et al. Linking physician burnout and patient outcomes. Health Care Manage Rev. 2008;33(1): 29-39.

METHOD AND MATERIALS

An electronic survey was sent to practicing physicians at 11 institutions participating in the Physician Wellness Academic Consortium (PWAC) from Jan 2017 - Sept 2018. Burnout, professional fulfillment and intent-to-leave were measured with a version of the Professional Fulfillment Index.iv Data was aggregated and deidentified by PWAC prior to release. ivTrockel et al. 'A brief instrument to assess both burnout and professional fulfillment in physicians: reliability and validity, including correlation with self-reported medical errors.' Academic Psych 42.1 (2018): 11-24.

RESULTS

The estimated response rate was 63%. Compared with all physicians, Radiologists had lower rates of burnout (31%vs 36%) and fulfillment (38% vs 41%) with higher rates of intent-to-leave (34% vs 32%). Male Radiologists reported lower rates of burnout (28% vs 31%) and fulfillment (42% vs 48%) with higher rates of intent-to-leave (38% vs 32%), while female Radiologists reported lower rates of burnout (36% vs 40%), fulfillment (30% vs 35%) and intent-to-leave (26% vs 31%) compared with stratified counterparts overall.

CONCLUSION

We provide benchmarks for burnout, professional fulfillment and intent-to-leave within Radiology. Although male Radiologists have lower burnout rates and higher rates of fulfillment compared with female Radiologists, they have increased rates of intent-to-leave. This calls for exploration into gender differences and predictors of intent-to-leave.

CLINICAL RELEVANCE/APPLICATION

This study describes benchmarks of burnout, professional fulfilment and intent-to-leave within Radiology that will allow for further evaluation of drivers of this epidemic.

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IN005-EB-SUB

Assessing the Accuracy, Reproducibility and Repeatability of Novel Quantitative Approach to MRCP Imaging

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Hardcopy Backboard

Participants
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Rajarshi Banerjee, MD,DPhil, Oxford, United Kingdom (*Abstract Co-Author*) CEO, Perspectum Diagnostics Ltd

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Conclusion

Analysing MRCP scans using a quantitative assessment produces reliable, accurate and reproducible measures on both phantoms and biliary ducts regardless of scanner. Our analysis provides potential for applications in clinical settings.

Background

Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive imaging technique used to evaluate pancreatobiliary disease. Despite its widespread use, many limitations exist including variability in scan interpretation and duct depiction. MRCP+ is a new tool for objective and quantitative assessment of biliary duct morphology. Here, we assess the accuracy of MRCP+ on 3D-printed phantoms, the scan-rescan repeatability, and the reproducibility across several MRI scanners, to demonstrate the potential of quantitative MRCP processing.

Evaluation

In vitro and *in vivo* performance testing of the accuracy and repeatability of the device was assessed using 3D-printed phantoms and MRCP scans of hepatobiliary disease patients (n=10 biliary disease, n=10 parenchymal disease) and healthy subjects (n=20) on a variety of scanners, including Siemens Prisma 3T, Siemens Avantofit 1.5T, GE Discovery 3T and GE Optima 1.5T. Models were produced using novel diameter quantification techniques and an intelligent path search algorithm after multi-scale Hessian tubular enhancement and gradient vector flow analysis.

Discussion

In vitro performance testing demonstrated a high accuracy across scanners with a range of 98-100% stable match, -0.9-0.5mm limit of agreement (LoA); with a range of bias from 0-0.2mm from ground truth. Repeatability across scanners revealed a 0mm bias and -0.3-0.3mm LoA. Reproducibility across scanners revealed a bias of -0.3-0mm and LoA of 0.5mm to -0.6mm. *In vivo* performance profiles were demonstrated for tree volume (95% LoA for repeatability of -3.5-3.4ml and reproducibility of -1.5-2.8ml; normal reference interval [NRI]: 1-9ml), gallbladder volume (95% LoA for repeatability of -9.4-4.4ml and reproducibility of -8.0-12.0ml; NRI: 7-40ml), and duct diameter measures for the common hepatic (NRI: 2.6-6.4mm), cystic duct (NRI: 1.3-4.7mm), left-hepatic (NRI: 2.3-5.2mm), right hepatic (NRI: 2.3-5.3mm), pancreatic (NRI: 1.4-4.2mm) with a CoV of 13%.

IN006-EB-SUB

Reproducibility of Quantitative Features in Prostate mpMRI

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Hardcopy Backboard

Participants
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Yoganand Balagurunathan, PhD, Tampa, FL (*Presenter*) Nothing to Disclose

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Conclusion

We have shown that some quantitative imaging features are reproducible across sequential prostate mpMRI acquisition at a preset level of filters. A validated set of reproducible image features in mpMRI will allow us to develop a clinically reliable malignance risk stratification score. This will enable the possibility of using imaging as a surrogate to invasive biopsies

Background

Multiparametric magnetic resonance imaging (mpMRI) has emerged as a non-invasive modality to diagnose and monitor prostate cancer. Quantitative metrics on the regions of abnormality in prostate mpMRI has shown to be predictive of clinically significant cancer defined by Gleason grade groups. In this study we evaluate the reproducibility of quantitative imaging features using repeated mpMRI on the same patients.

Evaluation

We retrospectively obtained the de-identified records of 15 patients, who underwent two mpMRI scans within 2 weeks of the first baseline scan. The patient records were obtained from the Brigham and Women's Hospital, Harvard Medical School, shared as de-identified patient images through the TCIA (The Cancer Imaging Archive) repository and analyzed in our institution through an IRB-approved HIPAA-compliant retrospective study protocol. Indicated biopsied regions were used as a marker for our study radiologist to delineate the regions of interest (see Figure 1). We extracted 308 quantitative features in each mpMRI modality (T2w and ADC with b value of 0 and 1400 mm/s2) across the two sequential scans. Concordance correlation coefficients (CCC) were computed on the features extracted using sequential scans. Redundant features were removed by computing the coefficient of determination (R2) among features and replaced with a feature that had highest dynamic range within the intercorrelated groups.

Discussion

We have assessed reproducibility of quantitative imaging features among sequential scans and find that there were 19 T2w features and 2 ADC features that were reproducible (CCC >= 0.65) and non-redundant (R2 >= 0.99). We also found that z-transformation of the images prior to feature extraction reduced the number of reproducible features to 12 in T2w and 3 in ADC with similar cutoffs (See Table 1 & 2).

IN007-EB-SUB

Correlation between Texture Features of Abdominal Skeletal Muscles and Recurrent Gastroesophageal Hemorrhage After Secondary Prophylaxis in Cirrhosis

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Hardcopy Backboard

Participants
Yingying Liu, Shanghai, China (*Presenter*) Nothing to Disclose
Ji Zhou, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Mengsu Zeng, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Lei Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Shiyao Chen, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

Conclusion

Two shape features, i.e., mesh volume and voxel volume, and two gldm features, i.e. dependence non-uniformity and gray level non-uniformity were found to have close association with rebleeding after endoscopic treatment of cirrhotic gastroesophageal varices. This study shows that they may be used potential image indicators in the assessment of patients' re-bleeding risks.

Background

This study is to explore the correlation between the texture features of the skeletal muscle at L3 level and the prognosis of patients with gastroesophageal varices. We hypothesized that the texture characteristics of the muscle were correlated with the rebleeding risk after endoscopic treatment of cirrhotic esophagogastric varices and might be used as potential indicators for screening of treatment outcome

Evaluation

The CT scans and clinical records of 109 patients with gastroesophageal varices were retrieved with the research ethic board approval in Zhongshan hospital. The abdomen CT scans were collected from a 320-detector-row CT scanner (Aquilion ONE ViSION, Canon, Japan). 110 texture features of abdomen CT at L3 level abd a non-textured feature Skeletal Muscle Index (SMI) were computed. Spearman's rank correlation coefficient (Spearman's rho) was applied to study the correlation between SMI and texture features. Log-rank test was used to evaluate the morbidity of gastroesophageal varices bleeding between the two groups of patients based on texture features.

Discussion

According to that the Spearman's rho between SMI and texture feature is larger than 0.5 and the P value of the logRank test of the texture feature with respect to the re-bleeding time is smaller than 0.05, four texture features were determined with their optimal percentiles as thresholds, including two shape features (Mesh Volume and Voxel Volume) and two gldm features (Dependence Non-Uniformity and Gray Level Non-Uniformity). It can be seen from Tab.1 that, there was a significant difference in the incidence of rebleeding between the two groups distinguished by the four features with their optimal percentile values as cut-offs.

IN010-EB-SUB

High-Resolution Medical Image Generation and Disentanglement Using Progressive Growing of Generative Adversarial Networks: Possible Applications and Limitations

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Hardcopy Backboard

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Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Won-Jung Chung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sungwon Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is: To overview the methodologies of generative adversarial networks (GANs) To present the examples of progressive growing of GAN (PGGAN)-generated high-resolution medical images (X-ray and head/chest/abdomen CT) and visual scoring methods To demonstrate the disentanglement of latent spaces of GANs To discuss the applications and limitations of GANs in medical imaging

TABLE OF CONTENTS/OUTLINE

- Generative adversarial networks (GANs) - Examples of PGGAN-generated medical images X-ray (normal / abnormal) Head CT (normal) Chest CT (normal) Abdomen CT (normal) - Visual scoring methods - Disentangle of latent space of GANs - Applications and limitations of GANs - Summary

IN025-EC-SUB

Clinical Decision Support System Designed for Radiologists Employing Common Data Elements and Diagnostic Templates

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
David J. Vining, MD, Houston, TX (*Presenter*) Royalties, Bracco Group; CEO, VisionSR; Stockholder, VisionSR
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Cristian Popovici, Houston, TX (*Abstract Co-Author*) Employee, Patrisoft Outsourcing
Adrian Prisacariu, Houston, TX (*Abstract Co-Author*) Employee, Patrisoft Outsourcing
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Conclusion

A CDS system has been developed to guide radiologists during the reporting process. Potential benefits of radiologist-directed CDS include more complete radiology reports, guidance when applying clinical guidelines, avoidance of errors, and increased quality of care.

Background

Clinical decision support (CDS) in radiology often refers to applications that present clinical guidelines to clinicians to aid in the ordering of appropriate examinations. On the other hand, CDS designed for radiologists intends to guide the communication of actionable results; however, these systems are not widely available today. We have developed a structured reporting system that incorporates common data elements (CDEs) linked to diagnostic findings and a concept known as "diagnostic templates" (DTs) to trigger appropriate actions when certain finding details are dictated in order to improve the radiology report.

Evaluation

We developed a structured reporting system that captures key images and a radiologist's voice descriptions of findings, tags the images with metadata describing the anatomy, diagnosis and CDEs for each finding using natural language processing (NLP) referenced to an ontology, and assembles a multimedia structured report. We employ DTs to match sets of CDEs to an action that can modify the report, such as renaming a finding with more precise terminology, suggesting recommendations for follow up, labeling a finding with an ACR RADS score, or staging a tumor.

Discussion

As a radiologist dictates a report, the NLP identifies the anatomy and diagnosis from which it presents a visual display of CDEs to guide a radiologist in what to describe. As the radiologist dictates salient features, the CDEs are populated, and the DTs running in the background match patterns of CDEs to appropriate actions. The radiologist has the ability to overwrite any DT-triggered action before the final report is signed. Compliance checking is incorporated to alert the radiologist if laterality is not assigned, incorrect gender anatomy is dictated, or when critical CDE descriptions are missing. The purpose of the system is to guide radiologists to produce a more complete report in order to enhance clinical decision-making.

IN140-ED-SUB6

Artificial Intelligence-Driven Imaging for Ultra-Fast MRI: Cutting-Edge Technology and Clinical Application

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Station #6

Awards
Cum Laude

Participants
Kensuke Umehara, PhD, Chiba, Japan (*Presenter*) Nothing to Disclose
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Junko Ota, PhD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Magnetic resonance imaging (MRI) is an essential imaging modality due to its superior tissue contrast resolution. However, the acquisition of MR images requires relatively long scan time. Artificial intelligence (AI) imaging technology which can reconstruct 'realistic' high-resolution or denoised images from low-resolution or noisy images has recently attracted much attention in medical imaging. It has potential to provide an effective approach for accelerating MRI. The teaching points of this exhibit are to (1) review an overview of the conventional ultra-fast MRI technologies, (2) learn about the technical principles of AI imaging using convolutional neural networks (CNNs) and generative adversarial networks (GANs), and (3) demonstrate the benefits and effects of AI imaging for reconstructing high-quality MR images while reducing MRI scan time.

TABLE OF CONTENTS/OUTLINE

1. Introduction: Review the conventional ultra-fast MRI technologies. 2. AI imaging: Provide a technical overview of CNN-AI and GAN-AI imaging. 3. Proof of concept of AI-MRI: Present a concept of AI-MRI using AI imaging for reconstructing high-quality MR images. 4. AI-MRI showcase: Showcase comparison examples of CNN-AI and GAN-AI images in clinical cases. Demonstrate the effect of AI imaging for significantly reducing the MRI scan time.

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IN219-SD-SUB1

A Proper Statistical Method for Comparing Diagnostic Performances Between Stand-Alone Artificial Intelligence System and Multiple Readings from Multi-Reader Diagnostic Performance Study

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Station #1

Participants
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CONCLUSION

A proper statistical method to compare diagnostic performance of stand-alone computer-aided detection (CADe) and diagnosis (CADx) system and multireader readings is proposed. It can be used to demonstrate noninferiority or equivalence of AI-alone software compared to multireader performances.

Background

Multireader multicase ROC curve analysis is being used to analyze the diagnostic performance for computer-aided diagnosis. An alternative free-response ROC curve analysis is popularly being employed to analyze that of detection task. These required fully-crossed e.g., before and after software-assisted. However, when comparing between stand-alone system and multiple readings from human readers, proper statistical methods are not well known. A simple approach is taking average for area under the curves (AUC) then comparing between the AUCs of reader-averaged and stand-alone software, however, it ignores a reader variability. On the other hand, arbitrarily transformed data can be used to perform analysis, replicating CAD data as many times as the number of readers or inserting them as one of readers. We propose a statistical method to compare diagnostic performance of stand-alone artificial intelligence (AI) system with readings from multireader.

Evaluation

A simulation study considering various AUC values, reader variability, and the number of readers and cases was conducted to compare four statistical approaches (average, single, dual, proposed) with respect to the empirical significance level and coverage probability for testing the difference of the AUCs. We applied to a real-world data from an observer-performance study.

Discussion

When proposed method was applied, the empirical significance level (type I error) from various simulation scenarios were closer to the nominal significance level of 0.05, and the coverage rate-that is, the proportion of the time that the confidence interval contains the true difference of AUCs or pre-defined margin to declare non-inferiority of stand-alone software compared to readers-were at nominal one (95%).

IN243-SD-SUB2

Understanding Potential Customers of an In-House 3D Print Lab - A Survey amongst Physicians of Their Awareness, Needs and Comprehension of 3D Printing Technology

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Station #2

Participants
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PURPOSE

With 3D print labs (3DPL) becoming increasingly common in hospitals, this study surveys the physicians of a medium-sized hospital to better comprehend their needs and current know-how of this technology as well as their awareness of the in-house 3DPL.

METHOD AND MATERIALS

All physicians of our hospital and two affiliated research institutions (n=1086) were invited to participate in an online-survey containing 25 question regarding demographics, potential use-cases for 3D printing and location of the lab within the hospital. Additionally participants were asked to estimate cost, preparation and printing time of a simple and complex 3D printed model to evaluate their know-how of the technology.

RESULTS

193 responses were collected (17% response rate) with most responses from the anesthesiology department. 98% of participants knew about the existence of the 3DPL in our hospital. 33% had considered to order a 3DP. While 61% knew that a 3D print can be ordered from the electronical medical record (EMR), only 11% had used this function. Only 25% were able to identify the physical location of the 3DPL. The simple 3D model was overestimated regarding cost, preparation and printing time; the complex 3D model was underestimated regarding preparation and printing time while costs were correctly identified. Potential use cases were research (45%), planning (26%) and patient communication (20%).

CONCLUSION

Our study shows that while most referring physicians know about the existence of the 3DPL in our hospital only 11% had ordered a print via the EMR. This is contrary to the 33% that had already considered to place a 3DP order. This discrepancy might be explained with the complexity of the order process, the uncertainty about preparation and printing time and costs or generally not enough information about 3D printing in general.

CLINICAL RELEVANCE/APPLICATION

To be able to expand the service on an in-house 3DPL it is essential to understand the needs of potential referring physicians. Our study shows optimization potential regarding communication of 3D printing technology and the workflows to order a 3DP print.

IN268-SD-SUB4

Implementation of a Clinical Decision Support System for Alerting the Physician to Repeat Imaging Examination Orders

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Station #4

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CONCLUSION

The CDSS developed at our institution to notify physicians of potentially unnecessary examinations appears to be an effective tool for optimizing medical imaging. Further customization according to the requirements of each specialty will maximize its effectiveness.

Background

In imaging examinations using radiation, dosage reduction and optimization are imperative. However, for appropriate radiation exposure, it is essential to reduce and optimize the dosage and avoid unnecessary examinations. One example is repeat imaging examination (RIE) over a short period. We constructed a clinical decision support system (CDSS) by JJ1017 to detect when the same examination is being ordered again over a short period and accordingly alert the referring physician. The purpose of the study is to evaluate the effectiveness of the CDSS in eliminating unnecessary RIE.

Evaluation

A 'repeat' order is defined as an order placed within 30 days of the previous examination except for orthopedic (set at 10 days, as these patients undergo more frequent X-rays by necessity). From the system logs, the following was analyzed: user's behavior after system operation; reasons for RIE; comparison of distinctive departments and consideration of improvement measures. In a total of 37387 orders (CT, MRI, X-rays) over a 13-month period, CDSS detected 2353 (6.3%) as 'repeat', of which 6.5% (152/2353) were canceled. Most of the RIE orders were placed by pulmonologists (47.5%), and the most common reason was 'required as a designated protocol'.

Discussion

We performed a simulation by changing the definition of RIE for respiratory; the number of RIE dropped to 9.5%, which is the same percentage as orthopedic, when a 'repeat' was defined as an order placed within 6 days of the previous examination. An appropriate definition of a 'repeat' best customized to each department seems essential to develop an effective CDSS and to avoid 'alert fatigue'. In JJ1017, there are 200 or more codes representing body parts (cf.,RadLex: approximately 20 parts). The use of JJ1017 is expected to facilitate discrimination of RIE taking the detailed body parts into account and to help improve the quality of the CDSS.

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IN274-SD-SUB3

Feasibility of Adaptive Statistical Iterative Reconstruction-V Algorithm Combination with 80kV for Reducing Radiation Dose and Contrast Agent in Computed Tomography Portal Venography: comparison with Adaptive Statistical Iterative Reconstruction

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Station #3

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PURPOSE

To explore the feasibility of reducing radiation dose and contrast agent in computed tomography portal venography (CTPV) with the combination of 80kV and adaptive statistical iterative reconstruction-V(ASIR-V)when compared with adaptive statistical iterative reconstruction(ASIR).

METHOD AND MATERIALS

Sixty patients for CT portal venography(CTPV) imaging were randomly divided into group A and group B. Group A used 120kV tube voltage and 600mgI/kg contrast agent and was reconstructed with 40%ASIR on GE HD750 CT. Group B used 80kV tube voltage and 350mgI/kg contrast agent and was reconstructed with 40%ASIR-V,60%ASIR-V,80%ASIR-V and 100%ASIR-V on GE Revolution CT.The CT values and standard deviation (SD) of the main portal vein (MPV),left branch of portal vein (LPV),right branch of portal vein (RPV) were measured to calculate the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR).The image quality was subjectively scored by two experienced radiologists blindly using a 5-point system.The effective dose (ED) was calculated.Measurements were statistically compared with $p<0.05$ being statistically significant.

RESULTS

There was no difference in general data between two groups($p>0.05$).The contrast agent(22.14±2.59g) and effective radiation dose(2.14±0.21mSv) in group B reduced by 39.7% and 63.3% than those in group A(36.72±4.36g and 5.83±2.18mSv)($p<0.001$).The CT values did not change with the increase of ASIR-V strength,while the SD values gradually decreased and SNR values and CNR values increased accordingly.The SD values with 80%ASIR-V and 100%ASIR-V were lower and SNR values and CNR values were higher than the 40%ASIR(Table 1 and Table 2).The subjective scores on image quality by two radiologists had excellent agreement (Kappa>0.80),and subjective scores with 60%ASIR-V,80%ASIR-V and 100%ASIR-V were significantly higher than 40%ASIR($p<0.001$), and 80%ASIR-V provided the highest subjective score(Table 3).

CONCLUSION

Compared with 40%ASIR reconstruction,CTPV using 80kV and ASIR-V algorithm can significantly reduce radiation dose (63.3%) and contrast agent (39.7%),80%ASIR-V and 100%ASIR-V can achieve better image quality while 80% ASIR-V is the best reconstruction strength for CTPV using 80kV.

CLINICAL RELEVANCE/APPLICATION

CTPV with the combination of 80kV and ASIR-V algorithm can reduce the radiation dose and iodine dose compared with ASIR, and combination with 80%ASIR-V can provide the best images.

IN276-SD-SUB5

The Value of Radiomics in the Quality Control of Low-Dose CT Examinations of Solid Pulmonary Nodules - A Phantom Study

Sunday, Dec. 1 1:00PM - 1:30PM Room: IN Community, Learning Center Station #5

Participants
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CONCLUSION

Radiomics analysis can effectively evaluate and control the low-dose CT image quality of solid pulmonary nodules and may potentially supersede conventional CT image quality evaluation methods.

Background

Low radiation dose CT has been widely used in lung cancer screening. However, the image quality obtained by too low radiation dose is poor, which will affect the accuracy of pulmonary nodule analysis. Obviously, AI (Artificial intelligence) provides an accurate analysis basis for the detection and diagnosis of pulmonary nodules, which could be used to image quality evaluation take the place of SNR and CNR. This study aims to use radiomics method to analyze CT scan quality of simulated human models with thoracic pulmonary nodules, exploring the image quality control methods under low radiation doses.

Evaluation

A total of 41 texture parameters were obtained by CT Kinetics (C.K., V1.20A, GE Healthcare) software. R language (R Version 3.4.1) was adopted to analyze the extracted features by principal component analysis (PCA), and the result showed that three texture parameters including Uniformity, VoxelValueSum and HaralickCorrelation were picked. Furthermore. ANOVA was applied for the above three parameters under different tube voltage and tube current to evaluate the value of each parameter in image quality. When the tube voltage reduced from 140 kVp to 120 kVp, there was no difference ($p=0.117$) found in the Uniformity, while from 120 kVp to 80 kVp significant differences revealed ($p=0.000$). At 100 kVp, when tube current >60 mA or at 80 kVp, when tube current >90 mA, Uniformity did not change significantly. It showed that good image quality can be obtained. There was no correlation between other parameters and radiation dose.

Discussion

Our phantom studies showed that for the solid nodules, the trend of CNR and SNR decreased with the reduction of radiation dose, but there was no obvious inflection point. Therefore, it was impossible to accurately evaluate image quality. We found that among all the feature parameters extracted by radiomics, Uniformity has obvious inflection point under low radiation dose, which indicates that Uniformity can be used to evaluate image quality.

MI111-ED-SUB4

Peptide Receptor Radionuclide Therapy (PRRT): 2019 Update

Sunday, Dec. 1 1:00PM - 1:30PM Room: MI Community, Learning Center Station #4

FDA Discussions may include off-label uses.

Participants
Courtney A. Lawhn-Heath, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

-In Peptide Receptor Radionuclide Therapy (PRRT), a radioligand targets cell membrane proteins to selectively internalize radiation to tumor cells. -In the NETTER-1 trial, Lu-177 DOTATATE was found to prolong progression-free survival in midgut neuroendocrine tumor (NET) patients, leading to FDA approval in January 2018. -Early retrospective trials have found high efficacy of 177Lu-PSMA-617 in castrate-resistant prostate cancer (CRPC) compared to other systemic therapies.

TABLE OF CONTENTS/OUTLINE

1. Introduction to theranostics a. Concept of using a molecule for both imaging and therapy b. Review existing theranostic agents 2. Background on neuroendocrine tumors (NETs) a. Classification and types of NETs b. Existing treatments for NETs 3. Peptide receptor radionuclide therapy (PRRT) in NETs a. Introduce DOTA-TATE and PRRT b. Review results of NETTER-1 trial c. Compare results to previous non-randomized trials d. How is 177Lu-DOTA-TATE administered? e. Variations: 90Y vs. 177Lu, intra-arterial vs. intravenous, combination therapies 4. Background on castrate-resistant prostate cancer (CRPC) a. Disease characterization b. Existing therapies for CRPC and their efficacy 5. PRRT in CRPC a. Introduce PSMA and PRRT b. Review current early studies of 177Lu-PSMA-617 c. Review possible future directions

MI202-SD-SUB1

Ultrasound-Mediated Targeted Delivery of Dexamethasone Using Phase-Change Nanodroplets for the Treatment of Rheumatoid Arthritis

Sunday, Dec. 1 1:00PM - 1:30PM Room: MI Community, Learning Center Station #1

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PURPOSE

To develop an ultrasound-responsive nanosystem for the targeted treatment of rheumatoid arthritis (RA).

METHOD AND MATERIALS

The Dex-NDs-FA consisting of a lipid shell, perfluoro-n-pentane core and Dex were synthesized using a thin-film hydration and sonication method. The size and zeta potential were measured by dynamic light scattering and the morphology was observed using the TEM. Dialysis diffusion method was used to investigate the efficiency of Dex release and the thermal evaporation of Dex-NDs-FA was visualized using CEUS mode. For in vitro cell testing, the cytotoxicity and cellular uptake of Dex-NDs-FA conducted on RAW 264.7 cells were assessed by MTT tests, flow cytometry and confocal laser scanning microscopy, respectively. Moreover, the in vivo anti-inflammatory efficiency was observed after intravenous injection of Dex-NDs-FA into collagen-induced arthritis (CIA) rats. The statistical significance among the groups was performed with one-way ANOVA.

RESULTS

The Dex-NDs-FA were spherical in shape with an average size of 311.6 ± 3.8 nm and zeta-potential of -3.11 ± 0.15 mV. The 1 MHz ultrasound (US) could enhance the drug release and the total cumulative release rates of US-treated group was 85.6 ± 4.3%. In addition, the contrast signals measured by the diagnostic US proved that the occurrence of vaporization was depended on temperature. The US-mediated high-concentration of Dex-NDs-FA showed the highest in vitro cytotoxicity on activated RAW264.7 cells ($p<0.05$), and the cellular uptake tests demonstrated that nanodroplets modified with folate could enhance the uptake of activated cells. Moreover, the US-mediated Dex-NDs-FA exhibited excellent inhibition of synovitis and joint destruction in CIA rats.

CONCLUSION

The Dex-NDs-FA were successfully synthesized with around 300 nm in diameter, which showed good feasibility for passive targeting delivery into inflammatory tissue through EPR effect. Moreover, the Dex-NDs-FA could be effectively internalized by cells and show cytotoxicity on macrophages in high-concentration drug with US. Furthermore, the significant suppression of inflammation were achieved in vivo through the Dex-NDs-FA with US, acting as an efficient targeted agent for RA therapy.

CLINICAL RELEVANCE/APPLICATION

Our work offers a new strategy to the treatment of RA and US-mediated phase-change nanodroplets would have a great potential for the application in the areas of theranostic agent and medical treatment.

MI203-SD-SUB2

Relationship between Parameters of Intravoxel Incoherent Motion Diffusion-Weighted Imaging with Ki-67 Level in Cervical Cancer

Sunday, Dec. 1 1:00PM - 1:30PM Room: MI Community, Learning Center Station #2

Participants
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PURPOSE

Based on diffusion weighted imaging(DWI) and intravoxel incoherent motion diffusion weighted imaging(IVIM-DWI),to explore whether there is a statistical difference between the Ki-67 level and apparent diffusion coefficient(ADC) value,IVIM-DWI multi-parameter value (D value, D* value and f value) in cervical cancer.

METHOD AND MATERIALS

A retrospective study was performed on totally 67 patients with cervical cancer confirmed by surgery. All patients underwent multiple b-values(b=0,10,20,50,100,200,400,800,1000,2000 s/mm2)DWI before any anticancer treatment. The patients were divided into low expression group (Ki-67 <50%) and high expression group (Ki-67>=50%) according to the expression level of Ki-67. Relationship between the ADC value,the quantitative parameters from IVIM and the expression level of Ki-67 was assessed using independent sample t-test.

RESULTS

In high Ki-67 group, the mean D, D* and f value had significantly differences compared with those of the low Ki-67 group[(0.60±0.13)×10-3mm2/s vs (0.51±0.14)×10-3mm2/s,p=0.037,AUC=0.684; (19.48±14.18)×10-3mm2/s vs (8.85±6.53)×10-3mm2/s,p<0.001, AUC=0.760; (0.28±0.14)×10-3mm2/s vs (0.41±0.15)×10-3mm2/s,p=0.011, AUC=0.232].While the mean ADC value had no statistical significance between two groups((0.77±0.10)×10-3mm2/s vs (0.74±0.08)×10-3mm2/s,p=0.413).

CONCLUSION

The pre-treatment quantitative parameters D,D* values from IVIM model are of great value in predicting the Ki-67 level of the cervical cancer. Suggesting that the Ki-67 level can be predicted by non-invasive imaging examination, and thus clinical guidance can be provided.

CLINICAL RELEVANCE/APPLICATION

Ki-67 level can be predicted by non-invasive imaging examination and clinical guidance can be provided.

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MI216-SD-SUB3

Longitudinal Analysis of Molecular Imaging Identifies Short Term Recurrence in Glioblastoma Treated with Bevacizumab

Sunday, Dec. 1 1:00PM - 1:30PM Room: MI Community, Learning Center Station #3

Participants
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PURPOSE

To test the capability to aid prediction of clinical outcome, including 6-month and 12-month progression, and overall survival (OS) in recurrent glioblastoma treated with bevacizumab using amide proton transfer-weighted (APTw) imaging and diffusion-weighed imaging.

METHOD AND MATERIALS

Multimodal MRI of 40 patients treated for recurrent glioblastoma were retrospectively selected at 4 time points: baseline, initial follow up after bevacizumab, during true progression, and at the last visit. The patients were divided into 2 groups depending on conventional MRI suggests progression at 6 month or at 12 month. The APTw and apparent diffusion coefficient (ADC) values were calculated for each tumor voxel. Changes in tumor volume, APTw, and ADC during the baseline to the initial follow up were compared between progression and non-progression group, and then tested as predictors of OS, using Mann-Whitney U test and Cox proportional hazards regression model.

RESULTS

The initial follow up was performed at 40 days (median). After bevacizumab, 12 patients showed progression at 6 month and 20 patients showed progression at 12 months. Initial APTw decrease was pronounced in non-progression group compared to progression group at either 6 month (average APTw decrease 0.396%; 95% confidence interval [CI] 0.24-0.92% in non-progression group vs. 0.013%, 95% CI 0.063-0.38% in progression group, P =.04) or at 12 month (average 0.67%, 95% CI 0.378-1.173% vs. 0.157%, 0.00-0.445%, P =.031). Initial ADC decrease or tumor volume decrease was not significantly different between the two groups. No imaging predictor including initial and early reduction of APTw, ADC, and tumor volume, however, becomes a significant predictor for OS.

CONCLUSION

Reduction in APTw signal can become an early imaging biomarker compared to diffusion-weighted imaging or tumor volume change, to predict short-term stability after anti-angiogenic treatment.

CLINICAL RELEVANCE/APPLICATION

We recorded longitudinal MRI data of amide proton transfer-weighted and diffusion-weighted imaging and reported early change of molecular imaging can become an imaging biomarker for predicting treatment response in patients with recurrent glioblastoma. Use of this method will improve patient care by providing clinicians to better anticipate short-term outcome of patients.

MK297-ED-SUB10

MR Neurography Applied to Carpal Tunnel Release Surgery: How to Interpret and Surgical Implications

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #10

Participants
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TEACHING POINTS

This presentation aims to demonstrate: 1. How to define the most appropriate magnetic resonance imaging sequences for visualization of wrist structures for carpal tunnel syndrome decompressive surgery mapping 2. How to assess pathological alterations in the median nerve and surrounding structures in carpal tunnel syndrome 3. How to identify wrist anatomical structures 4. What to report when performing pre- and post-operative wrist imaging for carpal tunnel surgery or follow up

TABLE OF CONTENTS/OUTLINE

1. Magnetic resonance sequences to visualize wrist structures and their specificities a) T1 b) PSIF c) SPACE-STIR d) SPACE-DP-FS e) T2-TSE-FS 2. Interpreting an MR neurography in carpal tunnel syndrome 3. Reporting the findings for better surgical planning a) Median nerve pathological aspects b) Thenar motor branch exiting c) Surrounding anatomical structures 4. Advantages of pre-operative MR neurography in carpal tunnel syndrome surgery

MK298-ED-SUB6

Musculoskeletal Manifestations of HIV Infection: A Pictorial Review

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #6

Awards
Magna Cum Laude

Participants
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TEACHING POINTS

1. To review the pathogenesis of the most common musculoskeletal complications of HIV infection and AIDS. 2. To illustrate the radiological findings of the infectious, inflammatory, and neoplastic complications affecting the musculoskeletal system in patients with HIV. 3. To describe the imaging appearance and significance of other miscellaneous musculoskeletal disorders affecting HIV/AIDS population, including those related to antiretroviral therapy.

TABLE OF CONTENTS/OUTLINE

Pathogenesis of HIV-related musculoskeletal disorders - Infectious complications - Inflammatory processes -Oncogenesis - Osteoporosis Imaging appearances of musculoskeletal infection in HIV/AIDS -cellulitis -abscesses -necrotizing fasciitis -pyomyositis -septic arthritis -pyogenic osteomyelitis -discitis-osteomyelitis -mycobacterial infections Imaging of HIV/AIDS- related inflammatory musculoskeletal processes - Reiter's syndrome -Psoriatic arthritis -Polymyositis -Primary HIV arthropathy -Hoffitis -Vasculitis HIV-related neoplasms -Kaposi's sarcoma -Non-Hodgkin's lymphoma -Leyomyosarcoma Miscellaneous musculoskeletal conditions in HIV-positive and AIDS patients - Osteonecrosis -Osteoporosis -Bone marrow disorders -Rhabdomyolysis -Hypertrophic osteoarthropathy -Bacillary angiomatosis

MK299-ED-SUB7

Easier to Catch Than a "Can of Corn": MRI and MRI Arthrogram of Shoulder Injuries in the Throwing Athlete

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #7

Participants
Maria Rebeca Arizaga Ramirez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Carlos Casian Ruiz Velasco, MD, Distrito Federal, Mexico (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

After the exhibit the reader would be able to, • Identify anatomic structures of the shoulder in MRI • Learn the kinematics of throwing • Understand the anatomical adaptations of the shoulder in the throwing athlete • Review the MRI and MRI arthrogram techniques • Recognize the imaging features of the most common shoulder injuries in the throwing athlete

TABLE OF CONTENTS/OUTLINE

• Introduction • Kinematics of Throwing • Anatomical Adaptations • MRI and MRI arthrogram protocols • Pathological Conditions • Consequences of Adaptive External Rotations a. Glenohumeral internal rotation deficit (GIRD) b. Internal Impingement c. Rotator Cuff Tears d. Labral Tears (SLAP) • Anterior Shoulder Injuries a. Anterior Capsule Injury • Posterior Shoulder Injuries a. Bennett lesion • Overuse Injuries • Key Points

MK300-ED-SUB8

Traumatic Thoracolumbar Spine Injuries: How to Help the Spine Surgeon

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #8

Participants
Silmara R. Coelho, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Julia E. Castro Anaya, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Mariana D. Silva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Leonardo M. Sugawara SR, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

• Mechanical stability is a critical factor for treatment decision making in patients with traumatic spinal injury. Stability of the spine is defined as the ability to prevent progressive deformity and the development of neurological injury, which depends on the integrity of the bone and ligament components. Injuries to one or both may result in instability of the spine requiring surgical stabilization. • Classification of vertebral fractures serves to facilitate communication and to develop optimal treatment protocols. Many classification systems were proposed, but none achieved universal adoption. The proposed systems have used several lesion characteristics as basis for classification, such as mechanism of inferred lesion, bone morphology, anatomical determinants of fracture stability and neurological status. • It is important, therefore, that radiologists are aware of the most important classifications of thoracolumbar spine lesions, since these conditions can be serious and potentially morbid and threatening, making a rapid and accurate diagnosis essential.

TABLE OF CONTENTS/OUTLINE

• Introduction: to review classifications of thoracolumbar fractures focusing in AO/TLICS (Thoracolumbar Injury Classification and Severity Scale). • Case-based review pictures and illustrating with some cases of our centre.

MK301-ED-SUB9

Make No Bones About: Quiz Based, Imaging of Vertebral Bone Tumors

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #9

Participants
Suman T. Prabhakar, MBBS,MD, Bangalore, India (*Presenter*) Nothing to Disclose
Sunitha P Kumaran, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
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Jainesh V. Dodia, MBBS,MD, Bangalore , India (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

• To enlist the various spectrum of vertebral tumors based on multiplicity and location. • To discuss the key imaging findings of each with emphasis on associated complications and treatment response.

TABLE OF CONTENTS/OUTLINE

We review spectrum of spine tumors with discussion in a quiz based format based on benign vs malignant and common location. The presentation has 12 different bony spinal tumors with discussion in a quiz based format. • Each new case has a brief clinical history at the top of the slide. • All questions have only one correct answer among the choices provided and some others require textual responses. • The discussion of that pathological entity follows the slides with the questions. • The following spinal tumors are discussed: Benign: Hemangioma, Osteoid osteoma, Osteoblastoma, Giant cell tumor, Osteochondroma, Aneurysmal bone cyst, Eosinophilic granuloma Malignant: Metastases, Myeloma, Lymphoma, Chordoma, Chondrosarcoma Plain radiographs, CT and MR imaging are very useful in characterizing and making a diagnosis or to suggest alternative evaluation in cases when necessary. A good knowledge of their imaging features helps to arrive at a diagnosis or a set of close differentials.

MK314-ED-SUB11

Nothing Wrecks Us Like the Plexus! Lumbosacral Plexus: Anatomic Review with Challenging Cases

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #11

Awards
Cum Laude

Participants
James V. Cortez, MD, Houston, TX (*Presenter*) Nothing to Disclose
Behrang Amini, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, Flowermound, TX (*Abstract Co-Author*) Consultant, ICON plc; Consultant, Treace Medical Inc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

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TEACHING POINTS

Evaluating the lumbosacral plexus can be a daunting task. We aim to provide a well-rounded review of the lumbosacral plexus to help simplify the process.

TABLE OF CONTENTS/OUTLINE

At the conclusion of the presentation, the reader will be exposed to: Basic terminology regarding spinal nerves Differentiation between normal versus diseased nerves Nerve injury classification Additionally, the reader will be familiar with the origins, course, function, and examples of pathology of the nerves of the lumbosacral plexus. Examples of nerve pathology utilized for this presentation include: Oncologic (benign and malignant etiologies and radiation/chemotherapy induced injury) Injury and entrapment Polyneuropathies and mononeuropathies

MK320-ED-SUB12

An Overview of Post-Operative Anterolateral Ligament Reconstruction

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #12

Participants
Carlos Felipe T. Lobo, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Marco Bianchi, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Review current understanding of the anatomy and the physiology of anterolateral ligament (ALL) of the knee, correlating with magnetic resonance imaging (MRI). Discuss and illustrate the association of ALL lesions and lesions of the anterior cruciate ligament (ACL), meniscus and other structures of the knee. Discuss and illustrate the adopted techniques for ALL reconstruction using MRI, computed tomography (CT) and conventional radiography.

TABLE OF CONTENTS/OUTLINE

INTRODUCTION Anatomy and physiology of ALL with MRI correlation. Tips to differentiate from other structures of the posterolateral corner of the knee. ALL INJURIES Review didactic cases of ALL injuries. Discussion of the associated lesions of ACL, meniscus and other structures of the posterolateral corner of the knee. RADIOLOGICAL IMAGING OF ALL RECONSTRUCTION Description of the most used and recent techniques. Illustration the post-operative findings using conventional radiography, CT and MRI.

MK352-SD-SUB1

An Updated Classification of A Normal Manubriosternal Junction: A Human Cadaveric Study Correlating Magnetic Resonance Imaging and Computed Tomography

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #1

Participants
Ye Na Son, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Wook Jin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Gou Young Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Until now, a normal manubriosternal junction (MSJ) was classified based on plain radiographs. To our best knowledge, there has been no studies correlating magnetic resonance (MR) imaging and computed tomography (CT) for the MSJ. Therefore, the aim of this study was to correlate the MR, CT, and the histologic features of the MSJ in non-arthritic cadavers and update the classification of a normal MSJ.

METHOD AND MATERIALS

Eleven human cadaveric MSJ specimens were used and scanned with MR imaging and CT at the same day. At first, two board-certified musculoskeletal radiologists and one board-certified pathologist evaluated whether 11 cadaveric MSJ specimens had normal MSJ or not using MR imaging, CT, and histology. And then, the two radiologists and one pathologist correlated the findings of MR imaging, CT, and histologic features with regard to the distribution of the cartilage (fibro-cartilage and hyaline cartilage), presence of the erosion-like change, cartilage fusion, and bony ankylosis. Also, the classification of a normal MSJ was updated by consensus.

RESULTS

Ten MSJ specimens were proved as normal MSJs and one was proved as an abnormal MSJ (metastasis). Among ten normal MSJs, five showed neither erosion-like changes nor ankylosis (type 1), three showed erosion-like changes without ankyloses (type 2), and two showed bony ankylosis (type 3). Among type 1 MSJs, two were entirely composed of hyaline cartilage by separation (type 1a) and three entirely were composed of hyaline cartilage by fusion (type 1b). Among type 2 MSJs, one was composed of hyaline cartilage by small erosion-like changes due to the cartilage invagination (type 2a) and two were composed of fibro-cartilage bar by large central erosion-like change (type 2b). Two type 3 MSJ specimens showed one partial ankylosis with peripheral hyaline cartilage (type 3a) and one total ankylosis (type 3b).

CONCLUSION

The six types (three categories) of normal MSJs were determined based on MR imaging and CT using normal cadaveric MSJs. Erosion-like changes and bony ankylosis are not always pathologic change and also can be seen on normal MSJs.

CLINICAL RELEVANCE/APPLICATION

Knowledge of the updated classification of normal MSJs may be important in order to reduce misdiagnosis of the normal finding as pathologic changes such as arthritis in the MSJ, and helpful to differentiate between normal and pathologic changes in the MSJ.

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MK353-SD-SUB2

Diagnostic Value of Axial Computed Tomography Images for Distal Tibiofibular Syndesmosis Injury

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #2

Participants
Lin Wang, MD, Nantong, China (*Presenter*) Nothing to Disclose
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Junfeng Xu, Nantong, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic value of axial computer tomography (CT) images for distal tibiofibular syndesmosis injury (DTSI).

METHOD AND MATERIALS

With institutional review board approval, a total of forty-five patients (21 females, mean age 45 years) with DTSI were prospectively enrolled. All patients underwent unenhanced CT scans and magnetic resonance (MR) examinations of ankles. CT examination was performed on a 16-slice spiral CT scanner (SOMATOM emotion, Siemens Healthcare, Forchheim, Germany), scan parameters were: tube voltage, 130 kVp; tube current time product, 80 mAs; pitch, 1.05; slice collimation, 0.7 mm. MR images were acquired using a 3.0-T MR scanner (Verio, Siemens Healthcare, Erlangen, Germany) with an extremity coil positioned around ankles. Morphological parameters on axial CT images including tibiofibular clear space (TFCS), tibiofibular overlap (TFO), the ratio of TFCS to fibular width (TFCS/FW), TFO/FW, and the widths of anterior (AB) and posterior (CD) distal tibiofibular ligaments at the corresponding tibial tubercle were measured (Fig 1 and 2). MR results served as the gold standard for the extent of injured ligaments (1 = normal syndesmosis; 2 = thickened syndesmosis; 3 = partially ruptured syndesmosis; 4 = completely ruptured syndesmosis) (Fig 3 and 4). Receiver operating characteristic (ROC) analysis was performed to assess the diagnostic value of CT morphological parameters for DTSI. Correlation between CT measurements and MR grading for DTSI was analyzed by Spearman's rank test.

RESULTS

A total of eighty injured ankles were analyzed, results of MR were shown in Table 1. The sensitivity, specificity, positive predictive value, negative predictive value and area under the curve (AUC) of each CT parameter were summarized in Table 2. TFO and TFO/FW had the highest diagnostic value for DTSI (AUC, 0.88 Vs 0.89, $P>0.05$) with cut-off values of 3.55 mm and 0.18, respectively (Fig 5). Combination of TFO/FW and CD was diagnosticly valuable for DTSI (AUC, 0.68) (Fig 6). TFO, TFO/FW, and combination of TFO/FW and CD were correlated with syndesmotic injury (all $P < 0.05$) (Table 3).

CONCLUSION

Morphological parameters of TFO and TFO/FW on axial CT images are valuable for diagnosis of DTSI.

CLINICAL RELEVANCE/APPLICATION

Morphological parameters on axial CT images are useful for diagnosis of distal tibiofibular syndesmosis injuries compared with MRI.

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MK354-SD-SUB3

Feasibility of Isotropic MAVRIC-SL with Spectral Bin Modulation for Metal Artifact Reduction at 3T MRI

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #3

Participants
Hong Seon Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

Spectral bin modulation, depending on spectral calibration scan, can allow a surgical prosthesis-dependent spectral bin reduction. To assess the clinical feasibility of isotropic acquisition of multi-acquisition variable resonance imaging combination slice selective (MAVRIC-SL) compared with MAVRIC-SL STIR (short tau inversion recovery) at 3T MRI.

METHOD AND MATERIALS

Both 1.3 mm isotropic MAVRIC-SL PD (proton density) and MAVRIC-SL STIR images were compared in 10 patients with surgical prostheses. For isotropic imaging review, multiplanar reformatted oblique images were generated and reviewed by musculoskeletal radiologist according to the prosthesis or structure of interest. For each patient, matched coronal images on isotropic MAVRIC-SL PD and MAVRIC-SL STIR were evaluated for qualitative and quantitative analysis. Overall metal artifact, noise, blurring, visualization of prosthesis margin and surrounding soft tissue were subjectively evaluated by using five-point scale. Quantitatively, the areas of metal artifact and peri-prosthetic lesions, if any, were measured. Additionally, the areas of each peri-prosthetic lesion were measured on corresponding axial and sagittal reconstructed images of isotropic MAVRIC-SL PD. Scan time were recorded in all image pairs. For statistical analyses, Paired Sample t-test was used to test for significance.

RESULTS

Scan times of isotropic 3D imaging and one-plane imaging were not significantly different (p=0.107). With these 1.3 mm isotropic sliced imaging, overall metal artifact, blurring, and noise were reduced and visualization of prosthetic margin and surrounding soft tissue were improved on qualitative analysis. The measured area of peri-prosthetic lesion was increased approximately 33.6% (1.22 cm2 vs. 1.63 cm2), compared with MAVRIC-SL STIR images. Four of those seven lesions were more clearly demonstrated in isotropic MAVRIC-SL PD images by utilizing the reconstructed axial and sagittal images.

CONCLUSION

Isotropic acquisition of MAVRIC-SL imaging is feasible for prosthetic and periprosthetic evaluation with spectral bin modulation. Isotropic MAVRIC-SL PD showed reduced metal artifact and enhanced lesion conspicuity due to thinner slice thickness and radiologist-defined multiplanar reconstruction images with comparable average scan time.

CLINICAL RELEVANCE/APPLICATION

Isotropic MAVRIC-SL with spectral bin modulation can be utilized as 1.3 mm isotropic acquisition with acceptable scan time.

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MK389-SD-SUB4

3D Morphometric Characterization of Femoral Cam Lesion Extent

Sunday, Dec. 1 1:00PM - 1:30PM Room: MK Community, Learning Center Station #4

Participants
Elizabeth Y. West, MD, New York, NY (*Presenter*) Nothing to Disclose
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PURPOSE

To quantify the radial and distal extent of femoral cam lesions in symptomatic femoroacetabular impingement (FAI) patients.

METHOD AND MATERIALS

An IRB approved retrospective search for preoperative hip CTs of FAI patients that underwent arthroscopic surgery from 7/1/2017-3/1/2019 yielded 81 hips (mean age 27 ± 9.4 years, M:F 51:30) after exclusion criteria (prior surgery before CT, n=12) were applied. Femur radial reconstructions were made in 1-hour increments over 360°. At each hour, the alpha angle (a) (abnormal defined as > 55°) and the distal extent of the cam (length from osseous extension outside the best fit circle to point of restoration of femoral neck concavity) were measured. Patient demographics and arthroscopic findings were obtained from the EMR. T-test, chi square, and logistic regression were performed with significance set to $p < 0.05$.

RESULTS

Cam lesions were classified based on radial extent of abnormal a: Type 1 (12:00-3:00) (47/81, 58%) and Type 2 (extension beyond 12:00-3:00) (34/81, 42%). Distal extent for Type 1 vs. Type 2: Mean distal extent (1.25 cm ± 0.45 vs. 1.59 cm ± 0.39) ($p = 0.001$). Percentage of cases with distal cam extension and normal a at a clock position (19% vs. 0%) ($p = 0.029$); the mean a was 48 ± 4.9 with a mean 1.9 hours of underestimated radial extent. Demographic and intraoperative findings for Type 1 vs. Type 2: Male sex (47% vs. 85%) ($p < 0.001$), BMI > 25 (25% vs. 62%) ($p = 0.001$), organized sports participation (71% vs. 43%) ($p = 0.012$), and cartilage damage at arthroscopy (34% vs. 67%) ($p = 0.005$). Differences in femoral version, acetabular version, LCEA, AIIS morphology, and labral tears at arthroscopy were not significant. Logistic regression showed likelihood of having a Type 2 lesion remains significantly increased (Odds ratio, 95% CI) with BMI > 25 (4.7, [1.6, 14.0]), male sex (4.8, [1.5,15.8]), and organized sports (3.3, [1.1, 9.8]) when controlling for each other.

CONCLUSION

A cam lesion extending beyond 12:00-3:00 has more cartilage damage and is more likely seen in males, high BMI, and organized sports participation. Typical lesions isolated to 12:00-3:00 may often have a distal extent not captured by a criteria.

CLINICAL RELEVANCE/APPLICATION

Residual osseous deformity is the most common cause of failed FAI surgery. Improved preoperative recognition of radial and distal cam extent may allow for better localization and surgical outcomes.

MS222-ED-SUB1

Scleroderma: What Radiologists Should Know

Sunday, Dec. 1 1:00PM - 1:30PM Room: MS Community, Learning Center Station #1

Participants
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Monica Munoz-Lopez, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Yumi Kimura Sandoval, BMBS, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Choi, BMedSc, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To discuss the clinical key features, classification, epidemiology and complications of systemic sclerosis (SS) To review and describe the subtle, common and not so common findings of scleroderma in the different systems involved by the different imaging modalitiesTips to identify multi systemic manifestations even in cases in which skin changes are preceded by involvement of internal organs To use the clinical manifestations and relevant paraclinical tests to know what findings look for based on theseCase-based review of the main imaging features of each system involved in scleroderma

TABLE OF CONTENTS/OUTLINE

- Overview of scleroderma (classification, pathophysiology, epidemiology)- Role of radiology in the assessment of systemic sclerosis - Clinical findings and characteristic features of different imaging modalities by systems (cardiopulmonar, musculoskeletal, renal, skin, gastrointestinal involvement), differential diagnosis, natural history and prognosis. - Clinical cases - Future directions and summary

NM124-ED-SUB5

Not For the Young at Heart: Cardiac TTR Amyloid Nuclear Imaging - Technique, Pathology, and Incidental Findings

Sunday, Dec. 1 1:00PM - 1:30PM Room: NM Community, Learning Center Station #5

Participants
Anne-Olivia Raulli, MD, Boston, MA (*Presenter*) Nothing to Disclose
Nayer Nikpoor, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Cardiac amyloid deposition is an under-diagnosed cause of restrictive cardiomyopathy which is traditionally diagnosed by myocardial biopsy. 2. The most common causes of amyloidosis are deposits of light chains (AL) and transthyretin (TTR). Two forms of the TTR amyloid disease are known: a senile form which accounts for the majority of patients and an inherited form caused by a mutation in the transthyretin gene. 3. There has been increasing interest in the use of 99m Tc-Pyrophosphate (PYP), a now outdated radionuclide for imaging of myocardial infarction for cardiac TTR amyloid imaging. 4. PYP localizes to TTR amyloid deposits with great sensitivity and specificity, thereby obviating the need for myocardial biopsy. 5. Focal PYP uptake may also be seen in various cardiac calcifications such as mitral, aortic, coronary and dystrophic calcifications as well as in rib fractures. 6. New medications recently approved by the FDA bring hope for the treatment of this fatal disease.

TABLE OF CONTENTS/OUTLINE

1. Background 2. Technique 3. Image interpretation: quantitative and semi-quantitative approaches 4. Correlation with cardiac MRI 5. Incidental findings 6. Implications for clinical practice and treatment

NM125-ED-SUB6

Differential Diagnosis of Atypical Parkinsonian Syndromes using 18F-FDG PET/CT

Sunday, Dec. 1 1:00PM - 1:30PM Room: NM Community, Learning Center Station #6

FDA Discussions may include off-label uses.

Participants
Rosaura Suazo Aguero, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Rodrigo Hernandez Ramirez, Leon, Mexico (*Abstract Co-Author*) Nothing to Disclose
Eva A. Izquierdo Echavarri, MD, CD.MX. , Mexico (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Movement disorders are frequent alterations among the elderly, being Parkinson disease the most common. Atypical Parkinsonian Syndromes (APS), also known as Parkinson-plus Syndromes, include corticobasal degeneration, multiple system atrophy and progressive supranuclear palsy and are considered part of the differential diagnosis. They all share similar clinical manifestations therefore radiologic features are essential for an accurate diagnosis. Over the last years, advances in metabolic imaging techniques have caused an impact for the diagnostic work up in neurodegenerative states. 18F-FDG is the most commonly used radiotracer for the assessment of regional cerebral glucose, where specific uptake patterns have been established for each disease.At the end of this review we will be able:1.To recognize the disease specific patterns of 18F-FDG uptake in APS and identifying the differential diagnosis.2.To acknowledge the utility of 18F-FDG in brain imaging.3.To evaluate the dopaminergic system by PET/CT.

TABLE OF CONTENTS/OUTLINE

Pathophysiology of Parkinsonian SyndromesClinical FindingsDescription of Radiotracers (presynaptic and postsynaptic)Establishing differential diagnosis of APS by analysing 18F-FDG uptake and PET/CT findings.Description of cases (Disease specific patterns)Conclusions

NM126-ED-SUB7

Bringing Light on the Era of Immunotherapy: The Role of CT and PET/CT-What Should We Know?

Sunday, Dec. 1 1:00PM - 1:30PM Room: NM Community, Learning Center Station #7

Participants
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Catalina Bravo Lopez I, DIPLPHYS, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Describe the role of imaging in the evaluation of patients treated with immunotherapy.Comparison of RECIST, immune-related response criteria (irRC), immune-related RECIST(irRECIST) and immune RECIST (iRECIST). Limitations and key points.Review of the use of FDG PET in immunotherapy response assessment: immune PET Response Criteria in Solid Tumors (iPERCIST), PERCIST PET/CT Criteria for Early Prediction of Response to Immune Checkpoint Inhibitor Therapy (PERCRIT), PETResponse Evaluation Criteria for Immunotherapy (PERCIMT).Identify atypical patterns of response, the so-called pseudoprogression (PP) andhyperprogression (HP).Understanding the importance of the patient medical examination and be familiar withthe imaging manifestations of immune-related adverse events for a good PET interpretation.

TABLE OF CONTENTS/OUTLINE

1 Introduction2 Objectives3 Review of the current literature on Imaging methods for monitoring patients treatedwith immunotherapy.a Describe the traditional and newer imaging response criteria for evaluation of asolid tumor.b Use of the F-FDG PET/CT: the evolution of PERCIST.4 Recognize the immunotherapy action.5 Checklist for PET reporting. Step by step. From the medical examination to the PETreporting.6The other side: atypical patterns of response and immune-related adverse events.7 Conclusion.

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NM203-SD-SUB1

The Utility of Positive 18F-FDG PET/CTs in Affecting Clinical Infectious Disease Management

Sunday, Dec. 1 1:00PM - 1:30PM Room: NM Community, Learning Center Station #1

Participants
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Benjamin L. Viglianti, MD,PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

18F-FDG PET/CT is a promising technique for localizing foci of infection. However, few studies to date have determined how often PET scans performed for infection lead to clinical management changes.

METHOD AND MATERIALS

We identified all 18F-FDG PET/CT scans conducted on adult patients at Michigan Medicine from January 2016 to January 2018 for a comprehensive list of infectious indications (n=263). Scans that were read as positive for infection (n=162) were identified through systematic review of radiology reports. Four independent reviewers assessed whether the scans changed clinical management (work-up and/or therapy) through review of patient charts including all clinical notes and radiology reports. Unclear cases were resolved by the consensus between the first and last authors.

RESULTS

Of the 162 positive 18F-FDG PET/CT scans, 42 (25.9%) changed clinical management. Among the six most common primary indications, 18F-FDG PET/CT changed management in the following: 13/32 (40.6%) cases of 'Endocarditis/Cardiac Device Infection'; 3/8 (37.5%) cases of 'Graft Infection'; 4/12 (33.3%) cases of 'Non-Spinal Osteomyelitis'; 6/18 (33.3%) cases of 'Occult Infection'; 8/41 (19.5%) cases of 'Sepsis/Bacteremia'; and 4/27(14.8%) cases of 'Fever of Unknown Origin (FUO)'. The most common changes in clinical management were a change in antibiotic choice or course (25/42, 59.5%) and surgery (8/42, 19%).

CONCLUSION

In this study, positive 18F-FDG PET/CT scans had varying utility in altering clinical management based on the primary indication for which the scan was ordered. Scans done for endocarditis, cardiac device infections, graft infection, and identification of occult infection were most likely to change clinical management. While a significant proportion of scans done for osteomyelitis appeared to change management, most of these patients had perceived contraindications to MR (i.e. CIED, hardware), which is the preferred diagnostic test in this case. These results also suggest that, in the setting of sepsis, bacteremia, and FUO, positive 18F-FDG PET/CT scans are unlikely to change clinical management.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/CT is most likely to lead to clinical management changes in cases of endocarditis, cardiac device infections, and graft infections and should be recommended for these specific indications when the initial work-up is indeterminate. More studies should investigate its utility in other infections.

NM204-SD-SUB2

18F-FDG PET/MRI of Patients with Chronic Pain Alters Management

Sunday, Dec. 1 1:00PM - 1:30PM Room: NM Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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PURPOSE

The goal of this work is to develop a clinical [18F]FDG PET/MRI method to accurately localize sites of increased inflammation related to sources of pain. The aims are to 1) determine whether imaging findings correlate with location of pain, and to 2) determine whether the imaging results affect management decisions.

METHOD AND MATERIALS

Patients with chronic pain were referred from pain physician specialists. 64 chronic pain patients have thus far been imaged with a GE SIGNA PET/MRI (time-of-flight PET; 3.0T bore; 4-8 min/bed position) from the head through the feet. Patients underwent imaging one hour after a 10mCi injection of [18F]FDG. MRI sequences included coronal DESS, coronal PSIF (isotropic), axial LAVA FLEX (with water/fat separation) and axial T2W FSE with fat-saturation. Two radiologists evaluated images (one blinded and the other unblinded to patient history). Maximum standardized uptake values (SUVmax) and target-to-background were measured using image analysis software (OsiriX v.8.0 64-bit). The radiologist unblinded to the patient exam and history determined if increased [18F]FDG uptake occurred in the site of symptoms and in other areas. Imaging results were discussed with the referring physician, who determined whether a change in management would follow.

RESULTS

Focal increased uptake of [18F]FDG in affected nerves and muscle (approx 2-4 times over background tissue) were identified in 57 of 64 patients at the site of pain and other areas of the body (SUVmax of lesions from 0.9 to 4.2 vs. SUVmax of background from 0.2 to 1.2). Modification suggested in the management plan based on imaging findings: 13/64 no change, 15/64 mild modification (e.g. diagnostic test) and 36/64 significant modification (e.g. new invasive procedure suggested). For example, PET/MR imaging helped to direct release of a fibrotic plantaris muscle that was causing foot pain and placement of blood patches to treat CSF leaks. New management plans have been implemented in 40 of 64 patients (63%).

CONCLUSION

[18F]FDG PET/MRI had lead to new management plans that had not been anticipated by the referring physician. Further following up with a large cohort of patients should be conducted to establish the effectiveness of [18F]FDG PET/MRI to guide interventions for relieving pain.

CLINICAL RELEVANCE/APPLICATION

Our data suggest that [18F]FDG PET/MRI can identify hypermetabolic or inflammatory abnormalities in patients suffering from neuropathic pain.

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NM205-SD-SUB3

Clinical Impact of FDG PET-CT in the Management of Cancer Patients: Experience in 9000 Cases

Sunday, Dec. 1 1:00PM - 1:30PM Room: NM Community, Learning Center Station #3

Participants
Antonio Maldonado, MD, Pozuelo de Alarcon, Spain (*Presenter*) Nothing to Disclose
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PURPOSE

The aim of this study was to establish the impact of whole body FDG PET-CT on global diagnostic and therapeutic management of cancer patients

METHOD AND MATERIALS

We retrospectively reviewed the clinical records from 7700 consecutive patients studied by PET-CT (5048 men and 3952 women; mean age 60.2 y). PET-CT studies were performed after injection of 10 mCi of FDG. For CT portion, oral and intravenous contrast were administered. All patients had their diagnosis of malignant neoplasm histologically confirmed. The primary sites were: lung (23.5%), lymphoma (17.5%), breast (14.7%) colorectal (9.4%), head and neck (5.3%), melanoma (2.6%) and others type of tumors (27%). PET-CT indications were: initial staging (23.2%), diagnosis (5.3%), restaging (40.9%), post-treatment changes vs recurrence (0.7%), suspected recurrence based on rising tumor marker levels (2.5%) and treatment response evaluation (27.3%). Changes in diagnostic and therapeutic management were evaluated based on information from PET-CT studies

RESULTS

Global patient management was modified by PET-CT results in 53% of the patients. Diagnostic management was modified by PET-CT in 63% of the patients. In 30% of cases a biopsy was avoided; in 15% was generated a new biopsy; imaging studies were avoided in 9%. Changes in the diagnostic process were more frequent when PET-CT indication was restaging (95%) or residual mass evaluation (87,5%). Therapeutic management was modified by PET results in 34% of cases. The most frequent type of treatment change was to administer chemotherapy (18%); in 16% patients surgical procedures were avoided; in 26% of cases PET-CT results supported previous treatment decision. Impact on treatment plans were more frequent when PET-CT indication were initial staging or residual mass evaluation

CONCLUSION

This retrospective study demonstrates that PET-CT shows an important impact in the diagnostic and therapeutic management of cancer patients and supports its introduction as a routine diagnostic tool in Oncology

CLINICAL RELEVANCE/APPLICATION

FDG PET-CT is an important tool in the management of cancer patients. Treatmente must be changed frecuently according to molecular imaging information

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NM235-SD-SUB4

Whole Prostate Total Lesion Activity on 18F-Fluciclovine PET/CT and Prostate-Specific Antigen Level are Associated with the Presence of Metastasis at Primary Staging

Sunday, Dec. 1 1:00PM - 1:30PM Room: NM Community, Learning Center Station #4

FDA Discussions may include off-label uses.

Participants
Olayinka A. Abiodun-Ojo, MD,MPH, Atlanta, GA (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate the role of preoperative 18F-fluciclovine PET/CT in predicting metastasis in patients with intermediate- or high-risk primary prostate cancer.

METHOD AND MATERIALS

Forty-five patients underwent fluciclovine PET/CT prior to radical prostatectomy (RP) with extended pelvic lymph node dissection (EPLND). Triple time-point PET acquisition {0-5 minutes (pelvis), 5-22.5 minutes (whole body) and 22.5-27.5 minutes (pelvis)} at 2.5 minutes/bed position was performed. Standardized uptake values (SUVmax, SUVmean, SUVpeak) and total lesion activity (TLA) of the whole prostate and hottest prostate lesion on PET were recorded. Clinical and fluciclovine uptake characteristics that correlated with the presence of regional nodal and non-regional metastasis were determined using t-test and Fisher's exact test.

RESULTS

4/45 patients were ineligible for RP due to systemic disease and therefore, pre-surgical biopsy Gleason scores of these patients were used. Histology (43/45), serial clinical follow-up and imaging (2/45) were reference standards for metastatic disease. Mean preoperative PSA was 27.9±31.8 ng/ml. Median time from imaging to surgery was 7 (range 1-42) days. All patients had multifocal disease on histology. Metastasis was detected in 26/45 (57.8%) patients. Of these, 15/26 (57.7%) patients had metastasis to regional lymph nodes only and an additional 11/26 (42.3%) patients also had non-regional metastasis. Mean PSA was significantly higher in patients with metastasis compared to those without metastasis (36.8±37.7 ng/ml vs 15.7±15.0 ng/ml; $p<0.01$). Of all the variables analyzed, whole prostate TLA (all time-points) was significantly higher in patients with metastasis than those without. Gleason score and SUVmean of the whole prostate (third time-point) were significantly higher in patients with non-regional metastasis versus regional metastasis (see table).

CONCLUSION

Prostate tumor burden as suggested by TLA of the whole prostate on fluciclovine PET may be useful in predicting the presence of distant metastasis in patients with primary prostate cancer.

CLINICAL RELEVANCE/APPLICATION

Total lesion activity of the whole prostate on fluciclovine PET may be predictive of presence of metastasis in patients with primary prostate cancer being evaluated for curative surgery.

NR331-ED-SUB7

There is Something in Your Eye: Imaging of Ocular Pathology

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #7

Awards
Certificate of Merit

Participants
Ruben Giovanetti Gonzalez, MD, Toledo, Spain (*Presenter*) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is: To provide a better understanding of ocular pathology through a detailed eyeball´s anatomy description. To review and illustrate imaging features and differential diagnostic clues of common and uncommon ocular diseases in Ultrasound (US), Computed Tomography (CT) and Magnetic Resonance (MR) imaging. To highlight diagnostic key points in order to identify pitfalls.

TABLE OF CONTENTS/OUTLINE

Ocular disorders diseases can range from neoplastic to degenerative, inflammatory or post-traumatic, among others. Although clinical examination and ophthalmoscopy are frequently enough to diagnose most entities, when there are difficulties or the exploration is insufficient (as in the presence of a cataract), additional diagnostic imaging can be required. By means of cases of our daily practice, we review usual and unusual ophthalmic pathologies and propose a radiological approach based on the recognition of US, CT and MR imaging patterns. We facilitate differential diagnosis tips to prevent misdiagnosis or pitfalls.

NR334-ED-SUB9

Up-to-Date Technique for Improvement of CT and MRI Imaging Quality in the Head and Neck: Theory, Clinical Applications

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #9

Participants
Koji Takumi, MD,PhD, Kagoshima, Japan (*Presenter*) Nothing to Disclose
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Yuichi Kumagae, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Iwanaga, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Yoshiura, MD, PhD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Head and neck examinations remain challenging due to get a high quality images without several artifacts such as motion artifact, distortion artifact, streak artifact, and dental metallic artifact. Some imaging techniques were reported such as metal artifact reduction technique on CT and MRI, compressed sensing, radial scan, rice-pad, DWI, ASL with turbo-spin-echo sequence, Sn filtered CT image, virtual monochromatic image on dual energy CT. The purpose of this exhibit are: 1. To illustrate the applications and its theory of each recent technique to improve CT and MR imaging quality in head and neck 2. To illustrate clinical cases and data with each technique in head and neck lesions 3. To discuss pitfalls and limitations of each technique

TABLE OF CONTENTS/OUTLINE

1. List of imaging quality deterioration in the head and neck 2. Clinical applications to improve motion artifacts: radial scan, averaging with compressed sensing for evaluation of head and neck squamous cell carcinomas 3. Clinical applications to improve distortion artifacts: TSE sequence for DWI, rice-pad for improvement of B0 inhomogeneity 4. Clinical applications to improve dental metallic artifacts: metal artifact reduction technique for CT and MRI 5. Clinical applications to improve contrast enhancement: Low keV virtual monochromatic image on dual energy CT

NR342-ED-SUB10

When Should I Think About a Transsynaptic Degeneration? A General Approach to the Transneuronal Degeneration

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #10

Participants
Fernanda B. Assuncao, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
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Luiza Araujo, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

-To understands the concepts of transsynaptic degeneration and explain the physiological forms of synapses in specific tracts and some cranial nerves. -Review the anatomy of some cranial nerves and specific tracts such as the dentatorubroolivar, cortico-ponto-cerebellar tract and mammillothalamic tracts with emphasis on the degeneration transsynaptic. -To demonstrate the pathogenesis of transsynaptic degeneration and understand the physiology of involvement in various diseases, highlighting the clues for diagnosis in the context of a relevant clinical.

TABLE OF CONTENTS/OUTLINE

- Introduction - Definition - Anatomy - Physiopathology - Discussion the main differential diagnosis of transsynaptic degeneration in the context of a relevant clinical and epidemiological scenari : - Transsynaptic Degeneration of Dentatorubroolivar tract - Transsynaptic Degeneration of Mammillothalamic tract - Transsynaptic Degeneration of Cortico-ponto-cerebellar tract - Transsynaptic Degeneration of Cranial Nerves - Conclusion

NR346-ED-SUB11

Open Your Mind: Everything You Need to Know About Third Window Pathologies of the Inner Ear

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #11

Participants
Camila V. Oliveira, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
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TEACHING POINTS

-Understand the differential diagnosis of third window abnormalities-Recognize inner ear anatomy and third window bony defects-Comprehend temporal bone CT and MRI techniques and imaging findings of each pathology-Recognize the most important imaging features to report

TABLE OF CONTENTS/OUTLINE

INTRODUCTION-Symptomatology and audiometry-Differential diagnosis of third window lesionsANATOMICAL CONCEPTS-Key anatomical landmarks demonstrated by illustrations with CT and MRI correlation-Mechanism of air and bone-conducted sound in third window lesionsCT AND MRI TECHNIQUES-CT and MRI protocols and how to optimize them-Difficulties and how to overcome themIMAGING INTERPRETATION-Systematic approach to evaluate temporal bone CT and MRI-What the surgeon needs to know-Template reporting systemINTERACTIVE CASE-BASED DIDACTICS -Sample cases to illustrate and solidify the concepts

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NR350-ED-SUB12

The Good, the Bad, and the Ugly: A Case-based Review of the Ultrasonographic Evaluation of Thyroid Nodules According to the 2017 ACR-TIRADS Consensus

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #12

Awards
Certificate of Merit

Participants
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TEACHING POINTS

1. To review the normal ultrasonographic anatomy of the thyroid gland and the most relevant technical aspects that ensure a correct exploration. 2. To learn how to classify the thyroid nodules according to the 2017 ACR-TIRADS consensus through a quiz-based presentation. 3. To know the follow-up or biopsy recommendations for each nodule category.

TABLE OF CONTENTS/OUTLINE

This educational exhibit will be presented in a quiz format. Teaching points and feedback information will be highlighted in the discussion of each case. The list of cases will help the reader to learn and understand the following: - Normal ultrasonographic anatomy of the thyroid gland. - Ultrasound technical considerations. - Ultrasonographic classification of thyroid nodules according to 2017 ACR-TIRADS consensus. - Follow-up or biopsy recommendations for each nodule category. Summary

NR368-SD-SUB2

The Miniature Pig as a Neuroimaging and Spectroscopy Model for Brain White Matter Development in Human Adolescents

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #2

Participants
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PURPOSE

We used advanced MRI techniques in adolescent miniature pigs to (1) study the sensitivity of DWI measurements to development of whole-brain white matter (WM); (2) explore the WM heterochronic development trajectories in various brain regions; and (3) quantify longitudinal changes in metabolites.

METHOD AND MATERIALS

12 female Sinclair mini-pigs underwent 3 MR spectroscopy sessions every 23.95±3.73 days beginning at 3 months of age using a clinical 3T scanner. Advanced DWI focused on cerebral WM and used an imaging protocol similar to human structural protocols consisting of fifteen b-shells (b=0-3500 s/mm2) with 32-directions/shell. DWI data were analyzed using diffusion kurtosis and bi-exponential modeling and provided the following measurements: FA, RK, KA, AK, tortuosity, and PDI. 1H-MRS data were collected using 1.2 X 1.0 X 3.0 cm voxels placed in left and right hemisphere WM using a Point Resolved Spectroscopy sequence (TR=2000ms, TE=30ms). Concentrations of NAA, MI, Glx, choline, creatine, and MM09 and MM14 were averaged from both hemispheres.

RESULTS

Whole-brain FA, KA, and PDI significantly increased with age (all $p<0.001$) while AK and RK significantly decreased with age ($p=0.027$, 0.025, respectively). Regional aging effects were assessed for the corpus callosum, superficial WM, parahippocampal WM, midbrain, thalamic radiation (TR), and internal/external capsule (I/EC). FA and KA increased in all regions except the parahippocampal WM. PDI significantly increased in the CC, superficial WM, midbrain, and TR. RK significantly decreased in the midbrain and TR. The PDI increase in the corpus callosum showed the most robust effect ($p=6.7 \cdot 10\text{-}7$), followed by the rise in KA in the TR ($p=1.4 \cdot 10\text{-}6$) and the rise in FA in the I/EC ($p=5.6 \cdot 10\text{-}6$). MI and MM09 significantly declined with age. Increased FA and KA significantly correlated with decline in MI and MM09. Correlations lost significance once corrected for age.

CONCLUSION

Clinical MRI scanners/protocols can be used to collect 1H-MRS and DWI data in pigs. Longitudinal effects that mirrored human results were observed for whole-brain and regional DWI and MRS measurements. Neurochemical correlations with DWI measures were indicative of ongoing WM myelination/maturation.

CLINICAL RELEVANCE/APPLICATION

Longitudinal effects of MRI measurements mirror human brain development in adolescents suggesting that swine may be a viable translational brain imaging research model.

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NR369-SD-SUB3

Quantitative Diffusion Tensor Imaging and Ventricular/Sulcal CSF Volumetry: A Marker to Diagnose the idiopathic Normal Pressure Hydrocephalus (iNPH)

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #3

Participants
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Saeedeh Mirbagheri, MD, New York, NY (*Presenter*) Nothing to Disclose

PURPOSE

The diagnosis of iNPH requires performing invasive procedures in rather elderly patients with multiple comorbidities. We set out to explore if using DTI metric values of the superior thalamic radiation (STR) in combination with the changes of ventricular/sulcal CSF volume would be helpful to diagnose the idiopathic Normal Pressure Hydrocephalus and differntiate it from healthy control.

METHOD AND MATERIALS

15 patients with diagnosis of iNPH and 15 age/sex matched healthy controls were selected. MRI: Whole brain diffusion-weighted data was acquired using a single-shot spin-echo diffusion-sensitized echo-planar imaging sequence with balanced alternating polarity Icosa21 tensor encoding scheme at different b-factors = 100, 500, 1500, 3000. s mm-2, TR/TE = 12000/75 msec; isotropic voxel = 2mm. Ventricular CSF Volumes (vCSFV) and the sulcal CSF volumes (sCSFV) were measured using MRI-cloud software packet. DTI Studio software was used for measurement of the DTI metric values including the fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), radial diffusivity (RD) of the STR tract in iNPH and healthy controls.

RESULTS

Our preliminary results support significant differences in the diffusion tensor metric values of the STR and the sulcal CSF volume in iNPH patients compared to the normal controls (table 1,2; Fig 1). Higher ventricular CSF/sulcal CSF volume ratio is seen in iNPH patients compared to healthy controls (HC) (table. 1). Significant decreased mean diffusivity value of the STR is also identified in NPH group compared to the HC (table. 2).

CONCLUSION

We demonstrate for the first time that using the combination of DTI metrics of the STR and sulcal/ventricular CSF volumetry is a non-invasive tool to diagnose the iNPH and diffrentiate it from the HC.

CLINICAL RELEVANCE/APPLICATION

The iNPH is one of the most common treatable causes of dementia in the elderly. iNPH is a form of chronic communicating hydrocephalus that results in a treatable syndrome characterized by the triad of gait impairment, progressive dementia, and urinary incontinence. Currently, the diagnosis of iNPH requires performing invasive procedures in rather elderly patients with multiple comorbidities. We demonstrate for the first time that DTI metrics of the STR and sulcal/ventricular CSF volumetry can serve as a joint biomarker to noninvasively diagnose and differentiate the iNPH from healthy aging brain.

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NR409-SD-SUB4

Stroke Protocol Optimization with Dual-Energy CT: Virtual Monochromatic Energy Image Selection with Enhancement of Residual Iodine Contrast and Hemorrhagic Transformations

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #4

Participants
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PURPOSE

In stroke imaging, follow-up dual energy CT (DECT) scans increase the sensitivity and specificity of differentiating contrast extravasation and hemorrhagic transformations in comparison to single energy CT (SECT). DECT algorithms produce kV-equivalent and virtual monochromatic energy image (VMI) reconstructions, which enhance contrast, reduce beam hardening artifacts, and maintain diagnostic image quality at doses comparable to SECT. However, it is unclear which reconstructions are the most valuable. Our aim is to evaluate the Hounsfield unit (HU) accuracy of VMIs in comparison to 120 kVp SECT HU values, and to assess the contrast-to-noise ratio (CNR) of clinically relevant materials for the purpose of optimizing the DECT stroke protocol.

METHOD AND MATERIALS

A tissue equivalent phantom was scanned in a Canon Genesis scanner using DECT (135 kVp and 80 kVp sequential scans) and SECT (120 kVp) acquisition modes. 120 kV equivalent images and VMIs with energies ranging from 40-130 keV were reconstructed in the scanner console using image and raw data analysis software, respectively. Regions of interest (ROIs) were placed in iodine, blood and brain mimicking inserts to measure HUs and CNRs with respect to brain mimicking tissue.

RESULTS

The 65 keV VMI was found to have higher iodine CNRs than the 120 kVp SECT and 120 kV-equivalent images (4.44, 3.42, 3.10, respectively). Compared to 120 kVp SECT, the 65 keV VMI iodine, blood and brain HU percent errors were 23%, 6%, and 2.5%, respectively. The 70 keV VMI and 120 kV-equivalent DECT reconstructions were found to have better HU agreement to the 120 kVp SECT for the iodine insert, with an error of 5%, and similar agreement for blood. However, the 70 keV VMI had an increased brain HU error of 7.5%, and the CNR decreased by 36% to only 2.82.

CONCLUSION

For follow-up stroke imaging, we recommend the use of the 65 keV VMI, which enhances the contrast between iodine and brain tissue at the expense of slight HU differences compared to the 120 kVp SECT scan. If greater HU accuracy is desired, the 70 keV VMI or 120 kV-equivalent image can be used instead, but significant CNR penalties will occur.

CLINICAL RELEVANCE/APPLICATION

For follow-up stroke imaging with dual energy CT, the use of the 65 keV monochromatic reconstruction enhances both brain and iodine contrast at the expense of slight HU differences compared to the traditional 120 kVp scan.

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NR410-SD-SUB5

Outcomes of Treatment-Induced Pseudoprogression and Correlation with MGMT Methylation Status in GBM Patients

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #5

Participants
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PURPOSE

A challenge in the management of glioblastoma is distinguishing true progression from pseudoprogression (PsP), which may have improved survival. MGMT methylation has been shown to correlate with PsP. This study aims to evaluate the rates of PsP and its outcomes, and correlate to MGMT status.

METHOD AND MATERIALS

An IRB-approved retrospective study included patients with histologically confirmed glioblastoma between 2010 and 2018. All patients underwent surgical resection followed by temozolomide and radiation. Baseline pre- and post-radiation MRIs were reviewed to assess the treatment response according to RANO criteria. Maximum dimensions and volumetric evaluations were performed. Patients were graded as partial response (PR), progressive disease (PD) or stable disease (SD). Those with initial PD who had subsequent improvement without intervention were classified as PsP. We evaluated overall survival (OS) and time to progression (TTP) from the time of diagnosis, with TTP based on subsequent MRI images and clinical response, and this was correlated with the MGMT.

RESULTS

Of 101 patients diagnosed with glioblastoma, 45 had at least 9 months follow-up. The MGMT status was methylated in 7, indeterminate in 2, unmethylated in 11, and not evaluable in 22. The response was recorded as PsP in 16, PD in 12, SD in 2, PR in 12. Patients with PsP had an excellent mean TTP and OS of 327 and 545 days. The mean TTP and OS for those with PD was 250 and 450 days, and for those with PR was 446 and 676 days. Those with MGMT methylation and PsP had TTP and OS of 437 and 560 days which was similar to those with PR. Those with PsP and unmethylated MGMT had a worse mean TTP and OS of 198 and 438 days.

CONCLUSION

Patients with PsP have improved outcomes compared to those with PD or SD, with a mean TTP and OS that is between those seen with PR/CR and PD/SD. These outcomes are further improved with MGMT promoter methylation. This data substantiates prior studies' conclusions that MGMT status may significantly influence response, and patients with PsP have improved survival compared to PD/SD.

CLINICAL RELEVANCE/APPLICATION

Pseuodprogression may predict a better overall response, and recognizing it in an earlier fashion may prevent initiation of unnecessary salvage therapies that can be reserved for later in the treatment course. Interestingly, MGMT methylation has been shown to correlate with pseudoprogression and increased survival.

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NR411-SD-SUB6

The Utility of Multiparametric MRI to Characterize Hypoxic Tumor Subvolumes in Comparison to FMISO PET

Sunday, Dec. 1 1:00PM - 1:30PM Room: NR Community, Learning Center Station #6

Participants
Nicole Wiedenmann, Freiburg, Germany (*Presenter*) Nothing to Disclose
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PURPOSE

This study compares mpMRI biomarkers apparent diffusion coefficient (ADC), ktrans, ve, and kep between FMISO PET derived hypoxic and corresponding non-hypoxic tumor regions in patients with head and neck squamous cell cancer (HNSCC) during definitive chemoradiation (CRT). The aim was to identify mpMRI parameters that are linked to hypoxia and might be used as a surrogate for FMISO PET.

METHOD AND MATERIALS

Patients with stage III-IVb HNSCC undergoing definitive CRT (total dose 70 Gy, 3 cycles cisplatin over 7 weeks) were enrolled for a prospective functional MRI and hypoxia PET/CT imaging study. Patients were prospectively imaged with serial FMISO PET and serial 3 Tesla mpMRI for T1w-, T2w- and contrast-enhanced perfusion and diffusion-weighted measurements (ktrans, ve, ADC maps) in weeks 0, 2 and 5. Hypoxic tumor subvolumes (HSV) were generated using a 1.4 x meanSUV (standardized uptake value) normal tissue threshold applied to the FMISO PET. Non-hypoxic tumor subvolumes (nonHSV) were created as complementary subvolumes of the primary tumor. Mean values for mpMRI signal intensities within HSVs and complementary non-HSVs were compared by a paired samples t-tests (95% confidence interval).

RESULTS

Mean values for mpMRI parameters apparent diffusion coefficient ADC, transfer constant ktrans, interstitial volume fraction ve, and kep were calculated and compared by a paired t-test analysis between HSV and non-HSV for weeks 0, 2, and 5. ADC values were smaller within hypoxic tumor regions for all time points with the difference being significant at baseline and week 2 ($p=0.007$, $p=0.004$). Interstitial space volume fraction ve was significantly smaller for HSV than for non-HSV at baseline ($p = 0.006$). Parameter kep showed a trend for higher baseline values in hypoxic as compared to non-hypoxic tumor regions ($p=0.092$). Perfusion parameter ktrans was significantly lower in HSV as compared to non-HSV at baseline ($p=0.035$).

CONCLUSION

Significant differences between hypoxic and non-hypoxic tumor subvolumes were found for mpMRI parameters ADC, ve, and ktrans at baseline and for ADC at week 2. Further studies are warranted to specify the role of mpMRI parameters as possible surrogate for hypoxia imaging.

CLINICAL RELEVANCE/APPLICATION

This study identified mpMRI parameters significantly differing between hypoxic and non-hypoxic tumor regions before and during radiation and might help to identify potential mpMRI surrogate markers for FMISO PET.

OB173-ED-SUB1

Opening Up the Ovary: A Multimodality Approach to Imaging Ovarian Neoplasms with Pathology Correlation

Sunday, Dec. 1 1:00PM - 1:30PM Room: OB Community, Learning Center Station #1

Awards
Magna Cum Laude
Identified for RadioGraphics

Participants
Erin Taylor, MD, New Haven, CT (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Ovarian cancer is common, accounting for approximately 4% of all female cancers. As clinical findings can be non-specific, imaging plays an important role in localization, characterization, and staging of suspected malignancies. As it is often treated surgically, knowledge of the histologic appearance can better inform pre-operative imaging studies. At the end of this exhibit, the learner will be able to do the following: Elucidate the utility and advantages of different imaging modalities used to assess ovarian neoplasms Characterize ovarian neoplasms based on their imaging appearance Correlate histologic findings to those seen with radiology

TABLE OF CONTENTS/OUTLINE

Imaging approach to assessing ovarian masses including utility of different modalties (US, CT, MRI, PET-CT) Surface epithelial-stroma: serous tumors (cystadenoma, borderline, cystadenocarcinoma), mucinous tumors (cystadnoma, borderline tumors, cystadenocarcinoma), endometroid tumors, clear cell, Brenner, Cystadenofibroma Germ cell: Teratoma (mature, immature, struma ovarii, carcinoid), Dysgerminoma, Yolk sac tumor, Embryonal carcinoma, Choriocaricinoma Sex cord-stromal: Fibroma, thecoma, fibrothecoma, Sertoli-leydig cell Miscellaneous: Lymphoma, Metastases, Krukenberg tumor Key distinguishing imaging features Summary/Conclusion

OB174-ED-SUB2

O-RADS Made Easy: A Pictorial Review

Sunday, Dec. 1 1:00PM - 1:30PM Room: OB Community, Learning Center Station #2

Participants
Amir R. Honarmand, MD, Darby, PA (*Presenter*) Nothing to Disclose
Tetiana Glushko, MD, Darby, PA (*Abstract Co-Author*) Nothing to Disclose
Hanna Tomsan, MD, Darby, PA (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Ovarian-Adnexal Imaging-Reporting-Data System (O-RADS) committee was formed under supervision of American College of Radiology in 2015. As per ACR, the long term goals were to minimize vague terminology and inconsistencies among reporting radiologists, to develop a standardized lexicon for classification, risk stratification, follow-up and management of ovarian masses. In October 2018, a white paper was published by the committee describing the standardized lexicon for reporting ovarian and adnexal masses. This exhibit aims to simplify the approach to ovarian lesion using the proposed new standardized terminology.

TABLE OF CONTENTS/OUTLINE

The goals of this exhibit include: to review recently released O-RADS guidelines to standardize descriptions of ovarian/adnexal lesions in step by step fashion, to demonstrate simplified basic descriptors (basic vocabulary), lexicon terms, major categories, and definitions, to provide examples of an O-RADS-based report of common adnexal/ovarian lesions ,to highlight the terms that have been commonly used in the past, but must be avoided based on O-RADS guidelines, and to provide case based review of recently published O-RADS ultrasound risk categorization and pre/post menopausal management.

PD170-ED-SUB6

Pediatric Systemic Vasculitis: Tips for Diagnosis

Sunday, Dec. 1 1:00PM - 1:30PM Room: PD Community, Learning Center Station #6

Awards
Magna Cum Laude

Participants
Emilio Inarejos Clemente, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
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Elida Vazquez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Enrique Ladera, 08950, Spain (*Abstract Co-Author*) Nothing to Disclose
Josep Munuera, MD,PhD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Ignasi Barber Martinez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. To define what pediatric systemic vasculitis are 2. To discuss the 2012 Revised International Chapel Hill Consensus of Vasculitides3. To review indications and protocols for imaging assessment of systemic vasculitis in children4. To describe the imaging findings of the commonest pediatric systemic vasculitis

TABLE OF CONTENTS/OUTLINE

Systemic vasculitis in children are classified according to vessel distribution: 1. Large vessel vasculitis: Takayasu2. Medium vessel vasculitis: Polyarteritis nodosa, Kawasaki disease3. Small vessel vasculitis: 3.1 Antineutrophil cytoplasmic antibody (ANCA)-associated vasculitis3.2 Inmune complex: Anti-glomerular basement membrane (anti-GBM) disease, Cryoglobulinemic vasculitis, IgA vasculitis, Hypocomplementemic urticarial vasculitis 4. Variable vessel vasculitis: Behcet's disease, Cogan's syndrome5. Secondary vasculitisIn this educational exhibit the authors will illustrate the imaging findings of systemic vasculitis in children from head to toe, highlighting the radiological key features useful for an early and accurate diagnosis. This will include clinical and histopathological correlation, indications for imaging, a multimodality imaging approach depending on the vasculitis subtype and area of body involved, and the essential CT and MR techniques necessary to evaluate each entity.

PD171-ED-SUB7

You Cannot Forget it Once You See: ACTA2 Mutation Cerebral Arteriopathy

Sunday, Dec. 1 1:00PM - 1:30PM Room: PD Community, Learning Center Station #7

Participants
Atsushi K. Kono, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose
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Keisuke Kiso, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Mutations in the gene coding for smooth muscle actin (i.e. ACTA2) cause diffuse smooth muscle dysfunction and an obvious cerebral arteriopathy known as multisystemic smooth muscle dysfunction syndrome. Until recently, cerebral arteriopathy induced by ACTA2 mutations was considered as a variant of Moyamoya disease. However, the cerebral arteriopathy caused by ACTA2 mutations has been reported to exhibit the unique imaging findings which is totally different from Moyamoya disease.This exhibit presents a review of a novel cerebral arteriopathy in patients with ACTA2 mutations, with emphasis on the differentiation from Moyamoya disease.After the participants see this presentation, (1) they will have an insight into the etiology, clinical significance, and neurosurgical management of this arteriopathy as well as charcteristic images. (2) They will also be able to distinguish ACTA2-induced cerebral arteriopathy from Moyamoya disease.

TABLE OF CONTENTS/OUTLINE

1) Gene of ACTA22) Pathophysiology of ACTA2 mutations-induced cerebral arteriopathy3) Other symptoms4) Representative images of the cerebral arteriopathy5) Differentiation from Moyamoya disease6) Management7) Screening of the systemic arteriopathy other than the cerebral lesion

PD172-ED-SUB8

False Positive Findings on 18F-FDG PET/MR in Pediatric Oncology Patients

Sunday, Dec. 1 1:00PM - 1:30PM Room: PD Community, Learning Center Station #8

FDA Discussions may include off-label uses.

Participants
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Ashok Joseph Theruvath, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

A growing body of research has shown that PET/MR can be of great value for staging and re-staging of pediatric cancer patients. The significantly lower radiation exposure compared to clinical PET/CT and the excellent soft tissue resolution of 18F-FDG PET/MR scans are two important benefits. However, when evaluating a PET/MR scan, the radiologist needs to be aware of possible false positive findings as misclassification of normal or benign PET-avid findings as tumor can have a great impact on further treatment and prognosis of the patient. The purpose of this educational exhibit is therefore to educate radiologists about possible false positive findings on whole body 18F-FDG PET/MR scans of pediatric cancer patients.

TABLE OF CONTENTS/OUTLINE

• FDG uptake in normal tissue: pediatric peculiarity • FDG uptake in non-neoplastic pathologies: o Vaccination o Infection o Oncology treatment related • Artifacts

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PD203-SD-SUB1

Metaphyseal Lesions in the Knee: A Review of 84 Patients with Achondroplasia - Beyond Irregularities, Splaying, and Fraying

Sunday, Dec. 1 1:00PM - 1:30PM Room: PD Community, Learning Center Station #1

Participants
Joan Albert Prat-Matifoll, MD , Sydney, Australia (*Presenter*) Nothing to Disclose
Denise M. Warner, MBBS, Sydney, Australia (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Achondroplasia is the most common non-lethal dysplasia and it is caused by a mutation in the Fibroblast Growth Factor Receptor 3 gene. The increased activity of this gene suppresses the proliferation and maturation of growth plate chondrocytes. The most relevant radiographic features include craniofacial and spinal abnormalities (decrease interpedicular distance, bullet-shaped vertebrae, canal stenosis, posterior scalloping, kyphoscoliosis), pelvic (squaring of iliac wings, short and broad pelvis, horizontal acetabular roofs), lower limb (rhizomelia, flaring and splaying of metaphyses, V-shaped metaphysis) and upper limb abnormalities (trident hand). Our aim is to describe a new radiographic feature involving the distal femoral and proximal tibial metaphysis.

METHOD AND MATERIALS

This restrospective study included all patients (203) with achondroplasia between 1998 and 2019. All patients (119) without available lower limb radiography were excluded. We reviewed the knee radiography of 84 patients, the following variables were included: age, gender, rhizomelic micromelia, femoral length, presence of femoral/tibial metaphyseal lesions, lesion measurement, lesion pattern, transition zone, periosteal reaction, soft-tissue mass, metaphyseal shape (flaring, splaying, V-shaped), metaphyseal irregularities, size of the epiphysis, irregular/delayed development of tibial and femoral epiphyses). The available knee magnetic resonances of these patients were also reviewed (1), the following variables were included (morphology of the lesion, signal intensity, extension to growth plate, soft-tissue mass, joint effusion).

RESULTS

The 84 patients showed typical radiographic features of achondroplasia around the knee, such as flaring and splaying of metaphyses. 23 patients had metaphyseal cotton-wool-like lesions associated with hypodense column-like lesions on radiography which corresponded to T2-hyperintense columns arising from the growth plate into the distal femoral and proximal tibial metaphysis. These lesions did not demonstrate associated periosteal reaction or soft-tissue mass.

CONCLUSION

The metaphyseal lesions shown in our study could be considered a radiographic feature of achondroplasia, and therefore these lesions could help radiologists diagnose this disease.

CLINICAL RELEVANCE/APPLICATION

This study could help further characterise the radiographic features of the lower limb in children with achondroplasia.

PD204-SD-SUB2

Thoracic Osteoarticular Pathology in Cystic Fibrosis: A Source of Added Comorbidity Coming Along with Longer Life Expectancy - How Prevalent is It and How Much Does It Depend on the Degree of Lung Involvement?

Sunday, Dec. 1 1:00PM - 1:30PM Room: PD Community, Learning Center Station #2

Participants
Luis A. Rubio Romero, MD, Baracaldo, Spain (*Presenter*) Nothing to Disclose
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Saez-Garmendia Fermin, Baracaldo, Spain (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate the prevalence and evolution of thoracic spine osteoarticular pathology in patients with Cystic Fibrosis (CF). To compare the severity of vertebral osteoarticular disease with the degree of lung involvement.

METHOD AND MATERIALS

A retrospective review was conducted in our institution including 200 patients diagnosed with CF between the years 2009 and 2017 who had at least one chest x-ray during that period of time. The degree of kyphosis and scoliosis (Cobb's angle) as well as the presence of thinning or loss of the intervertebral disc space and the presence of irregularities in the endplates of the vertebral bodies were assessed. Subsequently the patients were classified into five categories of severity (absent, mild, moderate, severe and advanced). Lung involvement was determined using the normalized Chrispin-Norman score. Comparison between the initial and most recent radiographs (mean interval time: 5 years), as well as correlation between the variables was performed through McNemar's and Chi-square tests using standardized statistic software.

RESULTS

The prevalence of pathology was higher than that of the general population (GP) according to the literature. Kyphosis (Cobs's angle >40º) was present in 29.9% of the patients of the sample (4,5% in the GP) and scoliosis (Cobs's angle >10º) was present in 12% (0,67-2,5% in the GP). Thinning or loss of the intervertebral disc spaces was present in 46.8% and irregularities in the vertebral endplates in 29.8%. Excluding scoliosis (slight, non-significant interval increase), a statistically significant increase ($p<0,001$) in severity was observed between the first and the last available examinations. The degree of lung involvement showed significant correlation ($p=0,003$) with the degree of osteoarticular pathology.

CONCLUSION

Patients with CF are at a higher risk for thoracic vertebral osteoarticular pathology than the general population. There is a significant correlation between the degree of lung involvement and the likelihood of osteoarticular pathology, although their clinical course might not be necessary related.

CLINICAL RELEVANCE/APPLICATION

Both clinicians and radiologists should be aware of the higher risk for thoracic vertebral osteoarticular pathology in this population group. Thoracic spine should be assessed in chest radiographs and CT scans to detect early changes in order to implement adequate conservative measures to prevent a more advanced involvement.

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PD236-SD-SUB4

Longitudinal Surface-Volume Consistent Infant Brain Atlases

Sunday, Dec. 1 1:00PM - 1:30PM Room: PD Community, Learning Center Station #4

Participants
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PURPOSE

Existing cortical surface and volumetric atlases are constructed independently, causing misalignment between the tissue boundaries of the volumetric atlas and the white matter and pial surfaces of the cortical atlas. We propose a method to construct surface-volume consistent longitudinal atlases for 6, 9 and 12 months old infants brains, such that cortical surface and volumetric analyses can be conducted consistently.

METHOD AND MATERIALS

The dataset consisted of T1- and T2-weighted images from 26 healthy infant subjects scanned between 6 and 13 months. Each image had 208 sagittal slices with 0.8mm isotropic voxel size. All the images were processed to obtain accurate tissue segmentation maps, as well as white matter and pial surfaces. To deal with longitudinal appearance changes, we use tissue segmentation maps, instead of intensity images, for registration. We construct the 12-month cortico-volumetric atlas by (i) surface-constrained group-wise registration of the tissue segmentation maps of subjects scanned at 11, 12, or 13 months, (ii) temporal kernel regression of the registered cortical surfaces to get cortical surface atlas As12, (iii) alignment correction of the registered tissue segmentation maps based on As12 and (iv) majority label fusion to compute the volumetric atlas Av12. The age-specific cortico-volumetric atlases prior to 12 months are obtained by parallelly transporting the longitudinal displacements of each subject to the 12-month atlas space. These transported longitudinal displacements are finally averaged to warp As12 and Av12.

RESULTS

We compared our cortico-volumetric atlases with atlases obtained using publicly available Demons registration (baseline) method. The qualitative and quantitative results show that the atlases constructed by the proposed method are consistent in both the surface and volumetric spaces, whereas the baseline method shows greater misalignments at the gray-white matter interface.

CONCLUSION

The proposed longitudinal infant brain atlases are consistent in both the surface and volumetric spaces and preserve anatomical details.

CLINICAL RELEVANCE/APPLICATION

We introduce a method to jointly construct longitudinal cortical surface and volumetric atlases in the same space, allowing consistent studies of infant brain development.

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PD237-SD-SUB5

Conventional and ZOOmit DWI for Evaluation of Fetal Brain at 3T: Preliminary Experience

Sunday, Dec. 1 1:00PM - 1:30PM Room: PD Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
Liqi Yang, Shenzhen , China (*Presenter*) Nothing to Disclose
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PURPOSE

Diffusion-weighted imaging (DWI) is increasingly performed to assess brain development in fetuses that are at increased risk for neurodevelopmental abnormalities. However, the implementation of conventional DWI in fetal brain in pregnancies is challenging due to chemical shift and susceptibility artifacts which result in ghosting and geometric distortion. The aim of this study is to evaluate the feasibility and clinical robustness of a zoomed diffusion-weighted EPI (ZOOmit-EPI) sequence in MR imaging of the fetal brain with comparison to the conventional single-shot EPI sequence.

METHOD AND MATERIALS

This IRB-approved study was performed in 8 women with singleton pregnancies (range, 23-33 weeks gestation) on a 3T MAGNETOM Prisma scanner with an 18-channel body matrix coil (Siemens Healthcare, Erlangen, Germany). For conventional DWI, 3 b values (50, 500, 800 s/mm2) and following imaging parameters were used: TR/TE=3000/65ms; FOV=260x260 mm2; matrix=130×130; slice thickness=4mm and slice number=15. For ZOOmit DWI, the same b values and following imaging parameters were used: TR/TE=2800/57ms; FOV=190x87mm2; matrix=114×91; slice thickness=4 mm and slice number=15. Signal-to-noise ratios and ADC values between the two methods were compared using Wilcoxon signed rank test. Statistical significance was defined as $p < 0.05$.

RESULTS

Compared with conventional DWI, ZOOmit DWI demonstrates less distortion and sharper depiction of the brain structures (Figure 1). Furthermore, the images obtained with the ZOOmit DWI method had better SNR (258.6±53.7 vs. 186.0.50±24.2, p=0.008). However, ADC values did not differ significantly between the two methods (1260.8±95.7 vs. 1252.6±88.5, p = 0.20).

CONCLUSION

ZOOmit DWI of the fetal brain leads to substantial image quality improvements and exhibits markedly reduced susceptibility and distortion artifacts relative to conventional EPI DWI.

CLINICAL RELEVANCE/APPLICATION

ZOOmit DWI may serve as a superior alternative for the diagnosis of fetal brain with reduction of susceptibility artifacts in conventional DWI.

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PH002-EB-SUB

The Need for Virtual X-Ray Fluoroscopic Imaging in Trauma IR: The Best for Proton Irradiation Dose Reduction

Sunday, Dec. 1 1:00PM - 1:30PM Room: PH Community, Learning Center Hardcopy Backboard

FDA Discussions may include off-label uses.

Participants
Yoshihiro Tanaka, BA, Ibaraki, Japan (*Presenter*) Nothing to Disclose

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TEACHING POINTS

In this study, we investigated the relationship between supporting images of a new concept and exposure reduction in traumatic IR.(Fig.1) This is a research on exposure reduction aimed at shortening the procedure time by creating a support image similar to the IR image using CT volume data, in contrast to the existing exposure protection and exposure reduction mechanisms of IR equipment.(Fig.2-3)

TABLE OF CONTENTS/OUTLINE

A virtual fluoroscopic image is a Ray Summation image that is similar to a fluoroscopic image, and blood vessel running and the lesioned part are superimposed and displayed. Thereby it possible to use information intuitively alongside fluoroscopic images, and to avoid unnecessary mapping imaging for anatomical identification and time waste due to blind catheterization under fluoroscopy, aiming at rapid vascular selection and hemostasis. Also, a workstation can be easily installed and implemented, and the CT volume data obtained in advance is used so that there is no need to purchase new and expensive IR equipment.(fig.4) As a result, the number of angiographies required for dissection can be minimized, which not only reduces the amount of contrast agent and exposure, but also reduces complications by shortening the procedure time.(fig.5)

PH127-ED-SUB8

A Handbook of Non-EPI Diffusion Tensor Imaging Sequences: Physical Basis, Technical Adjustments, and Potential Clinical Applications

Sunday, Dec. 1 1:00PM - 1:30PM Room: PH Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
Teodoro M. Noguerol, MD, Jaen, Spain (*Presenter*) Nothing to Disclose
Paula Montesinos de la Vega, Madrid, Spain (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Javier Royuela del Val, Cordoba, Spain (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD,PhD, Jaen, Spain (*Abstract Co-Author*) Speaker, Canon Medical Systems Corporation; Speaker, Koninklijke Philips NV; Speaker, Siemens AG

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TEACHING POINTS

1. Review the physical basis of conventional Echo Planar Imaging (EPI) Diffusion Tensor Imaging (DTI) and its limitations. 2. Explain, from an educational point of view, the physical basis and technical adjustments for obtaining non-EPI DTI sequences in different anatomical regions. 3. Show potential applications of non-EPI DTI in different clinical scenarios.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Physical basis of conventional EPI-DTI a. Advantages b. Limitations and pitfalls. 3. Non-EPI DTI sequences. a. Physical basis b. Sequences design (multishot, PROPELLER, TSE..) c. Technical adjustments including number of directions and b values. c. Coil selection and patient positioning d. 1.5T or 3T magnet? e. EPI vs. non-EPI DTI acquisitions. 4. Biological meaning of parameters derived 5. Potential indications of non-EPI DTI. a. Central nervous system applications b. Spine applications c. MSK applications d. Body applications. 6. Conclusions and take home messages

PH128-ED-SUB7

Contrast-Enhanced Spectral Mammography (CESM): How Does It Work?

Sunday, Dec. 1 1:00PM - 1:30PM Room: PH Community, Learning Center Station #7

Awards
Magna Cum Laude
Identified for RadioGraphics

Participants
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Samuel J. Fahrenholtz, PhD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is: Discuss the physics and physiological basis of contrast-enhanced spectral mammography (CESM) Differentiate the abilities of CESM from conventional digital mammography (FFDM)

TABLE OF CONTENTS/OUTLINE

1. How does mammography (FFDM) work? 2. When does FFDM fail? 2a. Breast Density 3. How does contrast-enhanced spectral mammography (CESM) work? 3a. kV, k-edge, and image subtraction 3b. Contrast dynamics, cancer biology, and the leaky vessel 4. FFDM vs. CESM 4a. Radiation Dose 4b. Contrast Risks 4c. Image Quality 4d. Quality Control

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PH200-SD-SUB1

Super-Resolution Blood Flow Imaging in Human Liver Using Ultrasound Diffraction Attenuation Microscopy

Sunday, Dec. 1 1:00PM - 1:30PM Room: PH Community, Learning Center Station #1

Participants
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PURPOSE

To provide a tool for fast super-resolution microvascular imaging in clinical based on contrast-enhanced ultrasound.

METHOD AND MATERIALS

Subjects and data acquiring: A vial of Sonovue was diluted with physiological saline (25 mg, 20 mL) and a dose of 0.1mL was injected by intravenous infusion into a young healthy male volunteer. Contrast-enhanced ultrasound (CEUS) frames with sparse microbubble distribution of the liver were acquired during each breath-holding for 20 seconds. Data processing: The frame stack was processed by spatial radiality transformation and temporal fluctuations analysis (Fig. 1e.) using Matlab and Java.

RESULTS

The UDAM attenuates the acoustic diffraction induced point spread functions of microbubbles and a super-resolved vascular structure of the human liver is achieved within 20 seconds (Fig.1d.). Liver microvessels with 100μm diameter are revealed in the UDAM image. Naked eyes can observe significant improvement in microvascular visualization compared with a single CEUS frame and the maximum intensity projection of CEUS frames (Fig. 1(a-c).).

CONCLUSION

In summary, we demonstrate the feasibility of the proposed UDAM method for fast super-resolution blood flow imaging in human liver.

CLINICAL RELEVANCE/APPLICATION

The UDAM is a novel, fast, and non-invasive imaging tool for the in vivo assessment of microvascular structures and is potentially beneficial to the study and diagnosis of liver cancers, cysts, microvascular perfusion et al. Moreover, the application of UDAM can be extended to other organs.

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PH201-SD-SUB2

Patient-Informed and Physiology-Based Modelling of Hepatic Contrast Dynamics in Contrast-Enhanced CT Imaging

Sunday, Dec. 1 1:00PM - 1:30PM Room: PH Community, Learning Center Station #2

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PURPOSE

Iodinated contrast agents are commonly used in CT imaging to enhance tissue contrast. Consistency in contrast enhancement (CE) is critical in radiological diagnosis. Contrast material circulation in individual patients is affected by factors such as patient body habitus and anatomy leading to significant variability in organ contrast enhancement, image quality, and dose. Toward the goal of improving CE consistency in clinical populations, in this work we developed a contrast dynamics model to predict CT HU enhancement of liver parenchyma in abdominopelvic CE CT scans.

METHOD AND MATERIALS

This study included 700 adult abdominopelvic contrast CT exams performed in 2014-2018 using two scanner models from two vendors. Each CT image was segmented using a deep learning-based segmentation algorithm and the hepatic parenchyma HU values were acquired from the segmentations. A two-layer neural network-based algorithm was used to identify the relationship between patient attributes (height, weight, BMI, age, sex), scan parameters (slice thickness, scanner model), contrast injection protocols (bolus volume, injection-to-scan wait time), and the liver HU CE. We randomly selected 60% studies for training, 10% validation, and 30% for testing the accuracy. The training output was the extracted HU values. The goodness-of-fit of the model was evaluated in terms of R^2, Adjusted R^2, Mean Absolute Error (MAE), and Mean Squared Error (MSE) between the model prediction and ground truth. In addition, the generalizability of the model was evaluated by comparing the R^2 in the training data (leave-one-out validation) and the testing data.

RESULTS

This preliminary model has an 0.51 R^2, 0.40 adjusted R^2, 10.0 HU MAE, 159.1 HU MSE, 0.6±12.8 HU Mean Error, and 2.5 HU Median Error on test data. For training data, the model has 0.59 R^2, 0.56 Adjusted R^2, and 0.5 predicted R^2. The close R^2 between testing and training data results indicate a reasonable generalizability.

CONCLUSION

Results showed considerable predictability of liver CE from patient attributes, scanning parameters, and contrast administration protocol. We envision to expand the model to include other major organs toward a comprehensive predictive model.

CLINICAL RELEVANCE/APPLICATION

A contrast dynamics model can be an essential tool to personalize contrast-enhanced CT protocol and to improve the consistency of contrast enhancement across different patients in diagnostics imaging.

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PH239-SD-SUB3

Radiation Dose Exposure During Pelvic Angiography and Intervention: What Can Be Done to Minimize Risk

Sunday, Dec. 1 1:00PM - 1:30PM Room: PH Community, Learning Center Station #3

Participants
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PURPOSE

Methods to decrease radiation dose during pelvic angiography are of paramount importance as many of the targeted patients are relatively young and desire future fertility. The purpose of this study is to evaluate the relative radiation dose exposure to patients during pelvic angiography and intervention as a function of bladder catheterization and additional factors utilizing an abdominopelvic phantom model.

METHOD AND MATERIALS

Samples cases of pre-specified digital subtraction angiography (DSA) runs were conducted upon a phantom model. The runs were obtained in a protocol which simulated imaging obtained during pelvic intervention and included anteroposterior (AP), bilateral oblique, and magnified views. A total of six sample cases were conducted without (Group 1) and with (Group 2) the presence of an apparatus simulating contrast in a distended bladder. Radiation dose data in the form of dose area product per frame (DAP/f) and air kerma per frame (AK/f) was compared between the groups. Radiation dose as a function of views and magnification was also compared.

RESULTS

The mean total DAP/frame for Group 1 was 141 mGy-cm2/f (137 - 145) compared to Group 2 mean total DAP/frame of 270 mGy-cm2/f (258 - 282), reflecting a significant decrease in radiation dose as a result of bladder catheterization simulation ($p < 0.01$). The mean total AK/frame for Group 1 was also significantly decreased ($p < 0.01$) at 0.446 mGy/f (0.433 - 0.459) versus 0.871 mGy/f (0.816 - 0.925) for Group 2. Dose parameters in the magnification and oblique views were also significantly decreased in Group 1 compared to Group 2.

CONCLUSION

In this controlled simulation of pelvic angiography utilizing an abdominopelvic phantom, there is a 48% reduction in DAP and a 49% reduction in AK on the basis of simulated bladder catheterization. This method of dose reduction during pelvic angiography has not previously been quantified. Other previously described techniques of modulating radiation dose were also investigated and confirmed to effect DAP and AK in a consistent manner. Based on our results, patients undergoing pelvic angiography should receive bladder catheterization unless there is a strong contraindication.

CLINICAL RELEVANCE/APPLICATION

Dose reduction in pelvic angiography is consistently achieved through bladder catheterization in addition limiting oblique views and magnification.

PH240-SD-SUB4

Comparing 3D MSK-View with 2D Standard Scans: Shortening Imaging Time of the Shoulder MRI Study - A Clinical Quality Feasibility Study

Sunday, Dec. 1 1:00PM - 1:30PM Room: PH Community, Learning Center Station #4

Participants
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CONCLUSION

There is no significant difference in image quality between the 2D scans and one 3D MSK-View in terms of detection of pathology and diagnostic confidence. The average time reduction achieved using one 3D MSK-View in comparison to three 2D scans were 3.35 mins (39%). This study proves the potential of replacing three 2D scans with one 3D scan in shoulder.

Background

2D sequences have been used in practice to evaluate shoulder pathologies. Partial volume and higher thickness make these scans unusable for reformatting to different orientations. Radiologists have to separately acquire multiple 2D fat-suppressed sequences for the complete diagnosis. Attempting lower thickness and higher resolution 2D scans for reformatting purpose is also practically impossible due to longer scan time. The only feasible alternate could be using fat-suppressed 3D turbo-spin-echo (MSKView) sequence, which has higher in-plane and through-plane resolutions for reformat as well as shorter scan time.

Evaluation

18 patients were scanned in a 3.0T wide-bore MRI (Ingenia, Philips Health Systems). The comparative scan protocol comprised of three 2D fat-suppressed PD spin-echo sequences and one isotropic 3D PD fat-suppressed turbo-spin-echo (MSKView) sequence. Sequence details are mentioned in Table-1 attached. Two independennt specialist MRI radiologists reviewed the 2D scans in all three orientations as well as the 3D scan reformatted in all three orientations. Both sets of images were rated on a scale of 1 to 5 on the basis of edge/sharpness, blurring, image artifact/noise, contrast between fluid and cartilage, small ligament delineation. Images were assessed viewing three specific structures Rotator cuff, labrum and ligament.

Discussion

Interrater agreement on image quality was compared between the 2D vs 3D scans via a multivariate non-parametric Hotelling's T2 test. There was no statistically significant difference between the 2D and 3D scans of 18 patients evaluated by each radiologist (alpha < 0.001 level). Further, the mean percentage observed agreement between 2D and 3D scans for all five measures across the radiologists was 91.8%.

PH241-SD-SUB5

Quantitative Evaluation of Bone Microstructure on a Novel Ultra-High Resolution Whole-Body CT

Sunday, Dec. 1 1:00PM - 1:30PM Room: PH Community, Learning Center Station #5

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PURPOSE

A novel ultra-high resolution multi-detector CT has recently been introduced (Canon Precision UHR CT). The system enables >2x improved spatial resolution (~150 µm detail size) compared to current generation CT. Among clinical applications that might benefit from the enhanced spatial resolution is assessment of microstructural factors affecting bone strength in spine and hips. We evaluate the performance of UHR CT in measurements of trabecular microarchitecture.

METHOD AND MATERIALS

Helical acquisitions (120 kVp tube voltage, ~10 mGy CTDI dose) of human bone samples embedded in a ~16 cm diameter plastic cylinder were performed. Two scanning protocols were compared: an UHR acquisition, featuring 0.25 mm slice thickness, 1796 detector channels, 160 detector rows, and x-ray tube focal spot size of 0.4x0.5 mm, and a Normal Resolution protocol (NR) implementing 0.5 mm slice thickness, 896 channels, 80 rows, and a focal spot of 0.8x1.3 mm. Both UHR and NR data was reconstructed using a sharp bone kernel. Micro-CT (µCT) of the bone samples were obtained at 28 µm voxel size. Trabecular bone metrics (thickness Tb.Th, spacing Tb.Sp and Bone Volume fraction BV/TV) were measured in 10 regions-of-interests (ROIs) distributed at corresponding locations in the CT and µCT volumes. Bone segmentations for the measurements were obtained with Bernsen's local thresholding.

RESULTS

UHR CT yielded noticeably improved delineation of trabecular patterns compared to NR CT. The parameters of the thresholding algorithm were selected so that the correlations against µCT in the measurements of BV/TV (which is fairly insensitive to spatial resolution) were comparable for UHR-CT and NR CT (both ~0.61). At the matched BV/TV correlation, UHR CT achieved ~10% improved correlation in Tb.Th compared to NR CT (0.58 for UHR vs. 0.52 for NR) and ~80% better correlation in Tb.Sp (0.58 for UHR vs. 0.32 for NR).

CONCLUSION

UHR CT achieves improved quantification of bone microarchitecture compared to standard resolution CT. The unique structural information provided by UHR CT will complement bone mineral density measurements to enable accurate estimation of fracture risk in osteoporosis.

CLINICAL RELEVANCE/APPLICATION

A novel whole-body ultra-high resolution CT improves quantitative assessment of vertebral microarchitecture compared to standard CT, enabling more accurate estimation of fracture risk.

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QI019-EB-SUB

Using Point-of-Care Patient Photographs with Musculoskeletal Radiography to Identify Errors of Laterality in Emergency Department Imaging

Sunday, Dec. 1 1:00PM - 1:30PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

To reduce errors in laterality in musculoskeletal imaging by evaluating the utility of point-of-care extremity patient photographs accompanying musculoskeletal radiography.

METHODS

352 consecutive musculoskeletal (MSK) radiograph-photograph combinations and corresponding radiography provider orders between October 1, 2018, and January 31, 2019, were retrospectively reviewed. Photographs were obtained simultaneously with the radiographs using the PatCam System (Camerad Technologies, Decatur, GA). In each case, laterality was recorded for all photographs, radiographs (based on lead side markers), and radiography orders. Any laterality discrepancy among these variables was recorded. The side indicated on the provider order was taken as the gold standard.

RESULTS

347 consecutive MSK radiograph-photograph combinations from 253 unique patients consisted of 129 upper extremity (shoulder, humerus, elbow, forearm, wrist and hand) and 218 lower extremity (hip, femur, knee, tibia/fibula, ankle and foot) radiographs. In total, two discrepancies in laterality were identified, 0.58% of the total sample. The first discrepancy consisted of a left foot radiograph, which was labeled as "R" on the radiograph and left in the order. In this case, the patient photograph confirmed with certainty that the incorrect side marker was placed. The second discrepancy consisted of a hip radiograph, in which one of three total images had discrepant L/R labeling; in this case, the patient was covered with a sheet, and both hips were included in the photograph; however, a monitoring device on the patient's left side in the photograph included on the radiographs was used to determine which film was incorrectly labeled.

CONCLUSION

In our study, over 1 in 200 patients was identified as having an error in labeling of laterality on radiographs. Patient photographs obtained concurrently with MSK radiographs can provide a valuable quality tool in identifying errors of labeled laterality. Obtaining patient extremity photographs at time of MSK radiography has the potential to reduce right-left errors by introducing additional visual data to confirm laterality.

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QI029-EB-SUB

State-Mandated Breast Density Notifications: Can They Be Less 'Dense'?

Sunday, Dec. 1 1:00PM - 1:30PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

For the past decade, increased awareness of the relationship between dense breast tissue and breast cancer risk has led to state legislatures requiring notification statements alerting women that breast tissue density may impact their health. Currently, breast density notifications (BDNs) have become mandatory in 36 states. BDNs are mailed directly to women as a component of their screening mammogram lay letter. Thus, women are expected to comprehend the notification independently, creating a substantial potential for misinterpretation. This has increased the importance of comprehension of written patient communications. Since 2016, the complex language of state-mandated BDNs has been challenged, as it is perceived to be beyond the comprehension of most patients. Yet, no attempts have been made to improve these notifications. Thus, our aim is to assess whether a revised BDN written at an appropriate reading level can improve perceived lifetime breast cancer risk and likelihood of patient-initiated discussion with their providers regarding their breast density compared to the current state-mandated BDN.

METHODS

The Flesch-Kincaid grade level was utilized to assess the readability of our current state-mandated BDN. A revised notification with similar content formulated at a lower reading grade level was developed. Both notifications were presented to patients for direct comparison, via a paper survey asking questions to evaluate patients' perceived lifetime breast cancer risk and likelihood to discuss breast density with their providers. The survey also recorded age range (e.g., '41-50 years old'), race, highest level of education achieved, and if the patient is a health care provider. The IRB at our institution acknowledged this as a quality improvement project exempt from approval. Surveys were distributed to screening mammography patients at four institutional outpatient imaging centers. Simple randomization was utilized to distribute the surveys in the waiting rooms along with standard intake forms between January 2019 and February 2019. The categorical survey responses were compared between the two surveys using McNemar's test. The Chi-square test was used to evaluate for different distributions of selecting the correct perceived risk and likelihood of initiated discussion for each notification for selected sociodemographic variables. Multivariate analysis was performed for statistically significant variables. For all analyses, $p < 0.05$ was considered statistically significant.

RESULTS

The Flesch-Kincaid grade level of the current state-mandated and revised BDN were 12th and 5th grade level, respectively. 500 surveys were analyzed: 283 patients obtained less than a college degree and 217 patients obtained at least a college degree. Survey data demonstrated 56.6% (283/500) of all women perceived dense breast tissue results in a 'high' lifetime risk of developing breast cancer from the current state-mandate BDN compared to only 2.2% (11/500) with the revised BDN ($p < 0.001$). With the current notification, the majority of patients who responded with a perceived 'high' lifetime breast cancer risk achieved less than a college degree (74.9%) [212/283]. Nearly all women were more likely to initiate a discussion with their provider regarding their breast density after reading the revised BDN (96.0%) [480/500] as opposed to the current BDN (32.8%) [164/500], $p < 0.001$. Similar to perceived lifetime breast cancer risk, the majority of patients who were unlikely to discuss breast density with their providers after reading the current BDN achieved less than a college degree (72.0%) [242/336]. On multivariate analysis, education level was a statistically significant sociodemographic factor in selecting the correct perceived breast cancer risk in the current BDN when adjusting for race and being a health care provider (odds ratio 9.02, 95% CI 3.16-25.71). On multivariate analysis, education level was a statistically significant sociodemographic factor for being likely to discuss breast density with her provider with the current BDN when adjusted for age (odds ratio 9.8, 95% CI 3.4-28.0).

CONCLUSION

Patient directed written materials that exceed the national recommendation of 6th to 8th grade reading level may lead to patient misunderstandings and potentially result in poor compliance. Our study emphasizes the importance of readability and its direct effect on not only improving women's health literacy, but also encouraging women to have an active voice in their own personalized care. Thus, it is imperative to revise any state-mandated breast density notifications written higher than an 8th grade level to decrease the misperceptions related to breast density notifications. This will facilitate better understanding of the notification and improve the quality of individualized breast cancer screening for women with dense breasts.

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QI104-ED-SUB1

Centralized Radiology Scheduling: How Improving Its Efficiency Can Improve Patient Access to Imaging and Satisfaction: A Close Examination of Key Process Steps and Process Metrics

Sunday, Dec. 1 1:00PM - 1:30PM Room: QR Community, Learning Center Station #1

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PURPOSE

Value based radiology contiues to grow with its focus on Quadruple aim: improved patient outcomes, reducing costs, improving the patient experience, and improving the well being and experience of the healthcare provider. Patient access to medical Imaging is a critical step towards value based imaging and scheduling is the key intake point that touches our patients early in the Radiology Value Chain. Large radiology practices use centralized scheduling as they benefit from pooling of scheduling resources, common shared knowledge and cost structure. However large centralized scheduling department can be plaqued by the problems of decreased efficiency, leakage, reduce access times and radiology order errors. Although scheduling wait times have traditionally been used as the key process metric to measure access to imaging in the care delivery process, it does not capture additional work flow process improvement oppurtunities that are necessary to drive the over patient out come experience. In our experience, an integrated scheduling team with a operational micro team units of Callers, Schedulers and Pre-Auth/Benefits is essential to maximes on efficiency and also patient satisfaction. In this intergated Trio-POD (Callers, Schedulers Pre Auth) there is significant cross training therefore further maximizing on patient scheduling Turn Around Times. An integrated multifunctional scheduling team also aids in alignment of the process metric toward improved access outcomes.

METHODS

We started out by extensively researching and studying the existing work flow and design of the centralized scheduling department. This was followed by a site visit with a team that included multidisciplinary staff (radiologist, IT person, Business support analysts) to gather data on work flow focussing on the bottle necks in the process chain and to assess the resource allocation and productivity of the teams. Data was collected on the call process metrics, access times, scheduling process times and staff productivity and utilization. Additional effort was also made to assess the impact on quality which primarly included measuring the percentate of scheduling errors. After a thorough analysis of a priority risk scoring (heat map) was created to address high impact and easy targets to achieve were charted. Key areas of improvement were identified in the work flow design and the need to integrate scheduler-Caller-Pre Auth teams and ensure visibility of the work across these three domains. Using Six Sigma Lean approach tools, solution pathways with key measuring metrics to assess progress were adpated by an operational excellence team. Key strategic target goals included: A: Redesign the work flow of scheduling & pre Authorization with elimination of waste. B: Create a cross functional units (A Trio Pod Model) of call handlers, schedulers and Authorization experts. C: Electronic Enhancements to current patient call reminders. D: Visibilty and accurate reporting of scheduling access and process metric monthly to operational committee. E: Update all Radiology protocols. F: Increase centralized scheduling staff and measure productivity.

RESULTS

Signficant improvement in the scheduling process metrics especially the call to wait times decreased from 4min 23 sec to 1 min 55 sec over 5 months (March to July 2018) for the same degree of call volumes/per month. There was also significant decrease in the ACR (Abandonment call rates) from 19.5% to 11.5% over the same time frame. As part of sustainabilty of the operational excellence project the current ACR are around 2.5% below industry standards. Interms of the patient Access to imaging schedules the 1st and 3 rd available dates for MRI exams also reduced from few week to less than 5 days.

CONCLUSION

Centralized scheduling performance efficiency is critical for improved access and patient satisfaction. Although, most practices put more emphasis on operational improvements from time of patients arrival for scan to report delivery bottlenecks in central scheduling can have significant impact on revenues as well. Radiology scheduling for large practices including academic centers have complex work flows secondary to variations in the physician practices, therefore it is important to understand their preferences and need for expedited appointments. We propose for a integrated scheduling model with highly functional units working as TRIO-POD which includes Callers-Schedulers-Authorization experts, an efficient cross functional team to improve through put and more importantly improved patient experience driven by prompt service and confirmation. Finally we reccomend the departmental operational teams be well informed of the scheduling process metrics looking beyond access times, a window that can shed light on refferal leakage.

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QI105-ED-SUB2

"United We Stand"; Contrast Reaction Management Training for Outpatient Imaging Centers with Emphasis on Teamwork

Sunday, Dec. 1 1:00PM - 1:30PM Room: QR Community, Learning Center Station #2

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PURPOSE

Life-threatening reactions to contrast media warrant prompt response by a well-prepared team. Building cohesive teams with an appropriate level of training can be challenging but is especially important at outpatient imaging centers with limited access to hospital services. The aim of this project was to create capable, well-trained teams by restructuring contrast reaction training in a large private practice's outpatient imaging centers. Teams of respondents include radiologists, radiology residents, nurses, radiology technologists, and patient care assistants (PCA). Our training program included over 130 personnel from these diverse roles.

METHODS

The impetus for our project was a potentially life-threatening contrast reaction, leading to a root cause analysis which revealed major deficiencies in our practice's contrast reaction management. Subsequently, two radiologists attended a reaction management training course in 2018, assisting in development of an interdisciplinary three-phase plan to revamp the existing contrast reaction management training: 1. Standardization - ensuring identical emergency contrast reaction boxes at each outpatient center. 2. Education - using multiple modalities, teach staff about reactions and how to manage them. 3. Simulation - participants attend a 2 hour simulation lab workshop, managing contrast reactions in small groups utilizing an interactive robotic patient. To standardize equipment at outpatient imaging centers, two instructors visited each location, assessed the equipment, and interviewed technologists, nurses, and pharmacists about current contrast reaction practices. This information was used to standardize and simplify the emergency contrast reaction boxes (figure 1). Briefing sessions were provided when the boxes were delivered to the outpatient imaging centers. The second phase was comprised of an educational presentation covering contrast agents, contrast reactions, and how to respond to them. This brief was distributed with associated pre/posttests to nurses and physicians online and via a hands-on workshop to technologists and PCAs. After reviewing the presentation, it became apparent that a preparatory step between slides and simulations would be helpful to improve the readiness and confidence of participants and to use the costly simulation lab time most efficiently. Therefore, we created professionally recorded videos of five contrast reaction scenarios and appropriate medication usage. These videos proved to be a vital component of our training program and were available to participants prior to their simulation lab experience. Finally, interactive simulations of six contrast reaction scenarios were scripted: hives, bronchospasm, laryngeal edema, vasovagal, anaphylaxis, and multi-symptom. Employees participated in the simulation lab experience in teams of 4-6, comprised of at least one physician plus technologists, nurses, and PCAs. The standardized emergency reaction box was utilized during simulations. Pre/posttests were provided, as well as a qualitative survey regarding the entire training experience.

RESULTS

Data was collected from multiple choice tests administered before and after each phase and qualitative surveys. Technologists and PCAs were issued different exams from nurses and doctors. Prior to training, average pretest scores were 65% in the MD/Nurse group and 67% in the Tech/PCA group. Statistically significant improvements in pre/posttest scores were made by each group during the first two phases ($p=<0.05$). Posttest scores improved with each phase of training (Table 1). Simulation lab pretest tech/PCA average score was 93% and 90% by the MD/Nurse group. Statistically significant ($p=<0.05$) improvements were made by both groups upon the completion of this training program when initial pretests and final posttests were compared. Lastly, qualitative survey results demonstrated positive feedback with a preference for video and simulation lab training over educational slides and hands-on workshop. Many participants indicated lack of equipment standardization or knowledge of its use as a significant barrier to managing reactions prior to completing training.

CONCLUSION

Participants showed meaningful improvement through each step of this training program. Ultimately, using multiple learning modalities, test scores prior to the simulations were above 90%, improving from an initial average of 65% before any training. It was evident that teams were well-prepared for the simulation labs with strong pretest test scores and, subjectively, their success in treating the simulated contrast reactions. Cost may be a barrier to simulation training, and having well-prepared participants allowed us to use lab time efficiently. The qualitative data collected reinforced the success of this three-part training program for all participants. We plan to utilize surveys in the coming months to measure the current comfort level of teams responding to contrast reactions after this vigorous training.

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QI106-ED-SUB3

A Comprehensive Lean Strategy to Improve Patient Access to MRI Examinations in an Integrated Multispecialty Practice

Sunday, Dec. 1 1:00PM - 1:30PM Room: QR Community, Learning Center Station #3

Awards
Quality Improvement Reports Award
Identified for RadioGraphics

Participants
Daniel S. Bor, BS, Denver, CO (*Presenter*) Nothing to Disclose
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PURPOSE

MRI is a high cost imaging resource that requires detail-oriented processes to ensure safe, high-quality care. The complexity of managing MRI resources is often a utilization challenge; however, timely access to MRI can be a major satisfier for patients and referring providers. In our integrated multispecialty practice, we noticed an insidious prolongation of our MRI access metrics. To address this issue, we assembled a cross-functional stakeholder team that utilized lean principles to improve MRI access.

METHODS

This quality improvement project was performed in an integrated healthcare system that serves 650,000 members, interprets 450,000 imaging exams per year, and employs 27 radiologists and 231 technologists and support team members. In June 2018, an interdisciplinary team created a smart goal of decreasing the average days wait by 50% (from 15 to 7.5 days) and creating capacity to meet demand for same day and next day MRI appointments by December 31, 2018. The project team analyzed the process for obtaining and interpreting an MRI. Benchmarking data and best practices were obtained from several peer institutions and from medical literature review. Working groups were assembled to identify and capture opportunities to create standard work, increase practicing to top of scope, remove waste, improve communication, reduce rework, and improve patient experience in every aspect of our MRI processes (Table 1). Working group stakeholders included patients, ordering providers, schedulers, imaging managers, business analysts, MRI technologists, and radiologists. Schedulers identified and removed holds and blocks and converted to an open, patient-centered scheduling template that allowed patients to freely book into appointment time slots. Imaging managers and our business analyst created processes to increase staff situational awareness, including a daily oversight strategy. Managers also performed daily schedule reviews to ensure few gaps and few low utility exams were performed. Radiologists redesigned MRI protocols to either meet or exceed quality and scan time of available external benchmarks. The MRI protocol selection process was codified and transferred to MRI technologists to enable them to practice at top of scope. MRI appointment time slots were decreased from 40/60 mins(noncontrast/contrast) to 30/45 mins. The primary outcome was patient access to MRI was the average days wait (i.e., the number of days from when the patient calls to schedule an MRI examination to the day of the patient's appointment). Secondary outcomes included time to the third available appointment (a lead metric for patient access measured each Tuesday at 4pm), availability of same day and next day appointments, MRI scan time lengths, MRI patient volumes, the number of provider outreaches performed by medical imaging for order changes, the number of technical call-back scans, and overall patient satisfaction. Differences were compared using an unpaired t-test with an alpha level of 0.05.

RESULTS

Figure 1 demonstrates the lag metric for MRI access, average days wait, decreased from 14.2 days to 5.8 days after intervention (-8.4 days, -59.2%, P<0.0001). The lead metric for patient MRI access, third available appointment, decreased from 18 days on May 1, 2018 to 0 days and was sustained from January through March 2019 (-16 days, -100%). Figure 2 demonstrates that technical callback rate was not changed during the intervention. Figures 3 and 4 demonstrate improvements in patient satisfaction metrics that coincided with this intervention. Pre (4/1/18-6/23/18) to post implementation (1/6/19-3/30/19) metric analysis demonstrated: average scan time decreased from 27.7 to 24.8 (-2.9 mins, -10.5%, P<0.0001), patient exam counts increased from 3,357 to 3,834 (+477 patients, +14.2%, P<0.0001). Total exam volume increased 4.2% in Q1 2019 compared to Q1 2018. 10 to 20 same and next day appointments were routinely available beginning in November 2018.

CONCLUSION

This project resulted in significant gains in patient access to MRI exams as measured by improvements in lead and lag access metrics as well as increases in the number of same day and next day MRI appointments. Scan times decreased, and patient volume increased after the interventions, confirming gains in operational efficiency at the same time we maintained quality and improved

patient satisfaction. Our imaging department now routinely has 10-20 same day and next day MRI appointments, which more effectively matches our supply and demand. Noting that many patients have other commitments and nonurgent exam needs, the average days wait of 5 days reflects a balance of having availability for immediate appointments and openings to meet patient preference. Our findings demonstrate the value of applying lean management principles to enable significant improvements in a complex process such as MRI access.

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QI107-ED-SUB4

Improving Accuracy and Reliability of TIRADS Reporting with Novel Automated Points-Based Template

Sunday, Dec. 1 1:00PM - 1:30PM Room: QR Community, Learning Center Station #4

Participants
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PURPOSE

The American College of Radiology published the thyroid imaging reporting and data system (TIRADS) criteria in May 2017. We questioned the reliability of the radiologist-reported TIRADS score and final management recommendations with free-form style radiologist reporting.

METHODS

At our institution, a template to directly convert the ultrasound findings into a calculated TIRADS score was built by a Body Imaging faculty member in May 2017, and integrated into our dictation software, to eliminate the biases of free-form reporting. While radiologists using free-form reporting simultaneously calculate the TIRADS score while dictating the ultrasound findings, a points-based template that has entry fields for all the criteria can increase the accuracy and reduce the bias associated with TIRADS assignment. The adoption of this points-based template by the reading radiologists was adopted in a rolling fashion, with a trial period that lasted several months. Inclusion of the TIRADS score within the radiologist report was encouraged, regardless of whether or not the template was used.

RESULTS

Between 2016 and 2018, nodules on thyroid ultrasound that were recommended for imaging or biopsy were included in our study. For each of the 953 such thyroid nodules, the radiologist-reported ultrasound findings, TIRADS score, and final recommendations were recorded. 721 of the nodules were evaluated after TIRADS criteria adoption at our institution in May 2017, and among these, 534 nodules were evaluated with the use of the points-based standardized template. The remainder were evaluated prior to TIRADS criteria adoption in 2016. For 953 thyroid nodules, we calculated expected TIRADS scores, using ACR criteria and reported ultrasound findings, and then compared these with the observed TIRADS scores in the radiologist report. The expected recommendations for recalculated TIRADS scores were based on the ACR criteria and compared with the observed recommendations in the radiologist report. Chi-squared tests between observed and expected subsets were used to analyze for statistical significance. 473 of 534 nodules assessed with the standardized template had an expected TIRADS score that matched the observed TIRADS score, while only 60 of 187 nodules assessed with free-form reporting after May 2017 had matching scores (89% versus 32%, statistically significant). (Figure 1). 16 of 232 thyroid nodules (7%) evaluated prior to May 2017 adoption of TIRADS criteria had observed recommendations that matched the expected recommendations. This improved to 41% (77 of 187) after adoption of ACR TIRADS criteria in May 2017 among all free-form radiologist reports, which further improved to 56% (297 of 534) with use of our TIRADS standardized template (statistically significant) (Figure 2). 65% of the thyroid nodules studied (121 of 187) should not have been recommended for further management per ACR criteria based on expected TIRAD scores of TR 1, 2, 3 (<1.5 cm), or 4 (<1.0 cm). In comparison, among the 534 nodules reported with our standardized template, only 27% (142 of 534) had these expected TIRADS scores (Figure 3), while 73% had TIRADS scores that require further workup by ACR criteria.

CONCLUSION

Using a standardized template for thyroid ultrasound reports can improve the accuracy of the TIRADS score, improve the reliability of recommendations for further management communicated to the clinician, and prevent unnecessary workup. Collaboration with the Endocrinology faculty and neuroradiology faculty is underway to implement ACR's R-SCAN tools to further improve interoperability of the thyroid ultrasound dictation among reports that use the new TIRADS template at our institution.

RO107-ED-SUB3

Radiation-Induced Malignancies: Current Update on Pathogenesis and Cross-Sectional Imaging Findings

Sunday, Dec. 1 1:00PM - 1:30PM Room: RO Community, Learning Center Station #3

Awards
Identified for RadioGraphics

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TEACHING POINTS

• Review the wide spectrum of radiation-induced malignancies (RIMs), including carcinomas & sarcomas • Discuss the etiology & pathogenesis of RIMs • Describe imaging findings of RIMs • Review role of imaging in screening & surveillance of RIMs

TABLE OF CONTENTS/OUTLINE

Introduction Cahan's criteria for diagnosis of RIMs Etiopathogenesis: Genetics (TP53, MYC genes), Li-Fraumeni syndrome, Increased risk in childhood malignancies, Bystander effect, and smoking & menopausal age Dose-dependence & Impact of different types of radiation on RIMs Radiation-induced carcinomas: Lung, thyroid, breast, esophagus, colon, gastric, endometrial & vaginal cancers Radiation-induced sarcomas: Angiosarcoma, unclassified sarcoma, leiomyosarcoma, malignant peripheral nerve sheath tumor & osteosarcoma Radiation-induced leukemias RIMs after head & neck irradiation RIMs after thoracic irradiation RIMs after pelvic irradiation Cross-sectional imaging findings Screening & surveillance Imaging Conclusion Summary: Radiotherapy is a 'double-edged sword' due to the risk of RIMs following treatment of primary malignancies. Carcinomas & leukemias develop after low dose radiation and sarcomas after high dose radiation. Select RIMs show characteristic imaging findings that help in early diagnosis. Imaging is an essential component of screening & surveillance of RIMs

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RO202-SD-SUB1

High-Dose Irradiation in Combination with Anti-PD-L1 and Anti-VEGF Promote Antitumor Immunity in Murine Lung Tumors

Sunday, Dec. 1 1:00PM - 1:30PM Room: RO Community, Learning Center Station #1

Participants
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PURPOSE

High-dose ionizing irradiation causes tumor cell death, but local recurrence and metastatic disease are observed following irradiation, indicating the inadequacy of radiotherapy-induced responses to maintain antitumor immunity. Therapeutic blockade of programmed death-ligand 1 (PD-L1) can enhance effector T cell function, but it may not be efficacious against all tumors as monotherapy. Anti-vascular endothelial growth factor (Anti-VEGF) therapy may enhance anticancer immune response by normalizing tumor vasculature and reprogramming the tumor microenvironment to an immune-permissive status. Here, we evaluated the antitumor efficacy of high-dose irradiation in combination with anti-PD-L1 and anti-VEGF therapy.

METHOD AND MATERIALS

C57BL/6 mice were implanted with murine Lewis lung carcinoma on the flank, and randomized into four treatment arms: control; RT (40 Gy/4 fx on day 1, 2, 3, 4), RT + anti-PD-L1 (100 μg on day 1, 4, 7, 10), and RT + anti-PD-L1 + anti-VEGF (100 μg on day 0, 3, 6, 9). Immune activation was assessed by flow cytometry. Antitumor response, survival, and re-challenged tumor response on the contralateral flank were evaluated.

RESULTS

Following RT, increased PD-L1 expression was observed on tumor cells (CD45-, $p = 0.050$), whereas increased PD-1 expression was observed on dendritic cells (DC, CD11c+, $p = 0.010$), myeloid-derived suppressor cells (MDSC, CD11b+Gr1+, $p = 0.012$), and macrophages (CD11b+F4/80+, $p = 0.002$). The combination of RT, anti-PD-L1, and anti-VEGF therapy improved survival ($p = 0.031$) and delayed the growth of contralateral flank tumor after re-challenge ($p < 0.001$) unlike in other groups. These outcomes were associated with tumor antigen-specific memory immune response induction. Mechanistic investigations showed the accumulation of CD8+ ($p = 0.046$) and CD4+ T cells ($p = 0.050$) in the combined therapy groups.

CONCLUSION

High-dose irradiation prompted adaptive responses by tumor cells and microenvironment meditating resistance to irradiation. High-dose irradiation in combination with anti-PD-L1 and anti-VEGF therapy may be a novel strategy for clinical evaluation to improve treatment outcomes.

CLINICAL RELEVANCE/APPLICATION

High-dose irradiation in combination with anti-PD-L1 and anti-VEGF promote antitumor immunity in murine lung tumors.

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RO203-SD-SUB2

The Relationship Between Fractures within the Irradiation Field Among Elderly Asian Women Who Have Received Definitive Radiation Therapy for Cervical Cancer Treatment

Sunday, Dec. 1 1:00PM - 1:30PM Room: RO Community, Learning Center Station #2

Participants
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PURPOSE

We investigate the relationship between fractures within the irradiation field among elderly Asian women who have received definitive radiation therapy for cervical cancer.

METHOD AND MATERIALS

A retrospective study of eighty-five elderly Asian women patients of more than 60 years old who received definitive radiation therapy (external beam radiation therapy+ intracavity brachytherapy) for cervical cancer from 2009 to 2016 in our institution. We evaluated the frequency of the intra-field fractures. Fractures were diagnosed by CT or MRI and insufficient fractures were deemed 'fractures' for the purpose of this study.

RESULTS

The median age was 70 years old (range, 60-86 years old). The median follow-up time was 52 months (range, 19-118 months). Seventy-three patients received a whole pelvis radiation therapy (WPRT) dose of 50 Gy. 12 patients received radiation therapy at 50 Gy and an additional radiation boost to the involved lymph nodes or parametrium (median 6 Gy). Intra-field fractures were found to have occurred in 35 patients. Twenty-seven (37%) in WPRT 50 Gy and 8 patients in WPRT 50 Gy plus boost, respectively. The median time to fractures was 19 months (range, 6-99 months). Sixteen patients had single region fractures and 19 patients had multiple region fractures. The cumulative incidence of fractures was increased in the WPRT 50Gy plus boost group (35.4% vs 79.5% at 4 years, p=0.0177).

CONCLUSION

The frequency of fractures within the irradiation field was high for elderly Asian women and the frequency of fractures increased when additional radiation boost treatment to the involved lymph nodes or parametrium was performed.

CLINICAL RELEVANCE/APPLICATION

The frequency of fractures within the irradiation field was high for elderly Asian women and the frequency of fractures increased when additional radiation boost was performed.

UR177-ED-SUB7

Cystogram: Still Alive and Useful

Sunday, Dec. 1 1:00PM - 1:30PM Room: GU/UR Community, Learning Center Station #7

Awards
Certificate of Merit

Participants
Javier Azpeitia Arman, MD, Madrid, Spain (*Presenter*) Nothing to Disclose
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TEACHING POINTS

- To understand the utility of cystogram, indications and contraindications. -To review the study protocol. -To describe normal anatomy and normal imaging appearances of the bladder. -To illustrate appearances of various frequent and unfrequent pathological entities. CT, US , MR and pathology correlates will also be shown.

TABLE OF CONTENTS/OUTLINE

In spite of the use of endoscopy and cross-sectional imaging techniques, cystography has still nowadays a role in bladder evaluation. We review cystograms indications and contraindications, describe how to perform the studies and analyze image interpretation, emphasizing pitfalls and clues to differential diagnosis. We also provide correlation with CT, US, MR and pathology.We present: - Normal anatomy of the bladder. - Basic protocol, and protocols in different indications: to assess vesicoureteral reflux, to detect contrast leaks or fistulas, after radical prostatectomy, incontinence in women. - Imaging findings in normal studies. - Pathology. Filling defects (lithiasis, ureterocele, blood clot), Addition images (diverticula), Bladder wall lesions (Tumors: leyomioma, carcinoma, sarcoma, Inflammatory: cystica, polypoid, papillary, granulomatous BCG cystitis), extrinsic lesions: Prostate (hyperplasia and carcinoma), gynaecology (uterine and ovarian tumors), gastrointestinal (colonic cancer, diverticulitis)

UR178-ED-SUB8

Immunoglobulin G4-Related Disease of the Genitourinary Tract: The Great Imitator

Sunday, Dec. 1 1:00PM - 1:30PM Room: GU/UR Community, Learning Center Station #8

Awards
Cum Laude
Identified for RadioGraphics

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TEACHING POINTS

Immunoglobulin G4-related disease (IgG4-RD) is an increasingly recognized fibroinflammatory condition with a characteristic histopathologic appearance. Although IgG4-RD was initially reported as occurring in the pancreas, it is now well-known that multiple different organs including genitourinary tract can be involved by IgG4-RD. We'll focus on 1) the imaging findings of genitourinary tract involvement of IgG4-RD and address 2) the differential diagnosis and clinicopathologic features.

TABLE OF CONTENTS/OUTLINE

1. Clinicopathologic overview of IgG4-RD 2. Imaging spectrum of genitourinary tract involvement by IgG4-RD 1) IgG4-RD involving kidney: renal parenchymal lesions (multiple nodules, patchy infiltrative lesions), renal pelvis and perinephric lesions (diffuse wall thickening of renal pelvis, soft tissue mass encasing the renal pelvis) 2) IgG4-RD involving ureter: inflammatory pseudotumor, secondary involvement by IgG4-related retroperitoneal fibrosis 3) IgG4-RD involving prostate gland: diffuse prostatitis, periprostatic infiltrative lesion 4) IgG4-RD involving retroperitoneum: retroperitoneal fibrosis, inflammatory pseudotumor 5) IgG4-RD involving urinary bladder and urethra: inflammatory pseudotumor, interstitial cystitis, urethral caruncle 3. Imaging differential diagnosis of genitourinary tract involvement by IgG4-RD

UR179-ED-SUB6

Dual-Energy CT of the Renal Lesions

Sunday, Dec. 1 1:00PM - 1:30PM Room: GU/UR Community, Learning Center Station #6

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TEACHING POINTS

We focus on the diagnosis of renal lesions using dual-energy CT. First, we describe principle of dual-energy CT and types of CT scanners along with their advantages and disadvantages. Secondly, we show the optimal energy for a specific clinical questions. .Thirdly, we introduce the image and parameters calculated using dual-energy CT and also show clinical applications. Finally, we mention the pitfalls and emerging problems.

TABLE OF CONTENTS/OUTLINE

1. Concise description of the principle of dual-energy CT. 2. Types of CT scanners with their advantages and disadvantages. 3. The optimal energy for a specific clinical questions. 4. The image and parameters for the analysis using dual-energy CT. 5. The clinical applications. 6. The pitfalls and emerging problems.

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VI203-SD-SUB1

Evaluation of Outcomes Following Pulmonary Artery Stenting in Fibrosing Mediastinitis

Sunday, Dec. 1 1:00PM - 1:30PM Room: VI Community, Learning Center Station #1

Participants
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PURPOSE

Fibrosing mediastinitis (FM) is a rare disease characterized by fibrosis of mediastinal structures with subsequent constriction of the bronchi and pulmonary vessels leading to potential respiratory compromise and death. Presently there is no effective treatment mitigating this response. Thus, treatment has focused on reducing symptomology caused by compression of structures including percutaneous placement of pulmonary artery stents. Previous studies examining the use of arterial stents in FM are largely limited to case reports and no aggregated study of outcomes has occurred in nearly a decade. Given this knowledge gap, we assessed outcomes of pulmonary artery stenting in FM using multiple radiologic modalities.

METHOD AND MATERIALS

FM patients with pulmonary artery stents were identified through operative reports. At the time of analysis, 9 patients were included in this study (6 females, 3 males; mean age 44.17 years, range 13-68; total 13 stents) from 2005-2018. Results from CT, VQ, and echocardiography studies were collected to assess patency and physiologic response.

RESULTS

All patients had dyspnea on presentation. 7 patients had pre-stenting VQ studies demonstrating diffusion impairment. 100% of patients received initial stenting in the right pulmonary artery. Mean pulmonary artery diameter was 54% of normal lumen prior to stenting. Stenting improved mean systolic pressure differential across the stenosis (pre-stent: 12.00 mmHg, range 5-20; post-stent: 2.29 mmHg, range 0-10; $p < 0.005$). At first CT follow-up (mean 3.58 months, SD 0.52), stents demonstrated improved mean patency (pre-stent: 54.5%, post-stent: 70%). Mean primary patency measured by CT was 69% at average of 1.95 years (range 0.39-7.74). Right ventricular systolic pressures showed a mean 13mmHg reduction. Symptomatically, 89% reported improvement in dyspnea in the initial post-stenting period. There were no mortalities. No significant complications were noted beyond transient chest pain in 2 patients. 2/13 stents were re-intervened upon at 276 and 497 days.

CONCLUSION

Combined , this study demonstrates pulmonary artery stents remain widely patent and provide symptomatic improvement with minimal risk in cases of FM .

CLINICAL RELEVANCE/APPLICATION

This study demonstrates the efficacy, safety, and durability of pulmonary artery stenting and the importance of ongoing imaging follow-up in assessing outcomes in attempts to reduce FM symptoms.

VI204-SD-SUB2

The Initial Experience of 2D-Perfusion Angiography-Guided Balloon Pulmonary Angioplasty

Sunday, Dec. 1 1:00PM - 1:30PM Room: VI Community, Learning Center Station #2

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PURPOSE

The usefulness of balloon pulmonary angioplasty (BPA) has been shown in the treatment of chronic thromboembolic pulmonary hypertension (CTEPH). However, there are no indicators for BPA's target vessel and endpoint definitions, which depend on the operator's experience and the angiography's visual evaluation. In this study, we conducted 2D-perfusion angiography (2D-PA) during BPA to investigate whether it could be an indicator to select BPA's target vessel and endpoint definitions.

METHOD AND MATERIALS

Thirteen patients with twenty-nine treated pulmonary artery segments were included in this study. Those with chronic total occlusion vessels were excluded. To quantify changes in pulmonary blood flow, 2D-PA applications were used. A target ROI in the lung parenchyma was placed in corresponding areas on DSA both pre- and post-BPA. Time to peak (TTP), wash-in rate (WIR), peak density (PD), area under the curve (AUC), and mean transit time (MTT) were assessed. The correlations between the pulmonary-flow grade score (PFG) and these parameters and between changes in PFG and changes in these parameters were evaluated. Using the parameter with the highest correlation, the cutoff values of grade 3 and others were examined using receiver operating characteristic (ROC) curves.

RESULTS

The spearman correlations between PFG and each parameter were as follows: TTP, -0.335, $p = 0.0102$; WIR, 0.539, $p = 0.0000127$; PD, 0.448, $p = 0.000426$; AUC, 0.436, $p = 0.000624$; and MTT, -0.367, $p = 0.00458$. The correlations between the changes in PFG and the improvement rate of each parameter were as follows: TTP, -0.481, $p = 0.00832$; WIR, 0.726, $p = 0.00000826$; PD, 0.666, $p = 0.000079$; AUC, 0.694, $p = 0.0000293$; and MTT, -0.373, $p = 0.0462$. Using the WIR as an index, the ROC curves of the definition of PFG 3 and others were drawn. The area under the ROC curves was 0.802 (95% confidence interval, 0.683 - 0.921). When the cutoff value was at 91.4, a diagnostic ability with a sensitivity of 0.760 and a specificity of 0.758 was obtained.

CONCLUSION

The WIR is the most sensitive and correlated marker of PFG. By setting the WIR cutoff value to 91.4, it became an index to determine the endpoint of BPA.

CLINICAL RELEVANCE/APPLICATION

This study shows the possibility of predicting the endpoint of BPA for CTEPH using 2D-PA.

VI205-SD-SUB3

Transperineal Laser Ablation (TPLA) for the Treatment of Lower Urinary Symptoms in Benign Prostatic Hyperplasia (BPH)

Sunday, Dec. 1 1:00PM - 1:30PM Room: VI Community, Learning Center Station #3

Participants
Guglielmo Manenti, MD, Rome , Italy (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

This is a pilot study aimed to assess safety and efficacy of transperineal laser ablation (TPLA) for treating benign prostatic hyperplasia (BPH).

METHOD AND MATERIALS

Sixteen patients (age 73.4 ± 8.4 years) with LUTS underwent TPLA under local anesthesia. Under US guidance, up to four 21G applicators were inserted in the prostatic tissue. Primary endpoint was absence of relevant complications intra and early (15 days) post-op. Secondary endpoints included operation time, ablation time, energy deployed, observation time, catheterization time, IPSS, Quality of Life (QoL), peak urinary flow rate (Q max), post-void residual (PVR), and prostatic morphology and volume, evaluated with 3T multiparametric MRI at 3 months.

RESULTS

No intra or early post-op complications occurred. Mean ablation time was 33.3 minutes (range 25.3 min -max 42.4) , mean energy deployed 12,137 J (range 7204.4 - max 14,3483 J), mean hospital stay 113 minutes, and mean catheterization time 7.1 days (range 1.1- max 9.3 days). At 3 months, mean IPSS improved from 22.3 to 7.4 ($P < 0.001$), mean QoL from 3.4 to 1.7 ($P < 0.001$), mean Q max from 5.1 to 12.5 mL/s, mean PVR from 148.3 to 87.1, and mean prostate volume from 54.9 to 42,3 mL.

CONCLUSION

TPLA is feasible and safe in the treatment of BPH. Our preliminary data show significant clinical results at 6 months with an excellent performance of 3T multiparametric MRI to detect morphological and functional changes after the procedure.

CLINICAL RELEVANCE/APPLICATION

Transperineal laser ablation therapy is a safe and feasible treatment method for lower urinary tract symptoms in benign prostatic hyperplasia

Printed on: 10/29/20

VI242-SD-SUB5

Microwave Ablation of Lung Tumors: Early Radiological Parameters Determining the Treatment Outcome

Sunday, Dec. 1 1:00PM - 1:30PM Room: VI Community, Learning Center Station #5

Participants
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PURPOSE

To evaluate the impact of microwave ablation (MWA) in the management of inoperable lung tumors on a long-term follow up and the potentiality to retrospectively evaluate the early prognostic radiological parameters to predict the treatment response.

METHOD AND MATERIALS

50 patients (average age 64.1 +/- 14.8 years,23 males and 27 females) with 68 inoperable pulmonary lesions (8 primary, 60 metastatic); tumor board decision was to perform CT-guided MWA. Initial CT and/or MRI performed with assessment of the size, outlines, position and relation to the vascular and bronchial structures followed by CT-guided MWA. Contrast enhanced MRI and CT was performed 24 hours after the procedure thereafter CT and/or MRI performed at 3 months interval for one year. Certain parameters including the pre-and postablation size, ADC value 24 hours after the procedurearre precisely evaluated and correlated with the follow up images and longterm treatment responce.

RESULTS

44 lesions (64.7%) showed complete response with no residual activity on successive follow up while the rest (35.3%) showed incomplete response. Certain factors have been found and suggested as early predictors for the response including the maximum diameter of the lesion as well as its volume and the ADC value 24 hours after the procedure. The location of the lesion as well as its relation the significant vessel or bronchus in the current study didn't seem to affect the net response.

CONCLUSION

MWA of inoperable lung tumors provide an alternative therapeutic way with relatively high success rate, preoperative radiological assessment of the lesion namely the maximum diameter and volume as well as immediate 24 hour MRI assessment with DWI mapping may provide early predictors for the net response.

CLINICAL RELEVANCE/APPLICATION

Microwave ablation of pulmonary tumors is a valuable therapeutic tool and performing MRI evaluation within 24 hours following the ablation may predict the responce proving the potentiality for improving treatment efficacy.

AI029

Prediction of CT Perfusion Arterial and Venous Time-attenuation Curve Parameters Using Deep Learning Systems: Proof-of-concept for Developing a Personalized CT Perfusion Protocol for Acute Stroke Workup

Monday, Dec. 2 12:15PM - 12:45PM Room: AI Community, Learning Center

Participants
Charlotte Y. Chung, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose
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PROGRAM INFORMATION

This invited poster is an example of the exciting work in the artificial intelligence domain being supported by the RSNA R&E grant program. Visit each one, AI027 through AI039, to learn about the latest updates.

Printed on: 10/29/20

AI031

Multi-site Deep Learning Initiative with Decision Support to Improve Diagnostic Accuracy of Breast MRI and Reduce Unnecessary Biopsies

Monday, Dec. 2 12:15PM - 12:45PM Room: AI Community, Learning Center

Participants
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Katja Pinker-Domenig, MD, New York, NY (*Abstract Co-Author*) Speakers Bureau, Siemens AG ; Advisory Board, Merantix Healthcare GmbH
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PROGRAM INFORMATION

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AI034

Machine-learning Based Automated Prediction of CTA Collateral Status in Stroke Patients with Anterior Circulation Large Vessel Occlusion

Monday, Dec. 2 12:15PM - 12:45PM Room: AI Community, Learning Center

Participants
Seyedmehdi Payabvash, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
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PROGRAM INFORMATION

This invited poster is an example of the exciting work in the artificial intelligence domain being supported by the RSNA R&E grant program. Visit each one, AI027 through AI039, to learn about the latest updates.

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AI241-SD-MOA1

Impact of Image Resolution on Deep-Learning Performance for Pneumothorax Identification

Monday, Dec. 2 12:15PM - 12:45PM Room: AI Community, Learning Center Station #1

Participants
Paul H. Yi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
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Cheng Ting Lin, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the impact of image compression on the performance of deep convolutional neural networks (DCNNs) for identifying pneumothoraces.

METHOD AND MATERIALS

We obtained 4440 de-identified frontal chest radiographs (CXRs) from the NIH ChestX-ray 14 database, of which 2220 had a pneumothorax (50%) and 2220 did not (50%). The raw images were presented at a native resolution of 1024 x 1024 (0.4 mm per pixel); we created 5 copies of the 4440 CXRs, each with gradually decreasing resolutions: 768x 768, 512 x 512, 256 x 256, 128 x 128, 64 x 64, and 32 x 32. The images were split into training (70%), validation (10%), and testing (20%) datasets. We trained and validated a ResNet-152 DCNN pretrained on ImageNet to identify pneumothorax on each of these datasets. Testing was performed on a holdout set of 880 images at 1024 x 1024 resolution as a control. Receiver operating characteristic (ROC) curves were generated for the DCNN with area under the curve (AUC) calculated to evaluate test performance. AUCs were compared using the DeLong parametric method (significance defined as $p<0.05$).

RESULTS

DCNN performance for pneumothorax identification was lowest for images with 32 x 32 resolution (AUC of 0.71). The DCNN performance significantly increased to 0.84 when trained on images with resolutions of 64 x 64 and 128 x 128 (AUCs of 0.84 each; $p <0.001$ for both compared to 32 x 32). Further increases in resolution to 256 x 256 and above quickly reached a plateau of 0.87 (Fig 1).

CONCLUSION

ResNet DCNN performance for pneumothorax identification improves with increasing image resolution, but the relative benefit plateaus at a resolution of 256 x 256 and above, likely because this is the matrix size that ResNet automatically resizes all images to. Given current DCNN technical limitations for input image sizes, using lower-resolution images might not adversely affect DCNN performance.

CLINICAL RELEVANCE/APPLICATION

DCNN performance for pneumothorax identification improves with increasing image resolution, but the relative benefit appears to plateau at a resolution of 256 x 256 and above; using lower-resolution images thus might not adversely affect DCNN performance.

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AI258-SD-MOA2

Artificial Intelligence-Assisted Breast Cancer Risk Assessment

Monday, Dec. 2 12:15PM - 12:45PM Room: AI Community, Learning Center Station #2

Participants
Tiancheng He, Houston, TX (*Presenter*) Nothing to Disclose
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PURPOSE

The false positive rate for Breast Imaging Reporting and Data System (BIRADS) 4 is over 70%. Overbiopsy is estimated to cost the nation about $4 billion yearly while creating unnecessary pain and anxiety for the patients, as well as leading to uncertain outcomes. Current efforts focus on automated mammogram interpretation via artificial intelligence (AI), which performed well in open image datasets but not in clinical settings. Our hypothesis is that images alone are not capture all necessary information to predict cancer risk. We developed a deep learning-assisted decision support tool to integrate and analyze both imaging and non-imaging patient information for precise risk assessment of breast cancer.

METHOD AND MATERIALS

Natural language understanding is developed to extract information from free-text radiology and pathology reports and structured information of breast cancer patient demographics, lab tests, and imaging, while mammographic and/or ultrasound images of suspicious breast cancer patients are quantitated. Then, deep learning is deployed to integrate and analyze all extracted imaging and alphanumeric information extracted to predict the breast cancer risk. The prediction result is displayed by an odometer icon.

RESULTS

We assessed 9143 BIRADS 4 patients' data, including breast images, structured data, and free-text reports archived in data warehouse of eight hospitals since 2006. Physician abstractors tested 2285 BIRADS 4 patients' data to confirm the accuracy of the data extraction. We adjusted the model to ensure that all high cancer risk patients are assigned to do the biopsy, i.e., no false negative cases. Our validation result shows 100% sensitivity (actual and predicted malignant patient cases were the same 575 cases) and 79% specificity (actual benign patients' cases was 1710 and predicted benign patient's cases was 1351). The accuracy of our deep learning model is 84%.

CONCLUSION

A precise diagnosis support tool is developed for suspicious breast cancer patients using AI and large radiomics dataset. It improves patient-physician engagement in making an informed decision on breast biopsy. Future work will include multi-center trials and extend the model to BI-RADS 3 cases.

CLINICAL RELEVANCE/APPLICATION

The application is made accessible on the web, where it will display an index measure of biopsy recommendation that is more clinically relevant and informative than traditional BIRADS scores.

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AI273-SD-MOA3

Automated Quality Control of Adult Frontal Chest X-Ray with Deep Artificial Neural Networks

Monday, Dec. 2 12:15PM - 12:45PM Room: AI Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
Zhanhao Mo, Changchun, China (*Presenter*) Nothing to Disclose
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PURPOSE

To develop an AI based image quality control (IQC) suite for automatic assessment of frontal chest x-ray (CXR) images. We specifically focus on the identification of not good (NG) causes of 'scapula in the lung', 'nonmedical artifact', and 'incomplete depiction of lung field', which are abbreviated as 'scapula', 'artifact', and 'lung', respectively.

METHOD AND MATERIALS

1000 testing frontal adult CXR images were retrospectively randomly selected from our PACS system. CXR images of subjects with ages smaller than 17 were excluded. The 1000 CXR images have 890, 324, and 51 images with NG quality caused by 'scapula', 'artifact', and 'lung', respectively. One CXR image may have multiple NG problems. To specifically identify the three NG problems in a CXR image, we develop three deep learning based algorithms. The problems of 'scapula' and 'lung' are addressed with segmentation models, whereas the 'artifact' problem is tackled with a detection model. The segmentation model is based on an encoder-decoder neural network. The 'scapula' model can automatically demarcate the scapula if it exists in the lung field, while the 'lung' model is able to segment the lung fields in the CXR images and check the completeness of lung fields. The detection model is able to locate the nonmedical artifacts in the lung field in a CXR image and is realized with a multi-scale neural network with backbone of residualNet. The training of all three models were carried out with other datasets (1328 images for "scapula", 980 images for "artifacts", 512 images for "lung") which are distinctive from the 1000 testing data.

RESULTS

With the 1000 CXR images, the sensitivity for the 'scapula', 'artifact', and 'lung' models are 99.70%, 93.83%, and 92.16% respectively. The specificity of the three models are 94.44%, 95.84%, and 98.52%, respectively, while the accuracy of the models are 99.10%, 95.19%, and 98.19%, respectively.

CONCLUSION

Deep learning based models can effectively identify the NG problems of 'scapula', 'artifact', and 'lung' for CXR images with satisfactory performance.

CLINICAL RELEVANCE/APPLICATION

The AI based IQC suite can be applied to daily check the CXR image quality and further boost the quality of image diagnosis.

BR197-ED-MOA7

Knack for the NAC: A Comprehensive Review of the Nipple-Alveolar Complex (NAC)

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center Station #7

Participants
Daniel A. Lyons, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
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Charmi Vijapura, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Review anatomy and imaging techniques of the nipple-alveolar complex. Recognize benign versus malignant pathology of the nipple-alveolar complex and associated imaging findings.

TABLE OF CONTENTS/OUTLINE

Anatomy of the nipple-alveolar complex Superficial anatomy Ductal anatomy Normal variants Imaging techniques of the nipple-alveolar complex Mammography Ultrasound MRI Galactogram Benign pathology of the nipple-alveolar complex Mammary duct ectasia Nipple calcifications Abscess of Montgomery glands Nipple adenoma Malignant pathology of the nipple-alveolar complex Breast Carcinoma Paget's Disease of the nipple-alveolar complex

BR198-ED-MOA8

False Negatives and Missed Opportunities on Breast MRI: How Can We Do Better?

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center Station #8

Awards
Identified for RadioGraphics

Participants
Katrina Korhonen, MD , Philadelphia, PA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

1. MRI has high sensitivity in detecting breast cancer. However, false negatives may occur. Most false negatives can be categorized as either a failure to characterize or a failure to detect an abnormality. 2. Different subtypes of breast cancer may have variable enhancement on MRI; some cancers, such as low-grade DCIS or some invasive lobular carcinomas, may demonstrate only low-level or even no detectable enhancement. 3. Diligent search patterns of non-breast regions, including the major nodal stations as well as the liver, lungs, bones, and mediastinum, are critical to avoid missing extra-mammary metastases.

TABLE OF CONTENTS/OUTLINE

1. Review of the literature reporting on false negative breast MR studies. 2. Pictorial review of false negative breast MRIs as well as cancers seen only in retrospect. 3. Highlight reasons why cancers or other significant findings were not appreciated on MRI and suggest opportunities for improvement a. Failure to detect, including satisfaction of search and poor search patterns b. Failure to characterize, including erroneously attributing abnormalities as stable or as benign c. Cancers detected on other modalities due to low-level or no detectable enhancement on MRI 4. Explore technical reasons, including scan timing and patient positioning, that may hamper cancer detection on MRI

BR199-ED-MOA9

Malignant Papillary Tumors of the Breast: Radiologist's Role for a Complete Diagnostic Assessment

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center Station #9

Awards
Certificate of Merit

Participants
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TEACHING POINTS

1. Discuss key concepts of malignant papillary tumors of the breast 2. Describe different imaging characteristics that may facilitate diagnosis of malignant papillary tumors.3. Review the management of malignant papillary tumors with emphasis of the role of imaging in diagnostic biopsies4. To assess the role of magnetic resonance in papillary carcinoma for detection of multicentric disease.

TABLE OF CONTENTS/OUTLINE

1. Description of each of the following categories in malignant papillary tumors:a. Epidemiologyb. General featuresc. Clinical presentationd. Histopathologic characteristics2. Describe key imaging findings of ultrasound, mammography and MRI of each of the following pathologies:a. Malignant noninvasive: Intraductal papillary carcinoma, intracystic papillary carcinoma, solid papillary carcinoma, micropapillary ductal carcinoma in situb. Malignant invasive: Invasive micropapillary carcinoma, invasive papillary carcinoma3. Discuss management of malignant papillary tumors including the role of imaging in diagnostic biopsies with an assessment of proper technique by ultrasound, mammography and MRI4. Review the role of magnetic resonance in papillary carcinoma for detection of multicentric disease5. Conclusion

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BR227-SD-MOA1

Measurement Error Due to Terminal Digit Preference in Breast Cancer Tumor Diameter Reporting: A Population-Based Study

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center Station #1

Participants
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PURPOSE

Breast cancer treatment and therapy is based on tumour characteristics, such as tumour diameter. Error in tumour diameter measurement can lead to biased tumour size staging and hinder the effectiveness of personalized medicine. A subconscious "terminal digit preference" preference for tumour diameters that end with the digits zero or five has been observed in the measurement of colorectal and lung tumours, but has not been well described in breast imaging. The purpose of this study was to assess the extent of terminal digit preference among breast radiologists and pathologists.

METHOD AND MATERIALS

This national study included mammographic and histopathologic tumour diameter information for all T1-T3 invasive breast cancers <100 mm, diagnosed during 2012-2016 (n = 14,468). The presence of terminal digit preference was assessed graphically using histograms. Scatterplots and Bland-Altman plots were used to assess the agreement between mammographic and histopathologic measurements and identify visual signs of terminal digit preference.

RESULTS

Mammographic and histopathologic tumour measurements were available for 6865 cases. An additional 927 and 6676 cases had only mammographic or only histopathologic measurements, respectively. 38.7% of mammographic measurements and 34.8% of histopathologic measurements had terminal digits ending in zero or five. When comparing the agreement between mammographic and histopathologic measurements with a terminal digit of zero or five, the scatterplot demonstrated a checkerboard pattern, while the Bland-Altman plot showed a lattice pattern.

CONCLUSION

The measurement of breast cancer tumour diameters is affected by terminal digit preference. The visual signs identified in this study can be used to point to the presence of this type of measurement error.

CLINICAL RELEVANCE/APPLICATION

Underestimation of tumour diameter due to terminal digit preference can result in under-staging clinical or pathological tumour size classifications.

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BR228-SD-MOA2

The Study of Image Quality and Radiation Dosage with Patient-Assisted Compression in Mammography

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center Station #2

Participants
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Yahong Luo, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Huizhi Cao, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Amiee Chen, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the image quality, radiation dose and patient experience of patient-assisted compression (PAC)with those of technologist compression(TC) in mammography.

METHOD AND MATERIALS

This study was approved by institutional review boards, and written informed consent was obtained. 261 participants aged 45-75 years coming for bilateral mammography were enrolled in the diagnostic study. After positioning each breast, the technologist performed the compression and exposure of the first breast, initiated the compression of the other until 4 daN and then let the patient complete the compression using a remote control device. Subjective image quality was rated using 4-point scale(4, excellent;1 bad) by a panel of physicians, and compression force, breast thickness, average glandular dose and pain value for each breast were assessed for PAC and TC. And the patients feeling during the examination was recorded.

RESULTS

The image quality of PAC and TC was 3.8+/-0.4 Vs. 3.7+/-0.5 for craniocaudal (CC) and 3.9+/-0.3 Vs. 3.8+/-0.4 for mediolateral oblique (MLO) views, respectively. The compression level in PAC was 8.85+/-2.31daN(CC) and 10.67+/-2.82daN(MLO) and in TC was 7.70+/-1.39daN(CC) and 9.36+/-2.38daN(MLO), and there was no significant different(P=0.76). Breast thickness was reduced with PAC (CC, 43.81cm Vs.44.97 cm; MLO, 44.37cm Vs. 45.38 cm), as well as glandular dose (CC, 1.17mGy Vs.1.19mGy; MLO, 118mGy Vs. 1.21mGy). When compared discomfort or pain felt in PAC with that in TC, the patients' feeling with better, equal and worse was 45%(118/261) , 40%(104/261) and 15%(39/261), respectively.

CONCLUSION

Patient-assisted compression may be a preferred technique for mammography examinations, providing an equivalent image quality to technologist compression with breast thickness and glandular dose.

CLINICAL RELEVANCE/APPLICATION

Patient-assisted compression can improve the patients experience in mammography examination without sacrificing image quality, which maybe useful in breast imaging.

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BR251-SD-MOA4

Tissue Sound Speed is More Strongly Associated with Breast Cancer Risk than Mammographic Percent Density: A Comparative Case-Control Study

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center Station #4

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PURPOSE

Increased mammographic percent density (MPD) is a strong independent risk factor for developing breast cancer. Previous studies have shown that tissue sound speed, derived from ultrasound tomography, is a surrogate biomarker of MPD. We examined associations of sound speed and MPD with breast cancer risk in a case-control study.

METHOD AND MATERIALS

We evaluated breast cancer risk associated with sound speed and MPD in a case-control study involving 59 participants with recent breast cancer diagnoses (cases, aged 30-70 years) and 150 participants with no history of breast cancer (controls), who were matched to cases on age, race, and menopausal status. The cases and controls were imaged with both ultrasound tomography (UST) and mammography. In cases, breast density was measured pre-treatment in the contralateral breast to avoid potential influences of tumor-related changes on MPD or sound speed. In controls, a randomly selected breast was imaged. The ultrasound tomography images were used to estimate the volume averaged sound speed of the breast, and the Cumulus software package was applied to mammograms to determine MPD. Odds Ratios (ORs) adjusted for matching factors and 95% Confidence Intervals (CIs) were calculated for the relation of quartiles of MPD and sound speed with breast cancer risk. OR differences were tested using a bootstrap approach.

RESULTS

MPD was associated with elevated breast cancer risk compared to controls, consistent with previous studies, although the trend did not reach statistical significance (OR per quartile=1.28, 95%CI: 0.95, 1.73; ptrend=0.10). In contrast, elevated sound speed was significantly associated with increased breast cancer risk in a dose-response fashion (OR per quartile=1.79, 95%CI: 1.30, 2.48; ptrend=0.0004) (Figure 1). The OR-trend for sound speed was statistically significantly different from that observed for MPD (p=0.01).

CONCLUSION

Our case-control study showed that increasing quartiles of whole breast sound speed were consistently and more strongly associated with increasing breast cancer risk than quartiles of MPD. These results show promise for UST's role in breast cancer risk stratification.

CLINICAL RELEVANCE/APPLICATION

Elevated breast density strongly increases breast cancer risk. UST has the potential to provide a more accurate, non-ionizing method for assessing breast density and its associated breast cancer risk.

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BR252-SD-MOA5

Supplementary Screening Axillary After Breast Cancer Surgery in Clinically and Mammographically Negative Patients

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center Station #5

Participants
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PURPOSE

Whether postoperative screening breast ultrasound (US) should include axillary scans is controversial. The purpose of this study is to evaluate the necessity of axillary scanning when supplemental screening breast ultrasonography is performed in clinically and mammographically negative postoperative women.

METHOD AND MATERIALS

Between January and March 2017, supplemental postoperative screening US were performed in 4052 consecutive patients. Among those patients, 3287 supplemental screening breast US examinations in asymptomatic women with negative or benign results at mammography were included for this review. Bilateral whole-breast screening US was performed by one of 10 experienced radiologists. The bilateral axillae were routinely scanned, and representative images were documented in all examinations. The positive screening US examinations were defined as cases with BI-RADS category 3 or more. The recall rate, positive predictive value (PPV3) and cancer detection rate (CDR) of biopsies in breasts and axillae were calculated separately.

RESULTS

Among 3287 screening US, there were 7 in breast, and 4 axillary recurrences. By adding supplemental screening US, 46 patients had positive findings in the breast (14.6 per 1000), and 25 had positive axillary findings (7.6 per 1000). Of them, 32 patients underwent biopsy for breast lesions, 5 patients underwent biopsy for axillary LN. Supplemental screening US detected clinically and mammographically occult 3 breast cancers (0.91 per 1000 screens), and 1 axillary recurrence (0.30 per 1000 screens), The PPV3 for the breast and axilla were 9.4% and 25.0%, respectively. Three axillary recurrences not detected by screening US were detected by chest CT or PET examination.

CONCLUSION

Axillary recurrence was very rare in postoperative patients who showed negative findings on mammography and present no symptom. Routine axillary scanning during postoperative screening breast US had minor effect on additional cancer detection, but rather increased the number of false-positive recalls and biopsies.

CLINICAL RELEVANCE/APPLICATION

Routine axillary scanning during postoperative screening breast US does not provide additional breast cancer detection, but rather increases the number of false-positive results leading to recall examinations and biopsies.

BR253-SD-MOA6

Learning Effective Radiomic Features for Characterization of Breast Lesions with Multi-b Diffusion-Weighted MR Imaging

Monday, Dec. 2 12:15PM - 12:45PM Room: BR Community, Learning Center Station #6

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PURPOSE

To compare the diagnostic performance of radiomic features computed from multi-b diffusion-weighted MR imaging for breast lesions characterization, and also compare the diagnostic performance between the radiomic features and mean values of diffusion metrics.

METHOD AND MATERIALS

Totally, 542 lesions in 542 patients with multi-b diffusion-weighted-images (b values: 0-2500 s/mm2) were acquired, where 100 radiomic features (by using Pyradiomics toolbox) were computed with multi-b diffusion-weighted-imaging, as well as mono-exponential (ME) with ME-ADC0-1000 and ME-ADCall-b, bi-exponential (BE) with BE-D, BE-D*, and BE-f, stretched-exponential (SE) with SE-DDC and SE-a, and diffusion kurtosis imaging (DKI) with DKI-D and DKI-K. Random forest (RF) model was adopted to achieve differential diagnosis based on the radiomic features and mean diffusion metrics of ME (mADCall-b, mADC0-1000), BE (mD, mD*, mf), SE (mDDC, ma), and DKI (mK, mD). The dataset is randomly split into the training and testing sets for 100 times to evaluate the performance of RF. The training and testing sets were randomly split into 50% and 50%. The performance of using radiomic features and mean diffusion metrics was compared with McNemar test and the receiver operating characteristic (ROC) analysis.

RESULTS

The AUCs of radiomic features for breast lesions diagnosis ranged from 0.80 (BE-D*) to 0.85 (BE-D), with sensitivity from 83% to 88%, and specificity from 74% to 82%, while those of the mean diffusion metrics ranged from 0.54 (BE-mf) to 0.79 (ME-mADC0-1000), with sensitivity from 74% to 88%, and specificity from 41% to 71%. There were significant differences between the mean values of all diffusion metrics and radiomic features of AUCs (all $P < 0.0001$). For radiomics computed from the 23 diffusion-related sequences respectively, the most important sequence and feature are BE-D (AUC: 0.85) and Shape-Sphericity (feature importance, FI: 0.04). For the radiomics computed from the combination of b2500, ME-ADCall-b, BE-D, SE-DDC, and DKI-K, the most important sequence and feature are DKI-K (FI:0.24) and BE-D-First-Order-Skewness (FI: 0.02), respectively.

CONCLUSION

Diffusion radiomic analysis performed better than the mean diffusion metrics alone, which allowed for reliable differentiation between benign and malignant breast lesions.

CLINICAL RELEVANCE/APPLICATION

Diffusion-related radiomics may improve the diagnosis and management of breast cancer.

CA160-ED-MOA8

CT Coronary Angiography Fractional Flow Reserve (FFR): A Primer for Radiologists and Cardiologists

Monday, Dec. 2 12:15PM - 12:45PM Room: CA Community, Learning Center Station #8

Awards
Certificate of Merit

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TEACHING POINTS

1. To review how noninvasive fractional flow reserve is derived 2. To review landmark clinical trials supporting the implementation of FFRCT 3. To highlight clinical cases where FFRCT has influenced management 4. To highlight important limitations of FFRCT technology

TABLE OF CONTENTS/OUTLINE

Introduction Computational flow dynamics and FFR. FFRCT vs FFRCath -> pros and cons Clinical trials supporting use FFRCT in a clinical setting PLATFORM DISCOVER-FLOW DeFACTO NXT Clinical cases where FFRCT improved diagnostic confidence and patient management Intermediate stenosis (50-70 %) Isolated severe branch vessel disease Heavily calcified coronary arteries Tandem stenoses Noninvasive preoperative clearance Limitations/Challenges of FFRCT analysis: Image Quality: EKG misregistration, Motion artifacts and increased noise precludes accurate assessment. Vessel Tortuosity, Stents and grafts. False positive results: Due to motion, suboptimal coronary vasodilatation and ventricular hypertrophy. False negative results: Due to motion, ultrashort segment plaque, manual segmentation error. Workflow and Reimbursement Future directions Appropriate use of FFRCT Post stenting FFRCT

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CA206-SD-MOA1

Predictors for Adequate Stress Response to Adenosine Triphosphate in Perfusion Cardiac Magnetic Resonance

Monday, Dec. 2 12:15PM - 12:45PM Room: CA Community, Learning Center Station #1

Participants
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PURPOSE

Adenosine triphosphate (ATP) is commonly used for stress perfusion cardiac magnetic resonance (CMR) in the Asia-Pacific region rather than adenosine, dipyridamole or regadenoson, despite the paucity of data for its use. Our study aims to identify the factors that predict adequate stress response to 140mcg/kg/min protocol of ATP stress perfusion CMR and how many patients achieve adequate stress with a 50% increase in ATP infusion if the standard dose fails.

METHOD AND MATERIALS

A retrospective cross-sectional study from January 2016 to January 2019 was conducted. 128 subjects were given ATP infusion at a standard dosage of 140mcg/kg/min for 3 to 5 minutes during stress perfusion CMR. Adequate stress was defined as >=2 of the following criteria: 1) heart rate increased >=10 bpm, 2) systolic blood pressure (SBP) dropped >=10 mmHg, 3) positive splenic switch-off (SSO) sign and 4) presence of symptoms. A 50% increase in infusion rate was given to inadequately stressed subjects. Multivariable logistic regression analysis was then applied to identify significant predictors of inadequate stress response to ATP.

RESULTS

111 out of 128 (86.7%) subjects achieved adequate stress response to the standard protocol. Multivariable logistic regression analysis showed that lower heart rate (HR) at rest ($p=0.04$, odds ratio=0.94), lower diastolic BP (DBP) at rest ($p=0.001$, odds ratio=0.89), higher weight ($p<0.01$, odds ratio=1.20) and female gender ($p<0.01$, odds ratio=0.027) were significant predictors of adequate stress response. The splenic intensity ratio (SIR) was significantly different between adequately and inadequately stressed groups ($p=0.01$). 13 subjects underwent increased infusion rate and 11 (86.4%) of them achieved adequate stress as a result.

CONCLUSION

The predictors of adequate stress response to standard ATP dose in perfusion CMR are lower HR and DBP at rest, higher weight and female. 86.7% of patients achieved adequate stress with standard ATP dose. Of those requiring a 50% higher infusion rate, 84.6% achieved adequate stress.

CLINICAL RELEVANCE/APPLICATION

Proportion of patients having adequate stress response to ATP stress CMR is high and predictors for adeqaute stress response are lower HR and DBP at rest, higher weight and female; while for patients with inadequate stress, a 50% increase in ATP infusion rate in most cases results in adequate stress.

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CA208-SD-MOA3

Impact of An Advanced Image-Based Monoenergetic Reconstruction Algorithm on Coronary Artery Stent Visualization Using Dual-Source Dual-Energy CT: Primary Study

Monday, Dec. 2 12:15PM - 12:45PM Room: CA Community, Learning Center Station #3

Participants
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PURPOSE

To investigate the image qualities of advanced image-based virtual monoenergetic images(Mono+), using a noise-optimized algorithm at different kiloelectron volts(keV) compared to linear blended 120 kilovoltage(kV) images, in the patients with coronary stents.

METHOD AND MATERIALS

15 patients (13 males, 2 female; mean age 64.13±11.82; 21 stents totally) who had undergone Coronary Computed Tomography Angiography (CCTA) on a third generation dual-source CT scanner (SOMATOM Force, Siemens Healthineers, Germany) were included in the study. Linear blended 120 kilovoltage (kV) images (LB120) dual-energy data sets (M=0.6, 60% 90 kV and 40% Sn150kV) and sixteen Mono+ images in 10-keV intervals, ranging from 40 to 190 keV, were reconstructed. Double-blinded and independent qualitative evaluation of image quality was performed by two readers using a five-point scale, 5= excellent. Quantitative assessments included stent diameter, stent length, luminal attenuation difference (mean attenuation difference between stented and non-stented lumens), in-stent image noise (standard deviation (SD) within a standardized ROI), in-stent Signal-to-Noise Ratio (SNR), in-stent Contrast-to-Noise Ratio (CNR). Between group statistical analysis was performed via the analysis of variance (ANOVA).

RESULTS

The inter-observer agreement of the subjective image quality scores was substantial (Kappa=0.80). The subjective scores of the 80 keV were significantly higher than others except for 90 keV which showed no statistical difference (P=0.70).The stent diameter and length showed no significant difference between seventeen groups (P>0.05). High-keV mono+ reconstructions at 80 to 190keV decrease the in-stent image noise compared to LB120.The higher in-stent SNR and CNR were observed in mono+ 80keV and LB120, with significant differences to other keV mono+ images($p<0.05$).

CONCLUSION

In comparison to conventional 120kV CT image, mono+ reconstructions at 80keV can significantly reduce the in-stent noise and provide better objective and subjective image quality for coronary stents.

CLINICAL RELEVANCE/APPLICATION

In conventional CCTA, it is difficult to evaluate in-stent restenosis due to metal artifacts of coronary stents. Mono+ reconstruction technology shows potential to improve stent visualization and help assess lumen visibility and patency.

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CA230-SD-MOA5

Pre-Ablation Assessment of Cardiac Anatomy and Function: Impact on Recurrence of Atrial Fibrillation

Monday, Dec. 2 12:15PM - 12:45PM Room: CA Community, Learning Center Station #5

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PURPOSE

To evaluate various anatomic and functional cardiac parameters, as well as the introduction of the TactiCathTM ablation catheter, on the long term outcome of pulmonary vein antrum isolation (PVAI), also known as pulmonary vein ablation, for treatment of atrial fibrillation.

METHOD AND MATERIALS

An ECG-gated cardiac CT angiogram was performed on 78 consecutive patients who underwent PVAI at our institution from July 2013 to March 2016. Medical records with two year follow-up and complete CT imaging data were available for review on 72 patients, including 36 patients treated prior to introduction of the TactiCath catheter, and 36 patients treated after the introduction of the TactiCath catheter.

RESULTS

The study population included 53 men and 19 women treated for atrial fibrillation, including 25 with paroxysmal atrial fibrillaton and 47 with persistent atrial fibrillation. Recurrent atrial fibrilation was found in 32/72 (44%) of treated patients by 24 months. Univariate analysis demonstrated a higher incidence of recurrent atrial fibrillation among patients who remained on anti-arhythmic medications 14/22 = as compared to those who did not 18/50, p = 0.03. There was a lower incidence of recurrent atrial fibrillation in males 20/52 (38%) as compared with females 12/19 (63%), though this difference was only marginally significant (p = 0.056). Multivariate analysis of additional variables with logistic regression demonstrated a marginally significant association of reduced ejection fraction with recurrent atrial fibrillation (p= 0.064). Logistic regression analysis demonstrated no significant differences in recurrence rate based upon age, paroxysmal/persistent fibrillation, left atrial volume, CHADS2 score, pulmonary vein area, and catheter type.

CONCLUSION

Gender and left ventricular ejection fracton were marginally significant predictors for recurrent atrial fibrillation after PVAI. Other anatomical features and the catheter type used for the procedure had no significant impact on long term recurrence rates after PVAI.

CLINICAL RELEVANCE/APPLICATION

With the increasing clinical application of pulmonary vein isolation in the treatment of atrial fibrillation, pre-procedure imaging has become a common indication for CTA. Triage of patients for this procedure should be based upon an understanding of how anatomical or functional imaging findings may impact outcome.

CA231-SD-MOA6

Improving Image Quality of Aortic and Pulmonary Valve for Children with High Heart Rates Using Second-Generation Motion Correction Algorithm

Monday, Dec. 2 12:15PM - 12:45PM Room: CA Community, Learning Center Station #6

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PURPOSE

To evaluate the effectiveness of a second-generation, whole heart motion correction algorithm (SSF2) in improving image quality of the Aortic and pulmonary valves in cardiovascular computed tomography angiography (CCTA) for children with high heart rates.

METHOD AND MATERIALS

42 consecutive symptomatic cardiac patients with high heart rates were enrolled. All patients underwent CCTA on a 256-detector row CT using a prospective ECG-triggered single-beat protocol. Images were reconstructed with a state-of-the-art first-generation coronary artery motion correction (SSF1) and SSF2. The image quality of the Aorta and pulmonary valves was assessed by two experienced radiologists using a 4-point scale (1: nondiagnostic; 2: detectable; 3: measurable and 4: perfect). Cases were further divided into the very high heart rate (VHHR) group and high heart rate (HHR) group using 120bpm as a cutoff for analysis.

RESULTS

The average patient age was 1.2±1.3 years (5 day-6 year), and the average heart rate was 122.6±18.8 (78-151) bpm. The overall image quality scores were improved to 2.4±0.8 with SSF2 from 2.0±0.8 with SSF1 for the Aortic valve, and to 2.0±1.0 with SSF2 from 1.7±0.8 with SSF1 for the pulmonary valve. In the HHR group, image quality scores were improved to 2.6±0.6 with SSF2 from 2.3±0.6 with SSF1 for Aorta valve and to 2.0±1.1 from 1.7±0.8 for pulmonary valve. However, the improvement for the pulmonary valve was not statistically significant ($p>0.05$). The bigger image quality improvement happened for the VHHR group where quality scores were improved to 2.2±0.9 with SSF2 from 1.8±0.8 with SSF1 for the Aorta valve, and to 2.1±0.9 from 1.7±0.7 for the pulmonary valve (all $p<0.05$).

CONCLUSION

A second-generation, whole-heart motion correction algorithm significantly improves CTA image quality of Aortic and pulmonary valves for pediatric cardiac patients with high heart rates, especially with heart rate higher than 120bpm.

CLINICAL RELEVANCE/APPLICATION

The second-generation, whole-heart motion correction reduces cardiac motion artifacts and improves image quality for Aortic and pulmonary valves for children with congenital heart disease.

CA232-SD-MOA7

Quantitative Assessment of Double Ventricular Strain in Patients with Dilated Cardiomyopathy Using Cardiovascular Magnetic Resonance Feature Tracking Techniques: A Preliminary Clinical Study

Monday, Dec. 2 12:15PM - 12:45PM Room: CA Community, Learning Center Station #7

Participants
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PURPOSE

Dilated cardiomyopathy (DCM) can cause structural and functional changes in the left/double ventricle. The purpose of this study was to assess the double ventricular myocardial systolic strain in DCM patients using cardiac magnetic resonance feature tracking (CMR-FT) and their underlying relationships with clinical parameters.

METHOD AND MATERIALS

We recruited 73 patients with DCM and 40 healthy volunteers to undergo CMR examinations. Then we used the routine cine images and CMR-FT to analyze the double ventricular myocardial global systolic strain and strain rates. Before the CMR examination, we collected the baseline clinical and biochemical indices.

RESULTS

The values of LVGLS,LVGCS,LVGRS and RVGLS were significantly lower in the DCM group than those in control group [LVGLS:(-4.7±2.5)%&(-14.4±2.4)%; LVGCS:(-6.1±2.6)%&(-21.8±2.3)%; LVGRS:(7.7±4.0)%&(39.2±9.0)%; RVGLS:(-9.9±6.5)%&(-19.5±3.7)%; P<0.01]. The left and right ventricular EF values were lower in the DCM group than those in control group [LVEF:(16.2±7.2)%&(58.0±5.5)%; RVEF:(19.9±11.8)%&(43.7±8.6)%; P<0.01]. In DCM group, the LVGRSR-D and RVGLSR-S values were correlated with the troponin I (TNI) levels(r=-0.307,P<0.05; r=0.499,P<0.01); the LVGRS,LVGCS and LVGCSR-S values were associated with the Lactate dehydrogenase (LDH) levels (r=0.000, P<0.05; r=0.309, P<0.05; r=0.268, P<0.05) ; the RVGLSR-S value was correlated with the creatine kinase (CK) level (r=0.334, P<0.05).

CONCLUSION

Our results suggested that the double ventricular systolic function and systolic strain were impaired in DCM patients. We also found that there was a correlation between the myocardial enzyme spectrum and parts of the double ventricular strain indexes in patients with DCM.

CLINICAL RELEVANCE/APPLICATION

This study showed that thedouble ventricular myocardial morphology and function were impaired in patients with DCM. Myocardial strain analysis may be used in the clinical diagnosis and evaluation of DCM and to a certain extent to guide its treatment decision-making.

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CA233-SD-MOA4

CT-FFR Profiles in Patients without Coronary Artery Disease

Monday, Dec. 2 12:15PM - 12:45PM Room: CA Community, Learning Center Station #4

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PURPOSE

To evaluate the effect of measurement location and lumen area changes on CT-FFR values in patients without coronary artery disease (CAD).

METHOD AND MATERIALS

Patients who underwent calcium scoring (CACS) and CCTA with CT-FFR were retrospectively included. Patients were excluded if their CACS was not zero, there were elevated troponin levels, or any cardiac abnormality on the CCTA studies. On-site CT-FFR based on an artificial intelligence, deep-learning algorithm (Siemens Healthineers) was computed for each coronary artery at proximal, mid, and distal segments. At each measurement location, the lumen area and Hounsfield Unit (HU) value was measured. CT-FFR was considered positive with values <0.75. The relationship between lumen areas, HU values, and CT-FFR was evaluated for each coronary artery and each location. Ratios between mid and distal values compared to proximal values for lumen and HU parameters were calculated.

RESULTS

A total of 106 patients were included. In 39 (37%) patients, the LAD had CT-FFR values <0.75, with a decrease in CT-FFR from 0.97 (SD 0.04) proximally to 0.62 (SD 0.10) distally in the abnormal patients. The Cx showed a limited number of patients with CT-FFR values <0.75 (n=16, 15%), with a decrease in CT-FFR values from 0.96 (SD 0.04) proximally to 0.65 (SD 0.09) distally in those patients. The RCA had 36 (34%) patients with CT-FFR <0.75, with distal CT-FFR values of 0.61 (SD 0.12) and proximal CT-FFR values of 0.98 (SD 0.02). 12 abnormal CT-FFR values were measured at mid segment, while all others were measured at distal segments. Lumen area was not significantly different between the abnormal and normal CT-FFR groups, while both HU and HU ratios were significantly lower in the abnormal CT-FFR group for all three major coronary arteries.

CONCLUSION

CT-FFR values in patients without coronary artery disease can become abnormal at a distal location without indicating flow-limiting stenosis, which depends strongly on HU values.

CLINICAL RELEVANCE/APPLICATION

CT-FFR values measured distally should always be interpreted in combination with the CCTA images in order to avoid false positives and over treatment.

CH219-ED-MOA8

Thoracic Lymphatic Metastases from Extra-Pulmonary Malignancies: Predictable Patterns of Spread

Monday, Dec. 2 12:15PM - 12:45PM Room: CH Community, Learning Center Station #8

Participants
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TEACHING POINTS

Recognition of patterns and unique pathways of lymphatic drainage of extrapulmonary malignancies help identify tumor site of origin and allow focused search for disease extent. The thoracic duct is the largest lymphatic vessel in the thorax, receiving lymph from the abdomen and pelvis via the cisterna chyli. Knowledge of its pathway, tributaries, and variant anatomy allows for better characterization of nodal metastatic disease. The liver has both superficial and deep lymphatic systems which helps predict site of intra-thoracic lymph node metastases in patients with liver malignancies. Hepatic dome malignancies drain to anterior or middle diaphragmatic nodal stations. Hepatic malignancies adjacent to the falciform ligament drain to the internal mammary nodal chain.

TABLE OF CONTENTS/OUTLINE

1. Overview of lymphatic anatomy and lymph node stations 2. Lymphatic drainage of pleural malignancies a. Anterior and posterior pleura b. Laterality, cancer staging, lung and chest wall invasion 3. Thoracic duct a. Anatomy, tributaries, cisterna chyli b. Variant anatomy (e.g. right supraclavicular lymph node metastasis in setting of right-sided thoracic duct) c. Distribution of metastases from abdominal and pelvic malignancies 4. Hepatic malignancies and intrathoracic lymphatic drainage

CH220-ED-MOA7

Drug-Induced Lung Disease in Precision Cancer Therapy

Monday, Dec. 2 12:15PM - 12:45PM Room: CH Community, Learning Center Station #7

Participants
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TEACHING POINTS

The purpose of this exhibit is: To raise awareness of drug-induced lung disease (DILD) in precision cancer therapy as a potentially fatal, yet often reversible disease. To give examples of CT imaging in DILD showing common patterns as well an example of different patterns in the same patient with the same medication.

TABLE OF CONTENTS/OUTLINE

Drug-induced lung disease in precision cancer therapy Short Quiz: DILD vs other differential diagnosis? Precision cancer therapy Common patterns in DILD An example of different patterns in the same patient with the same medication

Printed on: 10/29/20

CH221-ED-MOA6

Introduction to Artificial Intelligence and Big Data Research in Chest Radiology

Monday, Dec. 2 12:15PM - 12:45PM Room: CH Community, Learning Center Station #6

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TEACHING POINTS

1. AI algorithms can help radiologists improve detection and characterization of lesions as well as increase workflow efficiency 2. Radiologists play an important role in guiding the development and validation of AI algorithms

TABLE OF CONTENTS/OUTLINE

Review current and future applications of AI in chest imaging - Chest radiography o Image enhancement: optimize contrast, emphasize lines and tubes, bone suppression o Increased detection of lung cancers, benign nodules, and other disease (e.g., pneumonia) o Gaze pattern analysis - Chest CT o Image enhancement: denoising, allowing for further reduction in dose o Lesion detection o Volumetric segmentation o Longitudinal tracking - Identify patients for screening - Automated protocolling - Reading work list prioritization: Move cases with urgent finding to top of list and alert radiologists - Lesion Characterization: Differentiating between subsolid and solid lung nodules - Radiogenomics: extraction of quantitative features from medical images to develop reliable models to predict genomic information, clinical outcomes, and survival Discuss ways radiologists can participate in AI development - Identify use cases - Collect, curate, share images - Establish standards for validation - Monitor algorithm performance

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CH248-SD-MOA1

The High Prevalence of RV/LV Ratio >= 1 Among Patients Undergoing CT Pulmonary Angiography

Monday, Dec. 2 12:15PM - 12:45PM Room: CH Community, Learning Center Station #1

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PURPOSE

Increased ratio between the right and left ventricular (RV/LV) diameters >=1 is considered an important imaging marker for risk stratification among patients diagnosed with acute pulmonary embolism (PE). This ratio, however, which was originally used on echocardiography, may present also as a baseline state without the presence PE. Our goal was to assess the prevalence of RV/LV>=1 among consecutive patients undergoing CT pulmonary angiography (CTPA), and to compare the prevalence of RV/LV>=1 between patients with and without PE.

METHOD AND MATERIALS

Retrospective analysis of consecutive patients who underwent non-gated CTPA due to clinical suspicion of PE between 1.1.2014 - 31.12.2014. Each CTPA was investigated by measuring the axial RV/LV diameter. Comparison of the prevalence of RV/LV diameter >=1 between patients with and without PE was made.

RESULTS

The final cohort included 862 patients, 344 males (39.9%), median age 70 (inter-quartile range 58-82). 142 (16.5%) had PE. RV/LV diameter >=1 was found in 553 (64.1%) of all patients, of them in 453 (63%) patients without PE and 100 (70.4%) in patients with PE (p=0.117). Following multivariate analysis using logistic regression, we found that PE was not significantly associated with RV/LV diameter >=1 (odds ratio (OR) 1.4{95% CI 0.9-2.1}, p=0.102). Classification tree analyses identified RV/LV diameter ratio of 1.2 as a cutoff value between patients with and without PE. In patients with RV/LV diameter ratio of 1.2 or less 13.4% had PE, while in patients with higher RV/LV diameter ratio 23.5% had PE (p<0.001). The figure below shows the distribution of RV/LV diameter ratios among PE and non-PE patients.

CONCLUSION

This is the first study investigating the prevalence of RV/LV diameter ratio >=1 among all patients undergoing CTPA for suspected PE. Since RV/LV >=1 is highly prevalent among patients undergoing CTPA (64.1%), without a significant difference between those with and without PE, an RV/LV >=1 might not represent the cardiac response to the acute PE event, but rather the patient's baseline condition. Further studies are thus warranted in order to refine the most meaningful cutoff point of this ratio on CTPA.

CLINICAL RELEVANCE/APPLICATION

Clinicians should be aware of the high prevalence of RV/LV >=1 on any CTPA, since this finding (especially if RV/LV is close to 1), might not reflect an increased PE risk.

CH249-SD-MOA2

Comparison of Emphysema Scores on Low and Ultra-Low Radiation Dose CT Images Using Different Reconstruction Methods

Monday, Dec. 2 12:15PM - 12:45PM Room: CH Community, Learning Center Station #2

Participants
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PURPOSE

Emphysema score (ES) is a validated quantitative CT measure of emphysema severity. However, ES is highly dependent on the radiation dose and reconstruction algorithm. To obtain accurate ESs the image noise must be low. Deep learning-based reconstruction (DLR) can drastically reduce the image noise without blurring structure contours. We investigated whether ESs calculated from low dose CT (LDCT) and ultra-low dose CT (ULDCT) images reconstructed with DLR are equivalent.

METHOD AND MATERIALS

From 604 lung cancer screening trial participants, 100 were randomly selected. All had undergone chest LDCT - CT dose index (CTDIvol) 3.0 mGy - and ULDCT - CTDIvol 0.3 mGy - on a 320-detector CT scanner. The tube current second product for ULDCT was fixed at 5 mAs. The tube current for LDCT scans was under automatic exposure control; the preset noise was 22 Hounsfield units (HU). The other scanning parameters were identical. ULDCT was performed immediately after LDCT. All images were reconstructed with filtered back projection (FBP), hybrid iterative reconstruction (hIR), model-based IR (MBIR), and DLR. ES was defined as the percentage of lung voxels with intensity values below -950 HU; they were obtained using CIRRUS Lung Quantification software. The paired equivalence test (two one-sided t-test) was performed with the equivalence boundaries at -2 to 2, i.e., the difference in the repeatability of the ES, and a 0.05 alpha. Linear regression was also performed.

RESULTS

The mean ES from LDCT images reconstructed with FBP was 8.6 (SD 6.7, 95% confidence interval 7.3-9.9), hIR: 5.7 (9.0, 3.9-7.4), MBIR: 5.4 (7.3, 4.0-6.8), and DLR 3.5 (6.2, 2.3-4.7). From ULDCT images, these values were FBP: 20.3 (6.2, 19.1-21.5), hIR: 3.9 (5.8, 2.7-5.0), MBIR: 3.0 (5.4, 2.0-4.1), and DLR: 3.3 (5.6, 2.2-4.4). Only the ESs from LDCT and ULDCT images reconstructed with DLR were equivalent ($p<0.001$). Plotting the DLR values showed that LDCT ES = 0.80 × ULDCT ES ($r2=0.72$).

CONCLUSION

Among four reconstruction algorithms, equivalent ESs were obtained from LDCT and ULDCT images only when DLR was applied. There is a deviation which proportionally increases with ES; a correction factor would fix this.

CLINICAL RELEVANCE/APPLICATION

DLR yields comparable ESs from LDCT and ULDCT images, enabling the comparison of emphysema severity between and within patients who underwent scans with different settings.

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CH250-SD-MOA3

Radiomics Analysis Using Tumor Marginal Property for Pathological Invasion in Lung Adenocarcinoma

Monday, Dec. 2 12:15PM - 12:45PM Room: CH Community, Learning Center Station #3

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PURPOSE

Lung adenocarcinomas appearing as ground-glass nodules (GGN) have different pathological invasion and differentiating the degree is critical for treatment. We evaluated the additional marginal features using a radiomics approach from CT to predict the degree of pathologic invasiveness.

METHOD AND MATERIALS

We identified 236 patients from two cohorts (training n = 189, validation n = 47) who underwent operation for GGNs. All GGNs were pathologically confirmed as adenocarcinoma in situ (AIS), minimally invasive adenocarcinoma (MIA) or invasive adenocarcinoma (IA). Region of interest was semi-automatically annotated and 40 radiomics features were computed. We selected features using the L1-norm regularization to build the baseline radiomics model. Additional marginal features were developed using cumulative distribution function (CDF) of intra-tumoral intensities. An improved model was built combining the baseline model with the CDF features. Three classifiers were tested for both models. Classifier performance was measured from both cohorts for two models.

RESULTS

The baseline radiomics model included five features and resulted in an area under the curve (AUC) of 0.8419 (training) and 0.9142 (validation) on average for three classifiers. The second model with the additional marginal features resulted in AUC of 0.8560 (training) and 0.9581 (validation). All three classifiers performed better with the added features.

CONCLUSION

Our novel marginal features reflected pathologic invasiveness and could be useful in distinguishing IA from AIS and MIA.

CLINICAL RELEVANCE/APPLICATION

These additional tumor margin features that reflect the degree of pathological invasion may contribute to more accurate treatment planning in the near future.

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CH273-SD-MOA5

Development of a 3D U-net Deep-Learning Model for Automated Detection of Lung Nodules on Chest CT Images: Internal and External Validation Using LIDC and Japanese Datasets

Monday, Dec. 2 12:15PM - 12:45PM Room: CH Community, Learning Center Station #5

Participants
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PURPOSE

To evaluate the accuracy of a 3D U-net deep-learning model developed for the automated detection of lung nodules in chest CT images, by using Lung Image Database Consortium (LIDC) and Japanese Chest CT datasets

METHOD AND MATERIALS

In this HIPAA-compliant, IRB-approved retrospective study, the 3D U-net based deep-learning model was trained using 888 chest CT scans with a slice thickness of <=2.5 mm from the LIDC dataset. All lung nodules were identified and classified by four experienced thoracic radiologists who participated in the LIDC project. For internal model validation we used 89 chest CT scans that had not been used for model training. For external model validation we used 450 chest CT scans taken at an urban university hospital in Japan. Each case included at least one nodule of >5 mm that was determined by consensus between two experienced radiologists. We evaluated the accuracy of the model using free-response receiver operating characteristic (FROC) curves. The 95% confidence interval (CI) was computed by bootstrapping 1000 times.

RESULTS

In the internal validation, the average FROC score (average sensitivity at 1/8, 1/4, 1/2, 1, 2, 4, and 8 false-positives per scan) was 94.7% (95%CI: 89.1%-98.6%), corresponding to a sensitivity of 95% with one false-positive per scan. In the external validation, the average FROC score was 83.3% (95%CI: 79.4%-86.1%).

CONCLUSION

The 3D U-net deep-learning model, which was developed to detect lung nodules with diameter >5 mm on CT images, showed high performance in both internal and external validation.

CLINICAL RELEVANCE/APPLICATION

The proposed deep-learning model, which showed high accuracy for detecting lung nodules with diameter >5 mm on chest CT images, might improve the radiologist's clinical workflow by reducing the time taken to search for lung nodules.

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ER162-ED-MOA7

The Top 10 Radiological Diagnosis for the Pediatric Emergency Room: A Practical and Pictorial Review from Head to Toe

Monday, Dec. 2 12:15PM - 12:45PM Room: ER Community, Learning Center Station #7

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS

A review of the most frequent and characteristic pathologies in the emergency department for pediatric population that required a radiological diagnosis.

TABLE OF CONTENTS/OUTLINE

Based on our experience, we show a practical exhibition of the ten most frequent and most important diseases that every radiologist who attends pediatric emergencies should know: 1.Neonatal Hypoxic Ischemic Encephalopathy (HIE), 2.Cranioencephalic trauma, 3.Fractures, with a special focus on hidden fractures and child abuse, 4.Viral infection of the lower respiratory tract, 5.Bacterial pneumonia and complications related to pneumonia, 6.Pneumothorax, 7.Appendicitis, 8.Intussusception, 9.Hypertrophic pyloric stenosis (HPS), 10.Testicular and ovarian torsion. Samples, pitfalls, the best radiological tricks and tools for an initial analysis and the top differential diagnosis are shown for each one, as well as some recommended bibliography for a more in depth analysis.

ER165-ED-MOA6

Retroperitoneal Injuries on MDCT from Blunt and Penetrating Trauma Revisited: Pearls and Pitfalls

Monday, Dec. 2 12:15PM - 12:45PM Room: ER Community, Learning Center Station #6

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TEACHING POINTS

Review the retroperitoneal anatomy and organs Revisit retroperitoneal injuries on MDCT sustained from blunt and penetrating trauma Discuss diagnostic pearls and common pitfalls in diagnosing retroperitoneal injuries on MDCT

TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Incidence of retroperitoneal injuries b. Patient demographics c. Commonest mechanisms of injury 2. Retroperitoneal anatomy a. Boundaries i. Anterior: posterior parietal peritoneum ii. Posterior: transversalis fascia iii. Craniocaudal: diaphragm to pelvic brim b. Compartments i. Anterior pararenal 1. Boundaries: 2. Contents: ii. Perirenal 1. Boundaries: 2. Contents: iii. Posterior pararenal 1. Boundaries: 2. Contents: 3. Retroperitoneal injuries a. Anterior pararenal i. Gastrointestinal injuries: 1. Distal esophagus 2. Second and third portions of the duodenum 3. Ascending and descending colon ii. Pancreatic injuries iii. Vascular injuries: 1. Aorta 2. IVC b. Perirenal i. Adrenal injuries ii. Renal injuries c. Posterior pararenal i. Muscular injuries ii. Other 4. Diagnostic pearls 5. Common pitfalls

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ER204-SD-MOA1

Pregnant Trauma: Retrospective Analysis of Fetal Outcome in the Trauma of Pregnant Patients

Monday, Dec. 2 12:15PM - 12:45PM Room: ER Community, Learning Center Station #1

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PURPOSE

The purpose of this study was to analyze the fetal outcome in the trauma of pregnant patients. The relationship between fetal outcome and various factors such as the mechanism of maternal injury and fetal ultrasound findings were studied.

METHOD AND MATERIALS

The study was IRB approved and HIPAA compliant. Pregnant patients>=16 years old who sustained blunt or penetrating trauma 5/1/2005-2/28/2017 from two Level 1 trauma centers were included. During this period, a total of 152 pregnant patients met the inclusion criteria. Data collected included the type of trauma, mechanism of injury, maternal injury, fetal ultrasound, and fetal outcome.

RESULTS

130/152 (85.5%) patients sustained blunt trauma and 18/152 (11.8%) patients sustained penetrating trauma. Motor vehicle collision was the most common mechanism of blunt trauma (n=74 or 56.9%). Gunshot wound was the most common mechanism of penetrating trauma (n=10 or 55.6%). There were 12 cases of fetal demise; 11 from maternal blunt trauma (11/130) and 1 from maternal penetrating trauma (1/18). Findings on initial fetal ultrasound included no fetal heart rate (6/12), no acute findings (3/12), not obtained (2/12), and placental abruption (1/12). There were 15 cases of positive fetal ultrasound findings; 12 from maternal blunt trauma (12/130) and 3 from maternal penetrating trauma (3/18). Findings included no fetal heart rate (7/15), bradycardia/distress (2/15), perigestational sac bleed (1/15), uterine rupture (1/15), placental rupture (1/15), irregularly shaped gestational sac (1/15), and limited evaluation (2/15). Of 7 cases of no fetal heart rate, 6 cases were fetal demise while 1 case was an early normal pregnancy. Two cases of bradycardia/distress led to birth at the time of admission while the remaining cases led to normal pregnancy.

CONCLUSION

Eight percent of blunt trauma and six percent of penetrating trauma resulted in fetal demise. The most common finding on the fetal ultrasound associated with fetal demise is no fetal heart rate, followed by no acute findings. No fetal heart rate and placental rupture are two findings associated with fetal demise.

CLINICAL RELEVANCE/APPLICATION

Trauma in pregnant patients is important as it involves both the mother and the fetus. Imaging evaluation with MRI, CT, and fetal US provides important information during the initial evaluation.

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ER205-SD-MOA2

Usefulness of a Clinical Decision Support System (CDSS) for Suitability of Performance of an Aortic CT-Angiography for the Diagnosis of Acute Aortic Syndrome (AAS) MAPAC Imaging Project

Monday, Dec. 2 12:15PM - 12:45PM Room: ER Community, Learning Center Station #2

Participants
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PURPOSE

To evaluate the utility of the algorithm used in our emergency department for the suitability of performance of an aortic CT-angiography for the clinical suspicion of AAS. Also, to evaluate the possible association of the included variables with the radiological findings.

METHOD AND MATERIALS

An algorithm-based radiological approach was developed for clinical use of the CDSS. The algorithm considers three variable groups: symptoms, signs and clinical history; and three risk categories were established: low, intermediate, high. We reviewed aortic CT-angiography performed from March 2016-June 2018, which were requested due to suspected AAS using the algorithm developed. Chi-2 test and multinomial logistic regression were used in the statistical analysis performed between variables included in the CDSS algorithm and the findings in the CT.

RESULTS

We found 130 patients met the established criteria. In total, 19 patients (14.6%) had AAS and 34 patients (26.2%) had another acute disease. A total of 10 patients (7.7%) were in the low risk group, 48 (36.9%) in the intermediate group and 72 (55.4%) in the high risk group. None of the patients from the low risk group had AAS. In the intermediate group, 4 patients (8.3%) had AAS, while in the high risk group we found 15 patients (20.8%) with AAS. The probability of having AAS diagnosed in CT in those patients with a history of aortic aneurysm is 3.4 times higher (p=0.021), whereas the probability of having AAS with an auscultation suggestive of aortic valve insufficiency is 5.1 times higher. (p=0.019).

CONCLUSION

The use of an algorithm in the emergency department that includes clinical presentation, patient history and complementary tests, can be useful to optimize the diagnosis of AAS. Further investigations and a larger sample of patients are necessary to establish a clinical prediction rule.

CLINICAL RELEVANCE/APPLICATION

We propose a decision algorithm for performing an aortic CT-angiography in cases of clinical suspicion of AAS in the emergency department.

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ER206-SD-MOA3

Performance Evaluation of a Deep Learning Algorithm in Measuring Midline Shift in Head CT Scans

Monday, Dec. 2 12:15PM - 12:45PM Room: ER Community, Learning Center Station #3

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PURPOSE

Midline shift (MLS) has been associated with poor prognosis in patients with spontaneous intracerebral hemorrhage (sICH). Calculating the MLS is a simple way to quantify the early mass effect in patients with sICH.To evaluate the performance of a deep learning algorithm in measurement of midline shift for patients with sICH using head CT images.

METHOD AND MATERIALS

200 patients with cerebral hemorrhage from July 2017 to December 2018 were retrospectively collected in our hospital and 56 patients with acute sICH were finally included in this study. Two radiologists with more than 10 years' working experience used the Philips post-processing workstation software (Extended Brilliance Workstation) to assess MLS at several locations, including the pineal gland septum pellucidum and cerebral falx. MLS (max) was defined as the maximum midline shift among these locations. The average of MLS (max) measured by two radiologists was used as the gold standard. A deep learning-based commercial artificial intelligence (AI) diagnostic system was used to measure the MLS (max). Kappa statistic was used to analyze concordance of MLS(max) between the gold standard and deep learning algorithm. The wilcoxon signed rank test of paired samples was used to analyze the MLS(max) between the gold standard and deep learning algorithm.

RESULTS

In 56 patients with sICH, 38 (67.86%) patients had midline shift. MLS(max) was (4.81±0.70) mm for gold standard and (2.17±0.47) mm for deep learning algorithm with statistically significant difference ($P<0.001$). Kappa statistic between gold standard and deep learning algorithm was low ($K=0.032$), representing poor agreement for MLS (max).

CONCLUSION

AI based deep learning algorithm is still insufficiently accurate in measuring MLS (max) for patients with sICH in their CT images, resulting in poor agreement with gold standard.

CLINICAL RELEVANCE/APPLICATION

The clinical value of AI measured extent of midline shift in patients with spontaneous intracerebral hemorrhage is limited due to its insufficiency in measurement accuracy.

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ER227-SD-MOA5

Pitfalls of Automated ASPECTS: Initial Experience in A Tertiary Care Centre

Monday, Dec. 2 12:15PM - 12:45PM Room: ER Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
Shobhit Mathur, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
Omar Metwally, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Maria Zhu, MSc, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

PURPOSE

To compare the performance of automated ASPECTS provided by two software applications in acute stroke

METHOD AND MATERIALS

The non-contrast CT head studies of 91 consecutive patients referred with clinical suspicion of acute stroke were reviewed retrospectively by two observers and ASPECTS readings were made, first in an independent blinded fashion and later in consensus. A blinded consensus reading was also made on follow-up CT or MRI study (available for 67 patients) performed within 7 days. The observers then noted the readings from the software, also noting the possible cause of differences from the consensus readings.

RESULTS

The consensus human readings on the initial studies showed substantial correlation with automated results on the same studies from software package 1 ($r=0.613$, $p<0.001$) and software package 2 ($r=0.663$, $p<0.001$). The consensus human readings on follow up studies showed moderate to poor correlation with automated results on initial studies from software package 1 ($r=0.353$, $p<0.001$) and software package 2 ($r=0.428$, $p<0.001$). Segmentation errors, presence of extra-axial collections, anatomic asymmetry and chronic infarcts were common causes of misreadings by the softwares.

CONCLUSION

In our initial experience, although automated ASPECTS from both the softwares showed good correlation with human readings in acute stroke, they were moderate-poor predictors of final infarct volume.

CLINICAL RELEVANCE/APPLICATION

ASPECTS is a valuable tool in evaluation of acute stoke studies. The suggestions highlighted here would help ongoing improvement in the emerging machine learning based software applications in acute stroke imaging.

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ER241-SD-MOA4

256-Rows Dual-Energy CT Virtual Decalcification Technique for Detection of Bone Marrow Edema at Visual and Quantitative Analyses

Monday, Dec. 2 12:15PM - 12:45PM Room: ER Community, Learning Center Station #4

ER

Participants
Kun Zhang, MD, Changsha, China (*Presenter*) Nothing to Disclose
Luyou Yan, Changsha, China (*Abstract Co-Author*) Nothing to Disclose
Junhan Pan, BS, Changsha, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic performance of dual energy computed tomography (CT) virtual decalcification (VNCa) technique for detection of bone marrow edema (BME) in patients with vertebral compression fractures.

METHOD AND MATERIALS

This institutional review board-approved study included 29 consecutive patients with 73 vertebral fractures who underwent both a dual energy CT examination (Revolution CT scanner, GE Healthcare) and a 3-T magnetic resonance (MR) examination of the spine between October 2018 and January 2019. MR images served as the reference standard. Two independent and blinded readers visually evaluated all vertebral bodies for the presence of abnormal bone marrow attenuation on color-coded overlay virtual VNCa DECT images by using a binary classification system (0=chronic compression fracture, 1=acute compression fracture); specificity, sensitivity, predictive values, and inter-observer agreements were calculated. Another reader performed a quantitative analysis on VNCa DECT images; cut-off value was calculated using ROC analysis.

RESULTS

MR imaging depicted 43 edematous and 30 nonedematous vertebral compression fractures. In the visual analysis, VNCa DECT images had an overall sensitivity of 88.4%, specificity of 100.0%, positive predictive value of 100%, and negative predictive value of 90.3%. The interobserver agreement was excellent ($\kappa = 0.82$). CT content obtained from VNCa DECT images were significantly different between vertebrae with and without bone marrow edema on MR ($p < 0.001$). Receiver operating characteristic curve (ROC) analysis revealed an area under the curve (AUC) of 0.886. A cutoff value of 1036.9 mg/m3 provided sensitivity of 86%, specificity of 82.1% for the differentiation of edematous vertebral bodies. The AUC of visual image analysis is larger than quantitative VNHAP image evaluation (0.942 > 0.886).

CONCLUSION

Visual and quantitative analyses of dual energy CT virtual decalcification (VNCa) technique had excellent diagnostic performance for identifying acute and chronic compression fractures. And the diagnostic efficiency of the visual image analysis is higher than that of quantitative image evaluation.

CLINICAL RELEVANCE/APPLICATION

Dual energy CT virtual decalcification (VNCa) technique can serve as a useful tool for accurate diagnosis of acute and chronic vertebral compression fractures, which has potential clinical and health-economic benefits.

GI283-ED-MOA13

Learning to Ride the Wave: An Interactive Review of the Pitfalls in MR Elastography

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #13

Awards
Magna Cum Laude

Participants
Chenyang Zhan, MD,PhD, New York, NY (*Presenter*) Nothing to Disclose
Krishna Prasad Shanbhogue, MD, Jersey City, NJ (*Abstract Co-Author*) Nothing to Disclose
Myles T. Taffel, MD, New York City, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Magnetic Resonance elastography (MRE) estimates tissue stiffness by evaluating mechanical shear wave propagation using motion-encoding gradients. Compared with other non-invasive imaging technique such as ultrasound-based transient elastography, MRE has higher accuracy for detection of liver stiffness. With the approval of CPT code for MRE and increasing prevalence of nonalcoholic steatohepatitis, it is expected that utilization of MRE will continue to grow. This interactive exhibit will provide a case based review of MR elastography interpretation. Cases that highlight the pitfalls in MR elastography will be discussed. Analysis of the technical aspects of MRE failure will also be presented.

TABLE OF CONTENTS/OUTLINE

The majority of the educational exhibit will be presented in case-based quiz format. Table of Contents/Outline:- Brief review of MR elastography mechanism/technique- Discussion of MR elastography interpretation- Alternative pathologies that mimic high liver stiffness- Artifacts & failed cases.5 figures in abstract:- MR elastography interpretation requires evaluation of multiple sequences- Heterogeneity of liver fibrosis - Focal hepatic lesion mimicking focal fibrosis- Artifacts mimicking high stiffness- High stiffness secondary to Budd-Chiari Syndrome.

GI284-ED-MOA14

MR Staging of Rectal Carcinoma: A Case-Based Approach

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #14

Participants
Neeraj Lalwani, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose
David D. Bates, MD, Hastings On Hudson, NY (*Abstract Co-Author*) Research support, General Electric Company
Elena K. Korngold, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Hina Arif, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Ashish R. Khandelwal, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Mark E. Lockhart, MD, Birmingham, AL (*Abstract Co-Author*) Author, Oxford University Press; Author, Reed Elsevier; Editor, John Wiley & Sons, Inc; Deputy Editor, Journal of Ultrasound in Medicine

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TEACHING POINTS

The concept of mesorectum, The radiological appearance of mesorectum on MRI, Practical implications of radiological anatomy in staging rectal cancer and management, How to accurately stage rectal cancer on MRI?, Peals and pitfalls.

TABLE OF CONTENTS/OUTLINE

Understanding the anatomy of mesorectum, Staging of rectal cancer, T1 vs T2, T3 vs T4, Good vs. bad T3, T4a vs. T4b, Characteristics of suspicious nodes, Pelvic side wall nodes: Locaoregional vs metastatic, EMVI, Learning staging of rectal carcinoma and review selected cases

GI285-ED-MOA15

MRI of Abdominal and Pelvic Tumors in Pregnancy

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #15

Participants
Nikhar Kinger, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Ilkyu D. Oh, BA, Suwanee, GA (*Abstract Co-Author*) Nothing to Disclose
Courtney C. Moreno, MD, Suwanee, GA (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Pardeep K. Mittal, MD, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Review the imaging of pregnant patients Demonstrate the appearance of tumors in pregnant patients Characterize both benign and malignant tumors during pregnancy

TABLE OF CONTENTS/OUTLINE

Choosing between imaging modalities such as MRI, CT, ultrasound, and radiography for pregnant patients. MRI protocolling for pregnant patients with sequences such as T2, fat suppressed T2, T1 precontrast, in and out of phase, diffusion, and thin slice T2 images. MR imaging characterization of benign and malignant abdominal and pelvic tumors. Most common tumors in pregnancy are generally benign and include fibroids, corpus luteum cysts, and desmoid tumors. Malignant tumors include breast cancer and cervical cancer. The effects of pregnancy on these tumors. Treatment of tumors during pregnancy. Conclusions.

GI286-ED-MOA16

Let's Get to the Bottom of This: Updated Review of MRI Defecography in Males and Females

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #16

Participants
Soumya Maddula, MD, New York, NY (*Presenter*) Nothing to Disclose
Ilana Kafer, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

-Learn basic anatomy of the pelvic floor and its functional role in defecation in female and male patients. -Identify the various organs and muscles which separate the compartments of the pelvic floor. -Refresh on protocols utilized specifically at our institution and discuss protocol options -Understand normal and abnormal function and movement of pelvic floor muscles. -Identifying common pelvic floor pathology by compartment in both female and male patients.

TABLE OF CONTENTS/OUTLINE

I. Overview of Terminology II. Female Pelvic Floor Anatomy II. Male Pelvic Floor Anatomy III Review of Normal Pelvic Floor function IV. Interpreting Normal MR Imaging Findings V. Pathology by compartment a. Anterior Compartment i. Cystocele ii. Urethral hypermobility b. Middle Compartment i. Cervical prolapse c. Posterior compartment i. Rectocele ii. Intussusception iii. Dyssynergic Defecation d. 'Fourth Compartment' i. Enterocele ii. Peritoneocele

GI288-ED-MOA12

Nodal Staging of Gastric Cancer: Pictorial Illustration

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #12

Participants
Pulkit Maru, MBBS, Kolkata, India (*Presenter*) Nothing to Disclose

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TEACHING POINTS

1. Lymphatic drainage of the stomach. 2. Updated AJCC (TNM) and Japanese Gastric Cancer Association nomenclature of regional and distant nodal stations. 3. To know the exact stations on cross sectional imaging. 4. Lymph node morphological features predicting metastatic nodal involvement. 5. Types of surgical nodal clearance for gastric cancer.

TABLE OF CONTENTS/OUTLINE

1. Anatomical definitions of lymph node stations (Japanese classification of gastric carcinoma: 3rd English edition (2011)) a. Perigastric nodes b. Second tier nodes c. Second tier or third tier nodes (according to site of primary tumour) d. Third tier or metastatic nodes 2. AJCC 8th Ed (TNM) staging - N stages 3. Lymph node morphology 4. Types of lymph node dissections (according to a. D1 b. D1+ c. D2 d. D3

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GI338-SD-MOA2

The Role of Sarcopenia in Patients with Intrahepatic Cholangiocarcinoma Undergoing TACE and SIRT

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #2

Participants
Felix Hahn, MD,MSc, Mainz, Germany (*Presenter*) Nothing to Disclose
Lukas Mueller, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Roman Kloeckner, MD, Mainz, Germany (*Abstract Co-Author*) Advisory Board, Guerbet SA; Advisory Board, Bristol-Myers Squibb Company; Advisory Board, Sirtex Medical Ltd; Speaker, Guerbet SA; Speaker, Sirtex Medical Ltd; Speaker, BTG International Ltd
Sebastian Schotten, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph Dueber, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Arndt Weinmann, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Aline Maehringer-Kunz, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Sarcopenia has been proposed as a prognostic parameter for patients with intrahepatic cholangiocarcinoma (ICC). The aim of this study was to investigate the prognostic value of sarcopenia in patients with ICC undergoing TACE or SIRT.

METHOD AND MATERIALS

Between 1997 and 2018, 417 patients with ICC were referred to our tertiary care center. A total of 45 patients received TACE or SIRT and were included in this study. Psoas muscle index (PMI) served as an easy-to-measure marker of sarcopenia. Using optimal stratification, cut-off values for PMI regarding overall survival (OS) were calculated. As a control group, 198 patients undergoing liver resection were evaluated.

RESULTS

In the group undergoing TACE/SIRT, no predictive cut-off values for PMI could be calculated (best log-rank p=0.15, cut-offs 5.00cm²/m² in men and 3.45cm²/m² in women, median OS 9.4 months vs 15.0 months). In contrast, in the subgroup undergoing liver resection, optimal stratification yielded PMI cut-offs that were predictive for OS (cut-offs 5.74cm²/m² in men and 5.19cm²/m² in women, log-rank p=0.002, median OS 20.4 months vs 30.2 months). Tumor burden was significantly higher in the TACE/SIRT group compared to the resection group: multifocality in 62% vs 22% (p<0.001), mean sum of intrahepatic lesions 14.6cm vs 8.2cm (p<0.001), translobar spread in 50% vs 8% (p<0.001), and increased tumor volume (0%-25%/25%-50%/>50% in 19/16/10 vs 164/32/2, p<0.001).

CONCLUSION

In contrast to patients undergoing liver resection, PMI was not predictive in patients with ICC undergoing TACE/SIRT. Extensive tumor burden and poor survival times are likely to be factors that complicate establishing survival discriminators.

CLINICAL RELEVANCE/APPLICATION

Sarcopenia did not allow for reliable survival stratification following TACE or SIRT; other parameters like ECOG or tumor burden are probably more suitable (co)predictors.

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GI339-SD-MOA3

MDCT Features for Diagnosis of Single Adhesive Band versus Matted Adhesions in Small Bowel Obstruction

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #3

Participants
Pierre Berge, MBBS, Saint Martin du Bois , France (*Presenter*) Nothing to Disclose
Maxime Delestre, Angers, France (*Abstract Co-Author*) Nothing to Disclose
Anita Paisant, Angers, France (*Abstract Co-Author*) Nothing to Disclose
Antoine Hamy, MD, Angers, France (*Abstract Co-Author*) Nothing to Disclose
Christophe Aube, MD, PhD, Angers, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Francois Hamel, Angers, France (*Abstract Co-Author*) Nothing to Disclose
Aurelien Venara, MD , Angers, France (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The objective was to determinate computed tomography (CT) scanner signs to differentiate small bowel obstruction (SBO) induced by single adhesive band (SAB) and matted adhesions (MA) and to elaborate a radiological score predicting of SAB.

METHOD AND MATERIALS

All consecutive patients who undergone surgery from January 2013 to June 2018 for adhesions-induced SBO were retrospectively included. Reference of SBO type (SAB or MA) was given by surgery. All CT scan were secondary read by an observer blinded of clinical and surgical finding. Fisher's exact test, Mann-Whitney U test and a logistic regression model were used. The score was elaborated on 143 patients and validated on 50 patients of the same population.

RESULTS

Among the 193 patients having surgery for SBO, 119 (61.6%) had SAB and 74 (38.4%) had MA surgically proven. In multivariate analysis, the presence of a beak sign (OR=3.47, 95%CI [1.26;9.53], p=0.02), a closed-loop (OR=11.37, 95%CI [1.84;70.39], p=0.009), focal mesenteric haziness (OR=3.71, 95%CI [1.33;10.34], p=0.01) and focal and diffuse peritoneal fluid (respectively OR=4.30, 95%CI [1.45;12.73], p=0.009 and OR=6.34, 95%CI [1.77;22.59], p=0.004) were significantly associated with SAB. Contrariwise, the presence of diffuse mesenteric fluid without focal fluid (OR=0.23, 95%CI [0.06;0.92], p=0.04) and the diameter of the most dilated loop (OR=0.94, 95%CI [0.90;0.99], p=0.02), were inversely associated with SAB. Using the significant predictive factors of SAB, we built a composite score to radiologically predict the etiology of SBO. Area under Receiver Operating Characteristic (ROC) curve was 0. 8274. For a cut-off score = -0.523, sensitivity, specificity and the percentage of patients correctly classified were respectively 78.4%, 84.6% and 80.0%.

CONCLUSION

Several radiologic variables are strongly associated with the diagnosis of SAB-induced SBO. The present score could represent a significant tool in the decision of surgical management

CLINICAL RELEVANCE/APPLICATION

By discriminating single adhesive band and matted adhesions in adhesional small bowel obstruction, MDCT could be a key element in the decision for surgical management.

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GI340-SD-MOA4

CT Findings with High Specificity and Sensitivity for Closed Loop Small Bowel Obstruction

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #4

Participants
Riya Goyal, MD, Mineola, NY (*Presenter*) Nothing to Disclose
Hwayoung K. Lee, MD, Englewood Cliffs, NJ (*Abstract Co-Author*) Nothing to Disclose
Leonora Mui, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose
Sadjad Riyahi, MD, Sunnyside, NY (*Abstract Co-Author*) Nothing to Disclose
Martin R. Prince, MD,PhD, New York, NY (*Abstract Co-Author*) Patent agreement, General Electric Company; Patent agreement, Hitachi, Ltd; Patent agreement, Siemens AG; Patent agreement, Koninklijke Philips NV; Patent agreement, Nemoto Kyorindo Co, Ltd; Patent agreement, Bayer AG; Patent agreement, Lantheus Medical Imaging, Inc; Patent agreement, Bracco Group; Patent agreement, Mallinckrodt plc; Patent agreement, Guerbet SA; Patent agreement, Toshiba Corporation

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PURPOSE

To identify the sensitivity and specificity of computed tomography (CT) findings in patients with suspected closed loop small bowel obstruction (CLSBO).

METHOD AND MATERIALS

The radiology database and surgical reports from two suburban teaching hospitals were reviewed retrospectively for patients diagnosed with CLSBO over a 3 year time period. Eligible for inclusion were consecutive patients ages 13-100 with clinical suspicion of CLSBO based on presenting symptoms who had a CT abdomen/pelvis performed. Patients with a CT report containing key words, 'CLSBO' or 'internal hernia' or surgical report with a diagnosis of CLSBO/internal hernia who had a CT performed prior to surgery were included in the study. Two radiologists evaluated the scans for imaging features associated with CLSBO. The electronic medical records of the study population were independently reviewed for clinical factors and operative findings. Sensitivity and specificity were calculated for the diagnosis of CLSBO and each CT sign using postoperative diagnosis or clinical diagnosis for patients who did not undergo surgery as the reference standard.

RESULTS

Of 224 patients included in the analysis, 222 had surgical confirmation of CLSBO and 2 were diagnosed clinically. Sensitivity and specificity of CT findings included: proximal dilatation (97%, 5%), distal collapse (96%, 2%), mesenteric edema (94%, 5%), beak sign (91%, 17%) ascites (92%, 2%), fecalization (48%, 56%), whirl sign (27%, 88%), target sign (19%, 83%), radial distribution (19%, 78%), bowel wall thickening (19%, 81%), bowel enhancement (15%, 83%), multiple transition points (4%, 88%), pneumatosis (1%, 100%), free air (1%, 98%), and U or C configuration (28%, 59%). Common clinical findings included prior surgery (84%), cancer (29%), and serum lactate >2.2mg/dl (25%).

CONCLUSION

Imaging findings associated with CLSBO have either a high sensitivity (ascites, proximal dilatation, mesenteric edema, beak sign) or high specificity (whirl sign, target sign, radial distribution, multiple transition points). Accurate diagnosis requires systematic assessment for multiple signs.

CLINICAL RELEVANCE/APPLICATION

The accurate diagnosis of life threatening CLSBO requires attention to multiple CT imaging findings shown to have a high specificity and high sensitivity.

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GI344-SD-MOA1

Predicting Early Tumor Recurrence Prior to Surgery Compared with After Surgery for Patients with Single HCC

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #1

Participants
Dong Ik Cha, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyung Mi Jang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Hyun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Honsoul Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We evaluated whether predicting early tumor recurrence using preoperative laboratory and imaging factors is non-inferior than using preoperative and postoperative pathologic factors in patients with single hepatocellular carcinoma within the Milan criteria.

METHOD AND MATERIALS

549 patients with single HCC within the Milan criteria who underwent curative resection were included. Two prediction models for early recurrence of HCC were developed using selected preoperative factors only and using both preoperative and postoperative factors which were determined by stepwise variable selection methods based on Akaike information criterion (AIC). Area under the curve (AUC) for each receiver operating characteristic (ROC) curve of the two models was calculated, and the two curves were compared for non-inferiority testing. The predictive models of early HCC recurrence were internally validated by bootstrap resampling method.

RESULTS

Multivariable analysis of preoperative factors showed that AST/platelet ratio index (APRI), tumor size, arterial rim enhancement of the tumor, peritumoral parenchymal enhancement, and presence of nonhypervascular hepatobiliary hypointense nodules (NHHN) on gadoxetic acid-enhanced magnetic resonance imaging (MRI) were significant factors. On multivariable analysis after adding patholgoic factors, presence of microvascular invasion was added instead of tumor size. Comparison of the AUCs of the two models showed that prediction model using selected preoperative factors only was non-inferior to that using both preoperative and postoperative factors [preoperative factors only; 0.673 (95% CI: 0.623¬0.723) vs. after adding postoperative factors; 0.691 (95% CI: 0.639-0.744); p = 0.0013]. Bootstrap resampling method showed that the two models were valid.

CONCLUSION

The performance of using preoperative laboratory and imaging factors was not inferior to that using preoperative and postoperative pathologic factors for prediction of early recurrence after curative resection of single HCC within the Milan criteria.

CLINICAL RELEVANCE/APPLICATION

Since predicting early recurrnece using preoperative laboratory and imaging factors was non-inferior to that using preoperative and postoperative pathologic factors, more individualized patient care before and after surgery could be given to patients with expected early recurrence.

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GI364-SD-MOA5

Reproducibility of Radiomic Features Across Different Dose Strengths and Reconstructions for Diagnosis of Active Terminal Ileal Crohn's Disease on CT Enterography

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #5

Participants
Prathyush Chirra, Cleveland, OH (*Presenter*) Nothing to Disclose
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Kaustav Bera, MBBS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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Satish Viswanath, Cleveland, OH (*Abstract Co-Author*) Scientific Advisory Board, Virbio Inc

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PURPOSE

Radiomics is an objective method for extracting quantitative information from medical images and CT Enterography (CTE) is commonly used to diagnose terminal ileal (TI) Crohn's disease (CD). The purpose of this study was to identify Radiomics features of active terminal ileal (TI) CD and assess reproducibility of these features across different dose strengths and reconstruction settings.

METHOD AND MATERIALS

IRB approved, retrospective, single center study. Study cohort of 89 patients with active TI CD (44) & normal (45). All patients had a CTE on a dual-source CT (100% dose) with filtered back projection (FBP) reconstruction. Single source (50% dose) data was extracted and reconstructed with filtered back projection (FBP) and iterative reconstruction (IR) using sinogram affirmed iterative reconstruction (SAFIRE), yielding 3 datasets per patient: full-dose FBP (FDFBP),half-dose FBP (HDFBP), half-dose iterative reconstruction (HDIR). Cohort was split into a training set (n=69) and hold-out validation set (n=20). TI was annotated by an expert radiologist on FDFBP set, from which a total of 196 radiomic features were extracted. 5 top-ranked radiomic features for active TI CD were identified via cross-validation on FDFBP training set. These 5 features were used to train a random forest classifier to distinguish patients with active TI CD and normal, in 3 hold-out validation sets corresponding to each of FDFBP, HDFBP, and HDIR images. Statistical evaluation included ROC analysis and testing of feature significance.

RESULTS

Radiomic features showed higher texture heterogeneity within TI regions in patients with active TI CD as comapred to normals (all p values < 0.001).Using top-ranked radiomic features of intensity or gradient co-occurrence, hold-out AUC for FDFBP was high on both full-dose images (FDFBP AUC=0.9) and half-dose images (HDFBP AUC = 0.89, HDIR AUC = 0.91) with all p values <0.001.

CONCLUSION

Radiomic features of TI on CTE can reproducibly and consistently diagnose active CD across different dose strengths and reconstruction settings.

CLINICAL RELEVANCE/APPLICATION

Radiomic features of the terminal ileum exhibit a highly accurate and consistent signature for diagnosis of active TI CD across different doses and reconstructions and can be complementary to a radiologist for diagnosis of active TI CD even in low dose scans.

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GI365-SD-MOA6

Value of Diffusion Weighted Imaging and Circulating Tumor Cells on Predicting the Short-Term Efficacy of Chemoradiotherapy in Esophageal Squamous Cell Carcinoma Patients

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #6

Participants
Zhengyan Jia, Zhengzhou, China (*Presenter*) Nothing to Disclose
Jinrong Qu, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate diffusion weighted imaging (DWI) and circulating tumor cells (CTCs) in predicting short-term efficacy of chemoradiotherapy in patients with esophageal squamous cell carcinoma (ESCC).

METHOD AND MATERIALS

Fifty-one patients who were confirmed ESCC with pathologically and treated with chemoradiation were collected retrospectively from November 2016 to April 2018. All patients underwent DWI and CTCs examination before treatment. The ADC value was calculated on DWI images. CTCs were separated and divided into three substypes:epithelial CTCs, mesenchymal CTCs, hybrid CTCs. Short-term efficacy evaluation was performed using RECIST 1.1, which was divided into remission group (CR, PR) and non-remission group (SD, PD). The Mann-Whitney U test was used to compare parameters between groups. The predictive ability of ADC value and CTCs and their combination was analyzed by receiver operating characteristic curve (ROC).

RESULTS

Thirty-four patients were in the remission group, and 17 patients in the non-remission group among 51 patients. The maximum, average, and minimum values of the ADC in the remission group were lower than those values in the non-remission group (P=0.045, 0.033, 0.001). The mesenchymal CTCs in the remission group were higher than those in the non-remission goup (P=0.020). However, there was no significant difference between the remission group and the non-remission group in the numbers of epithelial CTCs, hybrid CTCs, and total CTCs (P=0.377, 0.771, 0.734). From ROC analysis, the area under the ROC curve of ADC minimum value, mesenchymal CTCs, and their combination was 0.777, 0.689, and 0.834, respectively. The sensitivity of ADC minimum value, mesenchymal CTCs, and their combination were 70.6%, 70.6%, and 64.7%, respectively. The specificity of ADC minimum value, mesenchymal CTCs, and their combination were 85.3%, 61.8, and 88.2%, respectively.

CONCLUSION

ADC values and mesenchymal CTCs can be used as a method to predict short-term efficacy of chemoradiotherapy in ESCC patients, and the mesenchymal CTCs combined with ADC minimum value provide higher diagnostic value in predicting short-term efficacy of chemoradiotherapy, which can be used as a new method for predicting short-term efficacy of chemoradiotherapy in ESCC patients.

CLINICAL RELEVANCE/APPLICATION

Combination ADC andCTCs can be used as a new method for predicting short-term efficacy of chemoradiotherapy for ESCC patients.

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GI366-SD-MOA7

Imaging Predictors of Pancreatic Adenocarcinoma Patient Survival After Resection

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #7

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PURPOSE

To identify predictors of survival for resected pancreas adenocarcinoma (PDAC) patients based on imaging findings on preoperative CT.

METHOD AND MATERIALS

IRB approved retrospective review of consecutive patients who underwent resection for pathologically proven PDAC with preoperative CT (within 60 days of surgery) performed between December 2006-July 2017. Patients with prior surgery or PDAC arising in a mucinous neoplasm were excluded. Two radiologists reviewed the preoperative CT and assessed PDAC imaging findings based on the American Pancreatic Association/Society of Abdominal Radiology PDAC reporting template. Interreader agreements (kappa statistics) were measured for the imaging variables and overall survival (OS) was associated with a consensus read of the imaging variables using Cox proportional hazard regression.

RESULTS

168 patients (mean age 66, 0.85:1 male:female) were enrolled: 126 had upfront surgical resection and 42 received neoadjuvant therapy. Imaging variables associated with decreased OS ($p<0.05$) were tumor arterial contact (HR 2.76, 95%CI 1.50-5.09, Kappa=0.52) and tumor contact specifically with the superior mesenteric artery (HR 1.98, 95%CI 1.08-3.61, Kappa=0.68). The presence of venous collaterals in the left upper quadrant (HR 2.32, 95% CI 1.11-4.85) was associated with decreased OS, but demonstrated fair reproducibility between readers (Kappa=0.38). Invasion of adrenal glands was also associated with decreased OS (HR 165, 95% CI 10.4-2646), however occurred infrequently (4/168) with fair reproducibility (Kappa=0.39). Tumor size was only significantly associated with decreased OS in patients who underwent upfront surgical resection (HR 2.30, 95% CI 1.19-4.42, kappa=0.49). Tumor contact with adjacent veins was not associated with decreased OS (HR 1.07, 95% CI 0.68-1.68, Kappa=0.44).

CONCLUSION

PDAC contact of any artery on preoperative CT is associated with shorter survival in resected PDAC patients. Tumor size was only associated with survival in the untreated resectable PDAC patients.

CLINICAL RELEVANCE/APPLICATION

Application of a PDAC reporting template may have a role in identifying predictors of survival that can aid in preoperative stratification of patients.

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GI367-SD-MOA8

Non-Contrast MRI as a Sequential Imaging for Characterizing CT-Detected Arterial Enhancing-Only Nodules in Patients at Risk for HCC

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #8

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PURPOSE

To determine the feasibility of non-contrast MRI as a sequential imaging for characterizing CT-detected arterial-enhancing nodules that do not washout in patients at risk for HCC.

METHOD AND MATERIALS

We retrospectively recruited 194 arterial enhancing-only nodules (mean size, 1.5 cm; range, 0.5-3.2 cm) detected on multiphasic CT that were subsequently evaluated with gadoxetic acid-enhanced MRI in 175 treatment-naïve chronic liver disease patients (130 males and 45 females, mean age, 56.6±9.8 years) from three tertiary referral centers. The diagnosis of all 118 primary liver malignancies including 105 HCCs and 13 combined HCC-CC was made by surgical resection and percutaneous biopsy. Two radiologists assessed T2WI, DWI, T1 dual GRE images (Dual GRE), and hepatobiliay phase images (HBP) for the following findings in each nodule: mild-to-moderate hyperintensity on T2WI, hyperintensity on DWI, hypointensity on HBP, fat content on Dual GRE, non-enhancing capsule, hemorrhage, nodule-in-nodule, and mosaic appearance. Assuming the presence of any one of these findings indicates the diagnosis of HCC, per-lesion analyses were performed to determine the sequences most predictive of HCC.

RESULTS

Per-lesion sensitivity, specificity, and accuracy per number of the sequence used is as follows: one sequence, 89.5-93.3%, 79.8-83.1%, and 85.1-88.1%; two sequences, 88.6-95.2% 79.8-85.4%, and 86.6-89.2%; three sequences, 91.4-92.4%, 79.8-85.4%, and 86.6-88.7%; all four sequences. 93.3%, 79.8%, and 87.1%. The combination of T2WI, DWI, and Dual GRE showed the best performance for HCC diagnosis with sensitivity, specificity, and accuracy of 91.4%, 85.4%, and 88.7%. Applying the same provisional criteria for HCC to diagnose primary liver malignancy showed the sensitivity, specificity, and accuracy of 90.7%, 97.4%, and 93.3% when using the combination of T2WI, DWI, and Dual GRE. In nodules < 1 cm, adding HBP increased sensitivity up to 13% without decreasing the specificity and accuracy.

CONCLUSION

Non-contrast MRI protocol of T2WI, DWI, and Dual GRE showed reasonable performance for discriminating HCC and primary liver malignancies in CT-detected indeterminate arterial enhancing-only nodules of patients at risk for HCC. In nodules < 1 cm, HBP may still be needed to preserve the sensitivity.

CLINICAL RELEVANCE/APPLICATION

Abbreviated non-contrast MRI protocol could be used as a sequential imaging to characterize CT-detected arterial enhancing nodules.

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GI368-SD-MOA9

Evaluation of Treatment Response in Phase IB of the Study of Patients with Advanced Melanoma Treated by CMP-001 in Combination with Pembrolizumab: Relationship with Pre-Treatment Tumor Burden (TB) Using Volumetric Computed Tomography (CT) Biomarkers

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #9

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PURPOSE

Advanced melanoma patients with increased hepatic metastases and total tumor burden (TB) have been shown to have reduced response rates to anti-PD1 treatment. Here we explore the predictive value of fractional baseline organ-specific TB acquired by volumetric computed tomography (CT) biomarkers in a subset of patients included in the phase IB study of anti-PD1 monoclonal antibody pembrolizumab and intratumorally injected Toll-like receptor 9 (TLR9) agonist CMP-001

METHOD AND MATERIALS

44 patients with advanced melanoma refractory to prior anti-PD1-therapy have been included. Volumetric assessment of baseline CT was performed using an advanced CT volumetric workstation to measure TB in viscera vs. lymph nodes and sub-cutaneous tissue. Fractional TB was calculated by dividing site-specific TB (viscera and LN/SQ) by total TB. Visceral fraction >0.3 and LN/SQ fraction >0.7 were defined as high. Survival analysis was performed, and progression-free survival (PFS) was calculated. Start date was defined as date of the first dose. Progression date was defined as date of last scan if the patient progressed. Date of last follow-up was selected as the later one between date of last scan and date of death. Kaplan-Meier plots were generated by visceral status and LN/SQ status (high vs. low)

RESULTS

Among 44 patients, two observations were deleted due to missing imaging data. Median follow-up time was 8.4 months (1st quartile 4.48, 3rd quartile 13.9) for this study. Higher visceral fraction (median 2.9 months, 95% confidence interval [CI] 2.7,+inf) was statistically significant associated with shorter PFS compared to lower visceral fraction (median 12.4 months, 95% CI 5.8,+inf; p=0.024). In contrast, LN/SQ PFS was longer in high fraction (median 12.43 months, 95% CI 8.4,+inf) compared to low fraction (median 4.6 months, 95%CI 2.8,+inf), although not statistically significant (p=0.096)

CONCLUSION

In volumetric CT analysis of subjects treated with the combination of pembrolizumab and CMP-001, high fraction of baseline visceral TB is associated with shorter PFS. On the other side, although not statistically significant, high fraction of baseline lymph node TB seems to be a favorable feature and is associated with longer PFS

CLINICAL RELEVANCE/APPLICATION

These results suggest that fractional organ-specific TB measured by volumetric CT is a potential prognostic marker in subjects with advanced melanoma treated with immunotherapy.

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GI369-SD-MOA10

Mucinous Cystic Neoplasms of the Liver versus Simple Biliary Cysts: CT/MR Features and Inter-Reader Agreement

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #10

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PURPOSE

Assess CT and MR features that may aid in differentiation of mucinous cystic neoplasms of the liver (MCN) from simple biliary cysts (SBC) and determine the inter-reader reliability of these features.

METHOD AND MATERIALS

A blinded, retrospective review of imaging in surgically resected, pathologically confirmed MCN (n=46) and SBC (n=57) was performed using CT (n=60), MR (n=11) or both (n=32) by 2 fellowship-trained radiologists. Features analyzed included: maximum cyst size and shape; homogeneity/heterogeneity of cyst contents; cyst wall thickness and calcifications; cyst septal location, thickness, regularity/irregularity and calcifications; presence of solid enhancing components; bile duct communication; protrusion of cyst into the bile duct; bile duct dilatation peripheral to the cyst; cyst restricted diffusion (MR); and total number of hepatic cysts. Inter-reader agreement was analyzed using kappa coefficient analysis. Chi-square analysis assessed for significant differences in occurrence of features between MCN and SBC using the senior reader's data.

RESULTS

Inter-reader agreement was substantial for CT features including septal calcification (0.88 [95% CI: 0.72, 1.00]) and cyst wall calcifications (0.75 [95% CI: 0.56, 0.94]). Inter-reader agreement was also substantial for MR features including cyst protrusion into the biliary duct (0.78 [95% CI: 0.38, 1.00]), septal location (0.76 [95% CI: 0.56, 0.96]), cyst contents (0.73 [95% CI: 0.50, 0.95]), and communication with the distal bile duct (0.71 [95% CI: 0.34, 1.00]). A significant variance in septal features on MR was noted between MCN and SBC, including septal location (central and central + peripheral in 62% of MCN versus 22% of SBC [p = 0.02]), septal nodularity (42% irregular/nodular in MCN versus 6% in SBC [p=0.02]), and septal thickness (>3mm in 78% of MCN versus 9% of SBC [p=0.04]).

CONCLUSION

There is substantial inter-reader agreement on multiple CT and MR features shared by MCN and SBC. Among those, the MR septal features including location, nodularity, and thickness may help distinguish MCN from SBC.

CLINICAL RELEVANCE/APPLICATION

CT and MR features of cystic liver masses can help differentiate mucinous cystic neoplasms of the liver from simple biliary cysts.

GI370-SD-MOA11

Joint Segmentation and Classification of Hepatic Lesions in Ultrasound Images Using Deep Learning

Monday, Dec. 2 12:15PM - 12:45PM Room: GI Community, Learning Center Station #11

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PURPOSE

To develop a convolutional neural network (CNN) model to jointly segment and classify a hepatic lesion selected by user clicks in ultrasound examination.

METHOD AND MATERIALS

4,309 anonymized ultrasound images of 3,873 unique patients with hepatic cyst (n=1,214), hemangioma (n=1,220), metastasis (n=1,001), or HCC (n=874) were collected and annotated. The images were divided into 3,909 training and 400 test images including 100 images for each lesion type, with no patient overlap. Our network is composed of one shared encoder and two inference branches which are respectively for segmentation and classification. The network takes as input the concatenation of an input image and two Euclidean distance maps of positive and negative clicks provided by a user. Simulated positive and negative clicks were used for training. For better generalization, the convolutional layers in the shared encoder were initialized using other network trained with breast ultrasound images. The performance of hepatic lesion segmentation was evaluated with Jaccard index (JI). Accuracy, sensitivity, specificity, and the area under the receiver operating characteristic curve (AUROC) for categorizing benign and malignant hepatic lesions and classifying four kinds of hepatic lesions were calculated.

RESULTS

We achieved performance improvements by jointly conducting two tasks. In segmentation only model, the mean JI was 68.5%. In classification only model, the accuracy of classifying benign and malignant lesions was 89.8% and that of classifying four kinds of hepatic lesions was 79.8%. Compared to this, mean JI and accuracy were 70.0% and 90.4% in the joint segmentation and classification model for classifying benign and malignant lesions. Similar results were also obtained for four kinds of hepatic lesions (mean JI: 68.4%, accuracy: 82.2%). The sensitivity, specificity, and the AUROC of classifying benign and malignant hepatic lesions were 95.0%, 86.0%, and 0.97. And those of classifying four hepatic lesions were 87.0%, 90.0%, and 0.95.

CONCLUSION

The proposed deep learning based system that simultaneously performs segmentation and classification of a hepatic lesion selected by a user in ultrasound images showed higher performance than segmentation only and classification only systems.

CLINICAL RELEVANCE/APPLICATION

The proposed system could assist the radiologists with little experience in ultrasound imaging with detecting hepatic lesions

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GU206-SD-MOA1

Intrauterine Saclike Fluid Collection in Early Pregnancy: Does it Matter if it Has an Echogenic Rim or a Sonographic "Sign"?

Monday, Dec. 2 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #1

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PURPOSE

To determine whether sonographic features of an intrauterine round or oval fluid collection ("saclike structure"), including the presence or absence of an echogenic rim, double sac sign, or intradecidual sign, are helpful in early pregnancy for determining whether the saclike structure is a gestational sac or for predicting prognosis.

METHOD AND MATERIALS

We identified all sonograms performed on women with positive hCG at our institution between 1/1/2012 and 6/30/2018 meeting the following criteria: presence of a saclike structure in the mid-uterus without yolk sac or embryo; no extraovarian adnexal mass; and follow-up information identifying location of the pregnancy as intrauterine or ectopic. Study authors reviewed sonographic images on all cases and recorded the following information: presence or absence of each of: echogenic rim around the collection, double sac sign (DSS), and intradecidual sign (IDS); and mean sac diameter.

RESULTS

650 sonograms met the inclusion criteria. Of these, 599 fluid collections demonstrated an echogenic rim, 182 a DSS, and 348 an IDS (findings not mutually exclusive). In all 650 cases, subsequent sonogram or other clinical follow-up confirmed that the patient had an intrauterine pregnancy. That is, none of the fluid collections proved to be intrauterine fluid with an ectopic pregnancy (sometimes termed "pseudogestational sac"). 41.2% were live at the end of the first trimester and 58.8% miscarried. None of the sonographic features (echogenic rim, DDS, IDS, mean sac diameter) of a saclike structure were predictive of prognosis, with no statistically significant relationship between presence or absence of one or two echogenic rings and outcome ($p>.05$, chi-squared).

CONCLUSION

In a woman with a positive hCG and no extraovarian adnexal mass, the sonographic finding of a saclike structure in mid-uterus is virtually certain to be a gestational sac. Sonographic features of the structure are of no diagnostic or prognostic value. Concepts introduced 30-40 years ago when ultrasound equipment had far lower resolution than currently, including DDS, IDS, and pseudogestational sac, have no role today in assessing early pregnancy.

CLINICAL RELEVANCE/APPLICATION

In a woman with a positive hCG, any round or oval fluid collection in the mid-uterus should be interpreted as a highly likely gestational sac. Sonographic "signs" are of no diagnostic value.

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GU207-SD-MOA2

Phase II Study to Evaluate Transrectal, Magnetic Resonance Image-Guided Laser Focal Therapy of Prostate Cancer in an Outpatient Setting Using Realtime MR-Thermometry: Ten Year Interim Results

Monday, Dec. 2 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #2

FDA Discussions may include off-label uses.

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PURPOSE

In the United States alone, new prostate cancer cases for 2018 were estimated at 164,960 and deaths at 29,430 according to the SEER Stat Database: Cancer Stat Facts: Prostate Cancer Statistics at a Glance, Estimated New Cases in 2018 and Estimated Deaths in 2018. Focal therapies for localized prostate cancer are increasingly being explored. Additionally, new treatments for patients with biochemical recurrence of prostate cancer are also under investigation. Our objective is to investigate the efficacy ofoutpatient MR-guided laser focal therapy for MR visible prostate cancer utilizing a transrectal approach for laser applicator placement and therapy delivery.

METHOD AND MATERIALS

All MRI-guided therapy was delivered using a 1.5 Tesla Philips Achieva XR system (Philips Healthcare, Best, The Netherlands) for image acquisition and real-time thermometry. DynaLOC (Invivo, Orlando, FL, USA) software was used for interventional planning. Laser therapy was delivered using a Visualase (Medtronic, Minneapolis, MN, USA) 15W, 980 nm diode laser with cooled (Medtronic, Minneapolis, MN, USA) or non-cooled (Clincal Laserthermia Systems, Framingham, MA, USA) laser fiber introduced transrectally.

RESULTS

136 men were treated. 210 cancer foci were treated. 115 of 136 patients were treatment naïve (85%). The remaining 21 patients were salvage patients (15%). Mean initial PSA was 7.4 ng/mL and the age range 44-87 years (mean = 67 years). Procedure time was1-4 hours. Post-treatment, mean PSA nadir was 3.65 ng/mL (51% mean decline in all patients at 6 months). No serious adverse events or morbidity were reported. 36 treatment regions were positive at six months biopsy for clinically significant prostate cancer (23% marginal recurrence or recurrent prostate cancer rate). We observed no statistically significant change in IPSS and SHIM scores at 12 months post-treatment.

CONCLUSION

Our data indicate that outpatient, transrectally delivered MRI-guided laser focal therapy for prostate cancer is both safe and feasible, achiving oncologic control in 77% of patients.

CLINICAL RELEVANCE/APPLICATION

In the current climate of cost-reduction and emphasis on minimally-invasive treatment of cancer, focal treatment of prostate cancer may be an attractive option. The precise energy delivery under MRI-guidance may have favorable results for cost control and quality of life without eliminating the possibility of whole-gland treatment in the patient's future.

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GU208-SD-MOA3

The Development of Deep Learning Based Prostate Cancer Detection System of MRI with Automatically Stitched Histopathologic Gold Standards

Monday, Dec. 2 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #3

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PURPOSE

To develop deep learning (DL) based prostate cancer detection system of MRI

METHOD AND MATERIALS

From 2011 Jan to 2018 Apr, a total of 2364 patients who underwent prostatectomy for prostate cancer were enrolled retrospectively. Finally, 350 patients examined with 3T MRI and underwent radical prostatectomy were included in the study. Image sets of T2 weighted images, diffusion weighted images (b=0, 1000) and ADC images were acquired (N=20328). For histopathological gold standard, pathologic slides of whole resected prostate were scanned and automatically stitched by in house developed software. Areas of cancer were drawn by a 25 year experienced uropathologist in slide by slide. Manual segmentation of cancer was done on the T2 weighted image by a 19 year experienced uroradiologist, based on pathology scans and played as gold standards of cancer. MR Images were registered one another by affine transformation. Images from 350 patients were split into learning set (N=300) and test set (N=50). We developed a deep neural network based on the fully convolutional networks (FCN) which predicts prostate cancer from prostate multi-parametric MR image. Our DL model was trained to simultaneously cancer detection and lesion segmentation which facilitates the relevant feature extraction for the categorization. MR images were reviewed by two independent uroradiologists. All readings were done based on PIRADS (Prostate Imaging Report and Data System) V2 and suspected segments of cancer were marked in 39 segments of prostate, suggested from PIRADS V2. ROC curve analysis was done for the evaluation of models from DL. Sensitivity, specificity, PPV, NPV, accuracy of test set were calculated by lesion based and compared with those from DL.

RESULTS

The overall accuracy of developed DL model was 0.85 and AUC of prediction model was 0.89. The accuracies of uroradiologists were from 0.83 to 0.84, which were similar to DL accuracy. Specificity was over 0.92 in two radiologists but sensitivities were varied from 0.22 to 0.46. Sensitivity of DL was highest (0.69) over the uroradiologists.

CONCLUSION

DL can detect prostate cancer as accurate as experienced uroradiologists.

CLINICAL RELEVANCE/APPLICATION

DL prediction of prostate cancer can help the PIRADS scoring of cancer, decision and guidance of biopsy in suspected patients.

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GU230-SD-MOA4

A Predictive Nomogram for Individualized Recurrence Stratification of Bladder Cancer Using Multiparametric MRI and Clinical Risk Factors

Monday, Dec. 2 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #4

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PURPOSE

To develop and validate a nomogram based on radiomics and clinical predictors for personalized prediction of the first two years (TFTY) bladder cancer (BCa) recurrence after operation.

METHOD AND MATERIALS

The preoperative MRI's of 71 BCa patients (34 recurrent) were evaluated which were divided into training cohort (n=50) and validation cohorts (n=21). The multiparametric MRI sequences obtained on 3.0T MR scanner including T2-weighted (T2W), diffusion-weighted (DW) and dynamic contrast enhanced (DCE) image sequence. Radiomics features were extracted from the T2W, DW, apparent diffusion coefficient and DCE images of each patient. A Rad_Socre model was constructed by using the support vector machine-based recursive feature elimination (SVM-RFE) algorithm and multivariate logistic regression model with the training cohort. Combined with the essential clinical factors mainly including patients' age at the time of initial surgery, gender, tumor histological grade and stage of the archived tumor with the maximal size in bladder lumen, tumor size and number, a radiomics-clinical nomogram was developed. Its performance was evaluated using the training and the validation cohorts. The potential clinical usefulness was demonstrated by using decision curve analysis. Cox proportional hazard models were performed to explore the association between clinical factors and Rad_Score with recurrence.

RESULTS

Of the 1872 features, the 32 with the highest AUC of receiver operating characteristic (0.8634) were selected with the training cohort, and were used for the Rad_Score model construction. The nomogram developed by two independent predictors, muscle-invasive status (MIS) and Rad_Score, showed good performance in the training cohort (Accuracy 88%, AUC 0.915, $p << 0.01$) and the validation cohort (Accuracy 80.95%, AUC 0.838, $p = 0.009$). The decision curve further demonstrated more net benefit by using the radiomics-clinical nomogram model than using radiomics or clinical model alone.

CONCLUSION

The proposed radiomics-clinical nomogram has potential in the preoperative prediction of TFTY BCa recurrence.

CLINICAL RELEVANCE/APPLICATION

MRI is the most ideal and noninvasive imaging modality for recurrence detection in BCa. Radiomics-clinical nomogram based on multiparametric MR imaging features as well as several important clinical factors associated with tumor recurrence has the potential for an accurate prediction for tumor recurrence.

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GU231-SD-MOA5

Quantitative Assessment of Diffusion Kurtosis Imaging Depicting Deep Myometrial Invasion: A Comparative Analysis with Diffusion-Weighted Imaging

Monday, Dec. 2 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #5

Participants
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PURPOSE

To investigate histogram analysis of diffusion kurtosis imaging (DKI) and conventional diffusion-weighted imaging (DWI) to distinguish between deep myometrial invasion and superficial myometrial invasion in endometrial carcinoma (EC).

METHOD AND MATERIALS

A total of 118 pathologically confirmed EC patients with preoperative DWI were included. The data were postprocessed with a DKI (b value of 0, 700, 1400, and 2000 s/mm2) model for quantitation of apparent diffusion values (D) and apparent kurtosis coefficient values (K) for non-Gaussian distribution. The apparent diffusion coefficient (ADC) was postprocessed with a conventional DWI model (b values of 0 and 800 sec/mm2). A whole-tumor analysis approach was used. Comparisons of the histogram parameters of D, K and ADC were carried out for the deep myometrial invasion and superficial myometrial invasion subgroups. Diagnostic performance of the imaging parameters was assessed.

RESULTS

The Dmean, D10th, and D90th in deep myometrial invasion group were significantly lower than those in superficial invasion group ($p<0.001$, <0.001 and $=0.023$, respectively), as well as the ADCmean, ADC10th, and ADC90th ($p=0.001$, 0.001 and 0.042, respectively). The Kmean and K90th were significantly higher in deep invasion group than those in superficial myometrial invasion group ($p=0.002$, and 0.026, respectively). The D10th, Kmean, and ADC10th had a relatively higher area under the curve (AUC) (0.72, 0.66, and 0.71, respectively) than other parameters did for distinguishing deep myometrial invasion of EC. D10th showed a relatively higher AUC than ADC10th did for the differentiation of lesions with deep myometrial invasion from those with superficial myometrial invasion (0.72 vs 0.71), but the variation was not statistically significant ($p=0.35$).

CONCLUSION

Distribution of DKI and conventional DWI parameters characterized by histogram analysis may represent an indicator for deep myometrial invasion in EC. Both DKI and DWI models showed relatively equivalent efficacy.

CLINICAL RELEVANCE/APPLICATION

Histogram analysis of diffusion kurtosis of magnetic resonace imaging can identify deep myometrial invasion in endometrial carcinoma from superfucial myometrial invasion as well as conventional diffusion weighted imaging did.

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GU232-SD-MOA6

How 3 Tesla In-Bore MR-Guided Biopsy Improves Detection of Prostate Cancer: A Study on 426 Patients

Monday, Dec. 2 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #6

Participants
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PURPOSE

This study evaluates the diagnostic yield of 3 Tesla in-bore trans-rectal magnetic-resonance-guided biopsy (3T-MRGB) for prostate cancer (PCa) detection based on Prostate Imaging Reporting and Data System version 2 (PI-RADSv2) scoring in patients with either suspected PCa or under active surveillance.

METHOD AND MATERIALS

This IRB-approved, HIPAA-compliant, single-institution, the retrospective study assessed data of 426 consecutive patients (mean age: 69 years) who underwent 3T multiparametric MRI (mpMRI) and subsequent 3T in-bore prostate MRGB between February 2012 and July 2018. Three subcohorts included patients who were biopsy-naïve (23%, 98/426), those with the history of recent negative template trans-rectal ultrasound-guided biopsy (TRUS-GB) (39%, 166/426) and those under active surveillance (38%, 162/426). Clinically significant disease (CSD) was defined as a Gleason score (GS) >= 3+4. The detection rate was also stratified based on the pre-procedural PIRADSv2 score.

RESULTS

Mean interval time between mpMRI and 3T MRGB was 80 days with mean biopsy time of 54 minutes. MRGB detected PCa in 65.7% (280/426) of patients, of whom 74%(207/280) had CSD. Cancer detection rate was comparable between transitional (64.7%, 147/227) and peripheral zone (66.9%, 133/199) lesions (p>0.5). In-bore MRGB detected PCa in 45% (75/166) of patients with the history of recent negative TRUS-GB, in 64.3% (63/98) of biopsy-naïve patients and 80.2% (130/162) of those under active surveillance. In AS subcohort, in-bore 3T MRGB upgraded GS in 48.1%(78/162) of patients compared to GS from TRUS-GB. The overall PCa and CSD detection rates for PI-RADSv2 categories of 3, 4 and 5 were 35%, 72.6%, 94.2%; and 23.3%, 54%, 71.6% respectively. A moderately high correlation was seen between PIRADSv.2 score and PCa detection rate (rs: 0.55, P<0.001). The rate of urosepsis was 1% (4 patients).

CONCLUSION

3T MRGB was safe and resulted in the detection of PCa in 45% of patients with recent negative TRUS-GB, in 64.3% of biopsy-naïve patients, and upgraded GS in 48.1% of patients under active surveillance. There was a moderately high PIRADS v.2 score correlation with 3T MRGB yield for PCa.

CLINICAL RELEVANCE/APPLICATION

In-bore MRGB has a high diagnostic yield in biopsy-naïve patients and patients with a history of negative TRUS-GB and can upgrade Gleason score in half of the low-grade prostate cancers.

HP123-ED-MOA6

Just Say No to Gad: Focused Non-Contrast Body Protocols and Alternative Contrast Agents

Monday, Dec. 2 12:15PM - 12:45PM Room: HP Community, Learning Center Station #6

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS

Gadolinium (Gd) deposition was first described in 2014, and numerous studies have confirmed Gd deposition in multiple organs.The Federal Drug Administration (FDA) released a new class warning in 2017 regarding gadolinium-based contrast agents (GBCAs) and risks of Gd deposition, recommending physicians take into account Gd retention and reduce lifetime doses. The purposes of this exhibit are:to describe the current state of GBCAs to understand potential for focused non-contrast body MRI protocols and role in reducing lifetime Gd doseto recognize potential benefits of Ferumoxylol as an alternative MRI contrast agent

TABLE OF CONTENTS/OUTLINE

1. Background on Gd Deposition Most up to date research on Gd deposition Variation in deposition for different GBCAs 2. Overview on FDA recommendations for GBCAs Review physician responsibilities 3. Discuss focused non-contrast body MRI protocols and its role in reducing lifetime Gd Biparametric prostate MRI Non-contrast surveillance for cystic pancreatic lesions Non-contrast evaluation of cohledocolithiasis in acute abdominal pain 4. Consider benefits of Ferumoxylol as an alternative MRI contrast agent Aortic atherosclerosis and endoleaks Transplant vasculature Pulmonary embolus

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HP206-SD-MOA1

Opportunistic Screening of Patients with Incidentally Discovered Fatty Liver on CT: Compliance of Ordering Physicians and Diagnostic Yield of Patients with Non-Alcoholic Steatohepatitis (NASH)

Monday, Dec. 2 12:15PM - 12:45PM Room: HP Community, Learning Center Station #1

Participants
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PURPOSE

Hepatic steatosis (fatty liver) is a frequent and often incidental finding detected on imaging that may not be reported, or briefly noted without any guidance to the referring clinician. To bring attention the potential significance of hepatic steatosis, we inserted standard text into the CT reports of patients with incidentally detected fatty liver advising the referring clinician to consider additional workup if the etiology was unknown. Our primary aims were (1) to measure adoption of the strategy by radiologists; (2) to evaluate the compliance of referring physicians to the guidance; and (3) to measure the diagnostic yield of clinical significant liver disease.

METHOD AND MATERIALS

In this retrospective study, 479 patients with CT exam reports between April 2016 and September 2017 containing the standardized recommendation were identified by means of a tag included within the radiology report. Electronic medical records of the patients were reviewed up to December 2018 to determine if the recommendation was acknowledged and if any action was taken.

RESULTS

In 479 patients whose reports included the recommendation there was acknowledgement of the recommendation in 166 patients (35%), change in patient management in 52 patients (11%), and further testing or medical consultation in 114 (24%) patients. Patients were more likely to have action taken if their CT was ordered by a primary care provider (PCP) compared to other specialties (47% vs 27%, $p<0.001$). Patients with urgent findings on their CT were less likely to have action taken compared to patients with chronic findings or normal exams (21% vs 38%, $p<0.001$). The final diagnosis in the 114 patients who underwent further liver evaluation was NAFLD in 56 (49%); alcoholic hepatitis in 9 (8%); and NASH in 8 (7%).

CONCLUSION

Inclusion of follow-up recommendations in reports of patients with incidentally discovered fatty liver on CT was more likely to acted upon by PCP and in patients with either otherwise normal or non-acute findings. In those patients who underwent further liver evaluation, 15% of patient were ultimately diagnosed with clinically significant liver disease (NASH and alcoholic hepatitis) and 49% were diagnosed with potentially significant liver disease (NAFLD).

CLINICAL RELEVANCE/APPLICATION

Evaluate the impact of fatty liver follow-up recommendations in radiology reports on ordering clinician follow up and diagnostic yield on patients with fatty liver disease.

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HP207-SD-MOA2

Radioprotection Training System to Multi-Professional Team and Medical Students in a Teaching Hospital

Monday, Dec. 2 12:15PM - 12:45PM Room: HP Community, Learning Center Station #2

FDA Discussions may include off-label uses.

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PURPOSE

To assess prior knowledge about the importance of radioprotection in a teaching hospital, to accompany the implantation of a protection campaign in the same hospital and to implement a permanent education program for the protection of medical education for awareness of professionals and medical students.

METHOD AND MATERIALS

Prospective project with educational intervention for physicians of the clinical staff, radiologists, radiology technicians, nursing, administrative and medical academics. A radioprotection commission was implemented to aware the health professional and patients about the correct indications, risks, and benefits of radiological exams. Professionals and patients of the hospital school were evaluated prior to the implantation of the campaign on knowledge of the importance of radiation protection, dose reduction, and safety. A distance-learning platform was created about the protection to complement the educational activities. Questionnaires of prior knowledge assessment, on the principles of Image Gently®, were distributed to 400 students, 50 residents and 100 healthcare professionals at the teaching hospital and 50 physicians of the clinical staff. RX and CT exams dose data report was registered.

RESULTS

The previous evaluation indicated an incipient knowledge, and most of them were unaware of the concept of radiological protection. 80% of the radiographers reduce dose for pediatric exams and 40 % for adult ones. 35% of the technologist ask about recent patient's previous exams. A radioprotection team were developed and the theme included in the medical students curriculum. Monthly data will be collected to new analyses with the methodology performed and education activities including patients and hospital health professionals staff.

CONCLUSION

The prior knowledge on the foundations and ideas of radiation protection were limited in our teaching hospital and, this, may lead to consequences for patients and health professionals themselves, for increasing the dose of radiation used and, consequently, damage to an overexposure. Therefore, we highlight the importance of creating campaigns and committees that act in this area of incentive to achieve goals for reducing exposure to radiation without detriment to the quality of radiological examinations.

CLINICAL RELEVANCE/APPLICATION

Radioprotection education to academic community and professional staff as well as patients can be applicable in teaching hospitals.

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HP208-SD-MOA3

Expectations of Critical Radiology Result Communication

Monday, Dec. 2 12:15PM - 12:45PM Room: HP Community, Learning Center Station #3

Participants
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PURPOSE

The necessity of timely communication of critical results is known and the division of these results into 3 levels of urgency is accepted. However, little data exists comparing radiologist and referring provider expectations regarding which imaging findings are critical results and how these results should be communicated.

METHOD AND MATERIALS

An anonymous survey asked radiologists and referring providers if ten findings were critical results and, if so, what level. Preferred method of communication for each level, appropriateness of the number of critical results called by radiologists, and level of difficulty in reaching someone were also assessed. $\chi 2$ test compared the distribution of level 1, 2, 3 and not a critical result/other categories for the findings as well as communication preferences. A word cloud tool was used to analyze comments for recurrent themes in free text responses.

RESULTS

19% (124/658) of providers responded. The distribution of level of urgency differed between radiologists and referring providers for intrabdominal abscess ($p = .019$), pulmonary nodule ($p = .02$) and solid renal mass ($p = .002$). Although distribution for DVT was similar for the 2 groups, overall 65/123 (52%) chose Level 2 and 53/123 (43%) chose Level 1. Among specialties, emergency medicine had the most findings classified as level 1 with the highest proportion. Pager was the preferred method of communication for level 1 53/123 (43%) and level 2 64/119 (54%) critical results. E-mail is preferred for level 3 64/119 (54%) and for non-critical findings 56/110 (51%). Radiologists were the only specialists that reported many/too many 5/32 (16%) critical results are called and that reaching someone in regards to a critical result is very difficult 2/18 (11%). Themes in free-text responses demonstrated a desire to use the EHR for communication and for alerting providers of critical results prior to patients reading their reports.

CONCLUSION

Differences between and amongst radiologists and referring providers were found in categorization of findings as critical results. Referring providers, especially emergency medicine, are more likely to choose higher levels of urgency.

CLINICAL RELEVANCE/APPLICATION

Radiologists and referring providers have differing expectations for critical results communication, creating opportunities for interdisciplinary consensus building and education.

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HP229-SD-MOA4

Allergy Skin-Testing in Patients with a Previous Hypersensitivity Reaction to a Gadolinium-Based Contrast Agent (GBCA): A Systematic-Review and Meta-Analysis

Monday, Dec. 2 12:15PM - 12:45PM Room: HP Community, Learning Center Station #4

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PURPOSE

To determine if AST reduces incidence of breakthrough immediate-hypersensitivity reactions to gadolinium-based contrast agents (GBCA).

METHOD AND MATERIALS

Original research studies, case series, and case reports of patients with a prior immediate-hypersensitivity reaction to GBCA undergoing repeat exposure to GBCA were evaluated. Studies reporting the proportion of breakthrough immediate-hypersensitivity reactions following corticosteroid premedication were included. MEDLINE (1946-2019), Embase (1947-2019) and CENTRAL (March 2019) were searched. Comparison of breakthrough reaction rates with and without AST was conducted. Co-variates were evaluated. QUADAS-2 was used to assess risk of bias and applicability.

RESULTS

Six studies containing 197 patients were included (3 with 132 patients without AST; 3 with 65 patients with AST). All patients without AST (N=132) had mild or moderate initial reactions. Seventy-three patients underwent repeat exposure with the same linear or macrocyclic agent following standard 13-hour oral premedication (Greenberger protocol). No patient was given an alternative agent. The breakthrough reaction rate was 43.8% (32/73); 9.4% (3/32) had an increase in reaction severity. 72.3% (47/65) patients with AST had a mild or moderate initial reaction and 27.6% (18/65) had a severe initial reaction. Twelve patients (18.5%; 12/65) underwent repeat exposure with the same or different agent after variable use of premedication. The breakthrough reaction rate was 0% (0/12). In 16.7% (2/12), AST was positive and a GBCA with negative AST was used. In 83.3% (10/12), AST was negative and GBCA was either not switched (40% [4/10]), switched empirically (10% [1/10]) or unknown (50% [5/10]).

CONCLUSION

Breakthrough reactions to GBCA are common (~40%) when the same agent is used despite 13-hour oral premedication. AST may reduce immediate-hypersensitivity breakthrough reactions, but the evidence is limited by small sample sizes and high-risk of bias.

CLINICAL RELEVANCE/APPLICATION

Larger studies are required to formally evaluate AST and switching of GBCA in patients with immediate-hypersensitivity reactions requiring repeat GBCA-enhanced MRI. Preliminary results indicate AST may have a favorable role in this patient population.

HP230-SD-MOA5

An Unconference on Communication Adds Value: One Approach to Improving Communication in the Radiology Department

Monday, Dec. 2 12:15PM - 12:45PM Room: HP Community, Learning Center Station #5

Participants
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Bruce B. Forster, MD, Vancouver, BC (*Abstract Co-Author*) Stockholder, Canada Diagnostic Centres; Travel reimbursement, Sectra AB

PURPOSE

To develop, implement and evaluate an unconference on communication for trainees, scientists, and radiologists in an academic radiology department.

METHOD AND MATERIALS

Using the unconference approach, department members selected the session topics through an online survey: communicating ideas to a larger audience, communication in conflict resolution and using new techniques to communicate with millennial learners. Following a plenary session on social media, individuals participated in a "world café" style session on the three topic areas. Facilitated by content experts, small groups focused on learning through dialogue and reflection. Following the unconference, an anonymous online survey was sent to participants to determine their attitudes.

RESULTS

48 department members attended and the survey response rate was 47.9%. Most radiologists stated that the event was relevant to their practice (87%), effective use of their time (82%) and that they learned something new (96%). Overall, the plenary session on social media communication was ranked the most helpful (87%) and new teaching methods was rated the most helpful small group session (80%). Reasons for this included practicality, importance in millennial learners and the interactive nature of the session. Most respondents (91%) preferred to have a semi-annual unconference event centered on various communication topics. Topics suggested for future sessions included communication around medico-legal challenges and novel technologies.

CONCLUSION

Although communication is integral to academic radiology, few radiologists receive structured teaching on this topic. This study demonstrates how a relatively simple evidence-based session can enhance participants' understanding of communication and ultimately enable better communication with colleagues and patients.

CLINICAL RELEVANCE/APPLICATION

The unconference is an effective platform for enhancing communication in radiology meetings by fostering learning through discussion and reflection, ultimately improving patient care.

IN008-EB-MOA

NLP Can Accurately Extract Reports Containing Pulmonary Artery Enlargement Based on a Relatively Small Amount of Training Data

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Hardcopy Backboard

Participants
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Irena Tocino, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Sophie Chheang, MD, New York, NY (*Abstract Co-Author*) Medical Director, Agamon Technologies

Conclusion

Advances in machine learning, affordable computing power, and availability of large data stores create the ideal environment for NLP to demonstrate its potential to structure radiology reports, even when the training corpus is relatively small..

Background

Textual data within radiology reports is unstructured and must be converted into a "table" format. Natural Language Processing (NLP) is one mechanism by which reports can be structured to perform data analysis. NLP has the potential to identify patient cohorts and to understand radiologist "behavior." Specifically, we want to develop an NLP model to identify reports containing "pulmonary artery dilation," which could be expressed in multiple ways.

Evaluation

Using 880 consecutive Chest CT reports from a single institution, predictive analytics models (decision tree, boosted decision tree, random forest) on 5 separate bag-of-words datasets were performed: 1. Remove stop words 2. Remove stop words + TF-IDF 3. Remove stop words + TF-IDF + bi-grams 4. Remove stop words + TF-IDF + bi-grams + stemming 5. Remove stop words + bi-grams + stemming 70% of the data was used to train and 30% to test. Five-fold cross-validation was used to further increase the value of this limited dataset. Logistic Regression was performed on the following variables: patient age and gender, in- vs outpatient, urgency, preliminary read, and whether a report was ready by a thoracic imager. The following characteristics of the reports are observed: 188/880 (21.4%) mentioned the pulmonary artery. Of these, 74 (39.4%) had pulmonary artery enlargement. 47.6% were read by thoracic imagers and 73.8% were initially read by a trainee. Median age was 60, average was 59.3, and std deviation was 16.6.

Discussion

Random forest has the best performance, regardless of the strategy to create the bag-of-words. The strategy involving all the available techniques (remove stop words, TF-IDF, bigrams, and stemming) has the best performance of 98.7%.Of multiple variables, only whether a scan was read by a thoracic imager was a statistically significant predictor ($p>0.001$) of whether a report would mention pulmonary artery enlargement.

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IN016-EB-MOA

Preventing Gender and Laterality Discrepancies in Radiology Reporting

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Hardcopy Backboard

Participants
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Conclusion

We developed a successful tool to assist users in identifying gender and laterality mismatch errors, rapidly correcting errors prior to finalizing reports, and reducing the overall rate of errors.

Background

Errors in radiology reporting such as laterality and gender specific discrepancies have significant clinical impact, jeopardize patient safety, and reduce the credibility of radiologists. Several programs have been created to address these errors, but many take effect after a report is finalized therefore allowing a window for medical error. The purpose of our project was to create a tool, called SafeSign, to assist in detecting gender and laterality mismatch errors, analyzing the frequency and spectrum of such errors, and allowing for correction prior to finalizing reports.

Evaluation

A 'SafeSign' button was added to the toolbar of our dictation system using AutoHotkey. When clicked, it would display the report in a new window in simple font with laterality and gender terms highlighted in different colors. If a mismatch between the extracted exam information and the report was detected, a 'discrepancy' banner would pop-up. 'Close and sign report' and 'log error/return to report' buttons were added for rapid correction and to log other errors detected by the user. When SafeSign was clicked, data including user identity, date/time, gender, modality and type of examination was logged to a database for analysis.

Discussion

The system detected 62 errors (57 laterality, 5 gender) out of 9759 SafeSign uses (error detection rate of 0.64%), with 75% of the laterality errors and 0% of the gender errors detected in x-rays. Laterality errors were detected in 1.31% of all radiographs. Significantly more errors were detected in male patients compared to female patients and 60% of the errors were detected in the PM, compared to the AM. The data also showed that users returned to the report after initiating SafeSign 28.27% of the time, presumably to make a change. Anecdotal data demonstrates that SafeSign enhanced the ability to detect other errors beyond gender/laterality mismatches including typographical, wrong word substitutions, nonsensical phrases, syntax, and changes to the findings/impression.

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IN026-EC-MOA

A DICOM-Embedded Annotation System for 3D Cross-Sectional Imaging Data

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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CONCLUSION

A widely compatible DICOM-native annotation pipeline with strong support for data visualization was created to facilitate computer vision projects involving 3D cross-sectional data.

Background

Annotation of imaging data, especially in 3D cross sectional imaging, remains challenging due to a paucity of common storage standards, user-friendly annotation tools, and visualization methods. Programmatic visualization tools such as Matplotlib and unspecialized formats such as CSV and XML are unfavorable for visualizing 3D cross-sectional annotations. We present a data-generation workflow that embeds radiologist annotations directly into DICOM headers. The resulting annotations are ready for use in machine learning projects and widely compatible and easily visualized in DICOM viewers such as OsiriX/Horos.

Evaluation

Our python-based annotation pipeline leverages the DICOM header at tag value (60xx, 3000), which supports 16 binary mask ROIs per cross-sectional image. It extracts radiologist annotations from OsiriX/Horos via the PyOsiriX toolkit and embeds them directly into the DICOM header. Additionally, a reverse pipeline was developed to push annotations from CSV databases into DICOM headers to enable visualization within DICOM viewers. This process is demonstrated with lung nodule segmentations in chest CTs in Horos (Figure).

Discussion

Effective annotation and visualization are among the most important factors towards successful deep learning model development. Our tool supports all annotation shapes, including oval, rectangular, polygon, and penciled ROIs. Leveraging the DICOM header overlay tags makes data visualization intuitive and compatible with most DICOM viewers. Our pipelines bridge between radiologist annotations in DICOM viewers and machine learning friendly formats, ultimately facilitating radiological machine learning research. This code and modular library will be released prior to RSNA 2019.

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IN204-SD-MOA1

CT Angiography of the Abdominal Aorta and Lower Extremities in Patients with Chronic Kidney Disease: A Low Contrast Dose Protocol Using Dual-Energy CT

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Station #1

Participants
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PURPOSE

CT angiography is used in the evaluation of abdominal aortic aneurysm (AAA) and peripheral vascular disease (PVD). Interventional Radiology and Vascular Surgery use this to determine disease extent, necessity for open surgical approach and retrograde versus antegrade access. A significant number of these patients have renal dysfunction, posing a risk for contrast induced nephropathy. We describe a dual-energy CT protocol to obtain adequate CTA images with drastically reduced iodinated contrast dose.

METHOD AND MATERIALS

11 total patients with CKD underwent CTA at reduced iodinated contrast dose of 34 cc from 1/2017 through 8/2017 (8 underwent CTA with runoff for PAD treatment planning, 3 CTA without runoff for aneurysm planning). Mean GFR within 1 week prior to the scan was 35.7. Two dual-energy protocols were used: kV of 80/140 (7 patients) and kV of 100/140 (4 patients). The scan was triggered at an abdominal aortic density of 120 HU. Control population of 10 patients with CKD underwent CTA at an average dose of 107 cc. The kV was 120 for 7 patients and 100 for 3 patients. Of the control, 8 underwent CTA with runoff and 2 underwent CTA without runoff. The mean GFR within 1 week prior to the scan was 51.1. Patients were followed via EMR for GFR 2 weeks to 1 month post-scan.

RESULTS

For the dual-energy protocol with kV of 80/140, the mean mA for each scan was 52.2/29.7. The average DLP for each scan was 665.6 mGy*cm. The mean density of the distal abdominal aorta was 278.7 HU. For the kV of 100/140, the mean mA for each scan was 29.37/22.9. The mean DLP for each scan was 802.4 mGy*cm. The mean density of the distal abdominal aorta was 235.5 HU. For the control population, the mean DLP for each scan was 1154 mGy*cm. The mean density of the distal abdominal aorta just proximal to its bifurcation was 355.9. There was no statistically significant decrease in GFR post-scan for the low contrast dose or control population.

CONCLUSION

A low contrast dose protocol using dual-energy CT provides adequate quality images at lower radiation dose in patients with CKD who undergo CTA for PAD or aneurysm treatment planning. This may decrease the risk of CKD progression. Larger studies would enhance the power of this study, confirming that sufficient imaging quality can be achieved at a reduced dose.

CLINICAL RELEVANCE/APPLICATION

Low contrast dose dual-energy CTA can provide adequate quality images at a lower radiation dose in patients with CKD.

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IN210-SD-MOA6

Digital Health Solution Tools: A Trend that Physicians Should Follow to Engage More with Their Patients

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Station #6

Participants
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PURPOSE

The main purpose of this research is to measure the real-world evidence of patient and physician digital engagement through a mobile clinical data sharing tool and to identify which variables drive the strength of that engagement.

METHOD AND MATERIALS

A mobile application was developed to enable easy access to laboratory and imaging results. Within the application a new functionality was implemented to enable patients to share exams reports with the referring physician, friends and family or even another physician, at patient's will. The application generates a link which can shared by Whatsapp, Messenger or e-mail, of a specific exam and expires after a time stipulated by the patient. All the data regarding the number of downloads, patient demographics, clinical and behavior from 2016 to 2019 has being analyzed. Every time a patient shares an exam report, the system tracks down when it was shared, with whom, if the recipient visualized the report or let the link expire, and if the recipient is a physician or not. Patient and physician engagement has being analyzed with this new digital sharing tool to better understanding of the added value this functionality brings to patient care. Data and metrics were compared with two years prior the implementations of this functionality at the mobile application and online patient portal.

RESULTS

Early results show that from 2016 to February 2019 more than 88,000 patients were enrolled in the application and a total of 253781 outpatient exams were shared from the mobile app, 16,071 in 2016, 44,000 in 2017 and 156,163 in 2018. Of all the shared links, only 40,683 (17%) was accepted by the recipient.

CONCLUSION

The increasing number of shared links reveals that a mobile app is appealing for the patient, who appears to be interested in engaging with his or her own healthcare. Being able to have the reports of their exams in the tip of their finger and have the power to share them for better understanding of the results seems to be positively evaluated by patients. On the other hand, there seems to be low acceptance by physicians. Further analysis with data related with this outcome should bring some light on the disparity of high patient engagement and low medical acceptance of a digital health tool.

CLINICAL RELEVANCE/APPLICATION

Real world evidence that patients are engaging more with their health with digital health solution tools, however physician are still resistant to this new trend.

IN222-SD-MOA3

Deep Learning Model Based on Multiple Computed Tomography Observation Window Setting Inputs for Pulmonary Nodule Detection

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Station #3

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PURPOSE

Deep learning based approaches have been shown promising in lung nodule detection on Computed Tomography (CT) images. To investigate whether combining clinical prior-knowledge in deep learning model may reduce the dependence of data and model size (i.e., model complexity), a three dimension convolutional neural network based on multiple CT observation window setting inputs, namely Multi-Window CNN, was proposed for lung nodule detection.

METHOD AND MATERIALS

The main idea of multiple windows inputs, inspired by the way of nodule screening of radiologists, is to increase the grey-level information of the nodule. In this study, a set of nodule candidates was generated by using morphology based method. All candidates VOI were set into 4 different window settings, including full dynamic window, lung window (LW: 1500, LI: -400), bone window (LW: 1500, LI: 300), and abdomen window (LW: 400, LI: 60). Applying the 3 layers multi-channel CNN architecture fed with 4 different windows to extract the features. After all, the feature vector was input into the 2 fully connected layers to create a feature representation. The architecture is shown in figure. To train the deep learning network, a total of 518 CT scans from LIDC dataset were used, randomly split patients into a training (80%), validation (10%), and testing (10%) sets. Numbers of nodule and non-nodule candidates are 1350 and 21600, respectively.

RESULTS

The sensitivities of the proposed Multi-Window CNN algorithm were 96.5% (138/143) with 3.43 FPs/scan in the LIDC dataset. In contrast, the relatively complex DL model (i.e., the champion of competition of Data Science Bowl, 2017) achieved the sensitivities of 88.1% (126/143) with 6.25 FPs/scan in the same testing dataset.

CONCLUSION

The experiment shows that the 3 layers DL model based on the multiple window inputs and relatively small data set may achieve a better detection performance than complex DL model. It indicates that combining the clinical prior-knowledge and DL approach may have the potential to effectively guide model learning, and provide further information for model training.

CLINICAL RELEVANCE/APPLICATION

Combining the clinical prior-knowledge to DL approach may have the potential to reduce the dependence of data and model size of DL model for lung nodule detection. Besides, it may achieve more effective training for DL model and better detection performance.

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IN248-SD-MOA5

Identifying Areas for Operational Improvement and Growth Opportunities in IR Workflow Using Workflow Modeling, Simulation and Optimization Techniques

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Station #5

FDA Discussions may include off-label uses.

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CONCLUSION

Workflow modeling and stochastic simulations provide a cost-effective way of identifying workflow inefficiencies and testing what-if scenarios for operational improvements.

Background

Identifying growth opportunities and areas for workflow improvement is essential for an imaging department to stay competitive. Efficient workflow orchestration is often hindered by uncertainties in patient arrivals, staff availability and variability in procedure durations. Workflow improvements are typically tackled using SixSigma and Activity-based costing methods. We present an alternative approach to address both tactical and strategic needs of an interventional radiology (IR) department using workflow optimization and discrete event simulation methods.

Evaluation

A comprehensive digital twin of patient workflow at a local hospital IR department was created based on expert interviews and 192 days' worth of EMR data. Patient arrival patterns and process times were derived from 4393 patient appointments. 196 unique procedures were modeled, each with its own process time distribution and rule-based procedure-room mapping. Dynamic staff schedules for IR radiologists, technologists, and nurses were incorporated in the model. The model was validated using deterministic approach; the last patient exit time metric used in validation differed by 9±23 minutes from empirical data, indicating model robustness. Model performance was further evaluated through a number of operational KPIs. Stochastic model simulation runs revealed CT room as the major workflow bottleneck between 9am and 12pm. Using stochastic integer programming a new staff schedule was identified stretching the existing pool of resources to support 7am-8pm operation.

Discussion

The model was reviewed with the clinical team and deemed accurate despite some inconsistencies in EMR timestamps. Discovery of the CT room as a major workflow bottleneck led IR department to arrange for CT borrowing privileges from the ER department. By optimizing staff schedules, a path to extending operations by 2.5 hours daily without requiring additional resources was identified. Furthermore, opportunities for adding extra appointments at times of lower utilization were identified.

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IN253-SD-MOA2

Clinical Value of Conventional and Enhanced MRI Texture Analysis for Preoperative Grading of Meningiomas

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Station #2

FDA Discussions may include off-label uses.

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PURPOSE

To explore the efficacy and clinical value of texture analysis of conventional and contrast-enhanced MRI image for the preoperative classification of meningiomas.

METHOD AND MATERIALS

The MR images of 130 meningioma cases were retrospectively analyzed, of whom 53 cases in WHO1, 64 cases in 2 and 13 cases in 3. Themaximum diameter of the tumor in MRI images was outlined as ROI by the Image J software. The histograms and grey-level co-occurrence matrix were used to measure the texture parameters, such as maximum value, minimum value, standard deviation, skewness, kurtosis, angular second moment, contrast, inverse different moment, entropy, correlation and so on, and compared with postoperative pathological grading results. The independent sample t test or the Mann-Whitney U test was used to compare the difference of Various parameters between low-grade and high-grade meningiomas. ROC curves for statistically significant parameters were used to confirm their efficacy in predicting the preoperative grade of meningiomas.

RESULTS

The SDs of of T2WI, FLAIR, ADC and T1CE of low-grade meningioma were lower than those in high-grade meningiomas, and the differences between the groups were statistically significant ($P< 0.05$).The skewness values of ADC sequence, T1CE sequence of low-grade meningiomas were 1.148 ± 0.783, 0.400 ± 0755, and the high-grade meningiomas were 1.221 ± 0.774, 0.113 ± 0.728, the difference between the two groups was statistically significant ($P<0.05$).The entropy values of the ADC and T1CE sequences of low-grade meningioma were 5.936±0.588, 6.419±0.539, respectively, and high-grade meningioma were 6.203±0749,6.633±0.522, the difference between the two groups was statistically significant ($P<0.05$); the ASM energy values of ADC and T1CE sequences were also statistically significant ($P<0.05$).The area under the curve (AUC)of EntADC, SkeADC, EntT1CE, and SkeT1CE were 0.731, 0.712, 0.694, and 0.670, respectively.Combined with EntADC, SkeADC and EntT1CE, the graded efficacy of meningiomas was significantly improved, with an AUC of 0.778.

CONCLUSION

Texture analysis can provide more quantification information, which can be more accurately distinguishing high grade meningiomas and low grade meningiomas before surgery.

CLINICAL RELEVANCE/APPLICATION

Heterogeneity and irregular shape are potential predictors for high-grade meningiomas, texture analysis can objectively evaluate the two features, could aid in meningioma grading.

IN271-SD-MOA4

Holographic Light Field Displays for 3D Viewing

Monday, Dec. 2 12:15PM - 12:45PM Room: IN Community, Learning Center Station #4

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CONCLUSION

Lightfield displays, such as the Looking Glass Hologram, will enable new opportunities to improve 3D visualization for multiple applications in radiology, interventional radiology and surgery.

Background

The field of radiology has utilized 3D volumetric imaging since the invention of CT and MRI in 1970s and 80s. However, despite the significant advances in 3D imaging and rendering, the interpretation of radiology remains onnly on 2D capable displays. Virtual reality headsets may simulate 3D viewing, but are fundamentally 2D. Improvements in 3D rendering and 3D printing have pointed to the limitations of 2D viewing for complex 3D objects. Recently, a new type of display, termed a light field display, has been invented allowing the direct visualization of 3D objects in a PC compatible display. We sought to evaluate the display device for application in viewing 3D data segmented from DICOM data.

Evaluation

We evaluated the Looking Glass Hologram (Looking Glass Factory, Brooklyn NY) lightfield display system for volumetric data sets segmented from clinical DICOM data. A range of training levels (medical student, resident, fellow and attending) and subspecialists (radiology, radiology subspecialists, surgery and neurosurgery) evaluated the display in their specific domains. Reviewers manipulated the data through either mouse based or Leap Motion controllers. All evaluators were able to manipulate the 3D objects within the viewer without difficulty. Up to four viewers could readily view the same object on the display. Live 3D video was interpreted without difficulty. The small, compact display enabled desktop 3D viewing without the need for dedicated headsets or goggles, enabling enhanced interaction between participants.

Discussion

Lightfield displays will enable the viewing 3D objects without the need for goggles or glasses. The technology will potentially enhance teaching of complex anatomy, improved surgical planning and patient teaching without the need for heads up devices that limit the interactions between participants. Improved segmentation and rendering techniques are necessary for improved visualization. Future potential applications include medical and surgical simulations.

MI112-ED-MOA3

Superparamagnetic Iron Oxide Nanoparticles: Applications and Developments in Diagnostics and Therapy

Monday, Dec. 2 12:15PM - 12:45PM Room: MI Community, Learning Center Station #3

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TEACHING POINTS

• SPIO can be used for diagnosis in MRI • Monodisperse SPIO improve physicochemistry and pharmacodynamics • SPIO in targeted probes can be used in in vitro diagnostic imaging (µNMR) • The potential of SPIO in magnetic particle imaging (MPI) must be evaluated.

TABLE OF CONTENTS/OUTLINE

Superparamagnetic iron oxide nanoparticles (SPIO) can be used to image tumors and metastases in the liver, spleen and bone marrow, lymph nodes and the CNS, MRA and perfusion imaging. Experimental approaches describe SPIO accumulationin inflammation, tumors and macrophages, atherosclerotic lesions and of SPIO ligands in tumor endothelia and tumor cells, areas of apoptosis, infarction, inflammation and degeneration in cardiovascular and neurological diseases. Labeling of stem or immune cells allows the visualization of cell therapies or transplant rejections. SPIO coupling to ligands, radio- and/or chemotherapeutics, embedding in carrier systems or activatable smart sensor probes enable molecular tumor therapies or the imaging of metabolic and enzymatic processes. Monodisperse SPIO will improve SPIO-based MRI in the future and targeted probes in DMR using chip-based µNMR may expand the spectrum of in vitro analysis. Magnetic particle imaging (MPI) as a new imaging modality offers new applications for SPIO in cardiovascular and interventional diagnostics and therapy.

MI204-SD-MOA1

Comparison of Metabolic Changes in the Liver with Hepatitis B Virus Infection and Fibrotic Change Using in Vivo Hyperpolarized 13C MR Spectroscopy: A Preliminary Study

Monday, Dec. 2 12:15PM - 12:45PM Room: MI Community, Learning Center Station #1

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PURPOSE

The purpose of this study was to compare the cellular metabolic changes in the liver with HBV infection and fibrotic change using in vivo hyperpolarized 13C MR spectroscopy (MRS).

METHOD AND MATERIALS

Animal models with HBV infection (n = 2) without fibrotic change and advanced hepatic fibrosis (n = 2) were induced in the mice by HBV and thioacetamide (TAA) injection, respectively. Also, normal controls (n = 2) were injected with PBS (7.4 pH) simultaneously by the intraperitoneal route. HyperSense DNP polarizer was used to hyperpolarize [1-13C] pyruvate (Pyr), and the real time 13C MRS was performed on the mouse liver following an injection of hyperpolarized [1-13C] Pyr.

RESULTS

A real time in vivo hyperpolarized 13C dynamic MRS demonstrated differential patterns of metabolic changes in the liver with HBV infection and fibrotic change, compared with normal liver. The ratios of [1-13C] lactate (Lac)/Pyr and [1-13C] alanine (Ala)/Pyr were significantly higher in hepatic fibrosis group than in normal and HBV groups ($P < 0.001$). Also, [1-13C] Lac/Pyr and [1-13C] Ala/Pyr in HBV group were significantly higher than in normal group ($P < 0.001$).

CONCLUSION

It is assumed that significant increases of [1-13C] Lac and [1-13C] Ala would be closely related to the progression of hepatic fibrosis. Further, the levels of [1-13C] Lac and [1-13C] Ala could be potentially considered as important biomarkers for the early diagnosis of hepatic fibrosis in patients with HBV infection.

CLINICAL RELEVANCE/APPLICATION

In vivo 13C-MRS might be potentially useful for noninvasive diagnosis and monitoring of patients with HBV infection regarding the progression to hepatic fibrotic change.

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MI205-SD-MOA2

Effect of Tract Ablation to Reduce Viable Tumor Cell Adhering in the Electrode After Radiofrequency Ablation for Tumor

Monday, Dec. 2 12:15PM - 12:45PM Room: MI Community, Learning Center Station #2

Participants
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PURPOSE

Radiofrequency ablation (RFA) is curative treatment methods for hepatic tumor, but tumor implantation at the needle tract is well-known complication. We aimed to evaluate the effect of tract ablation to minimize the number of viable tumor cell exposed in the needle after RFA using animal tumor model and live cell counting method.

METHOD AND MATERIALS

Hep3B-Luc cells were engrafted into Balb/c-nude mice. The mice whose tumor reached 10 mm in long diameter were selected and randomly assigned for three groups: Needle only (needle placement without RFA, n=10), RFA only (needle placement with RFA, n=11), RFA-TA (needle placement with RFA and tract ablation, n=10) groups. An internally cooled, 17-gauge RFA needle with a 10-mm active tip was used. Tumor RFA was performed for 1 minute at the 5 watt using pump cooling mode. Tract ablation was performed using 5 watt using non-cooling mode until the temperature reached 80-100 ?. The viability and viable cell numbers of adherent tumor cells at the RFA needle were evaluated by using the IVIS spectrum and live cell counting method with acridine orange/propidium iodide stain.

RESULTS

The BLI signals significantly differed between groups (needle only group, 8.2 M ± 7.0; RFA only group, 13.3 M ± 15.7; RFA-TA group, 3.9M ± 3.5, p=0.007). Host-hoc study revealed the difference occurred between RFA only group and RFA-TA group (p=0.049). The counted viable cell numbers also significantly differed between groups (needle only group, 20.8 ± 23.7; RFA only group, 305.9 ± 344.1; RFA-TA group, 3.0 ± 2.7, p=0.003). Host-hoc study revealed the difference occurred between RFA only group and RFA-TA group (p=0.002) and between RFA only group and needle only group (p=0.004).

CONCLUSION

Tract ablation greatly reduced the adherent viable tumor cells at the needle after performing RFA.

CLINICAL RELEVANCE/APPLICATION

We provided direct evidence that tract ablation greatly reduce the risk of tract seeding after RFA. We propose to incorporate tract ablation as a routine procedure in all liver tumor RFA.

MK302-ED-MOA8

Ultrasound-Guided Therapeutic Interventions for Pelvic Neuropathy

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #8

Participants
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TEACHING POINTS

Pelvic neuropathy can be attributed to a range of etiologies including nerve compression, recurrent microtrauma, iatrogenic injury and entrapment. Ultrasound-guided percutaneous injections techniques will be described with respect to the sciatic, pudendal, lateral femoral cutaneous, obturator, ilioinguinal and iliohypogastric nerves. For patients with recurrent pain following an initial therapeutic injection, neurolysis using ablation techniques can be a useful secondary therapeutic options.

TABLE OF CONTENTS/OUTLINE

Patients with neurogenic pelvic pain may present with varying complaints depending on the nerve involved including neuropathic pain, paresthesias, and other symptoms such as dyspareunia. Many of these pelvic pain syndromes are amenable to percutaneous ultrasound (US) guided treatment. Locally delivered anesthetic and anti-inflammatory drugs have been shown to aid in diagnosis and therapy. Neurolysis using cryotherapy or alcohol ablation are useful secondary therapeutic options. Utilizing US guidance has multiple advantages including safe real-time needle localization, avoidance of ionizing radiation, and reduced cost. An overview of technical approaches to various percutaneous US-guided pelvic nerve interventions with associated correlative pathological US and MRI findings is presented.

MK303-ED-MOA9

Bursa, Bursa, Bursa: Interventional Tactics and Tips for Radiologists

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #9

Participants
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TEACHING POINTS

There are numerous bursae throughout the human body which can become clinically symptomatic. Knowledge of the location of these bursae and their surrounding anatomy is important for both diagnostic and interventional purposes. Familiarity with several commonly symptomatic bursae within the human body enables radiologists to aspirate or inject these spaces with ease.

TABLE OF CONTENTS/OUTLINE

The purpose of this educational exhibit is to spotlight several potentially symptomatic bursae in the human body with a focus on their anatomy, imaging appearance and interventional treatment options available. • Review the general structure and function of bursae in the human body. • Highlight several commonly symptomatic bursae in the human body including the: olecranon bursa, subacromial-subdeltoid bursa, iliopsoas bursa, greater trochanteric bursa and ischiogluteal bursa. • For each described bursa, we will provide typical indications for intervention as well as tactics and tips for interventions. • Modalities featured for interventions will include ultrasound and fluoroscopy. There are many bursae in the human body which can become symptomatic. With knowledge of these various bursae and their percutaneous therapeutic options, radiologists readily can offer meaningful interventions to referring physicians and their patients.

MK304-ED-MOA10

Diffusion Tensor Imaging Application as a Prognostic Biomarker in Carpal Tunnel Syndrome after Decompression Surgery

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #10

Participants
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TEACHING POINTS

This presentation aims to discuss: 1 - How diffusion tensor imaging parameters, especially FA, may have a prognostic value to the carpal tunnel syndrome after decompressive surgery. 2 - Visual assessment of the path and location of the median nerve fibers for surgical purposes 3 - Correlation between FA, ADC and clinical evaluation can lead to a more accurate prognosis.

TABLE OF CONTENTS/OUTLINE

1. Overview od DTI application in carpal tunnel syndrome pre-operative investigation and surgical planning 2. Case reports evidencing the importance of pre- and post-surgical assessment of median nerve using DTI 3. Surgical outcomes of DTI in carpal tunnel syndrome

MK305-ED-MOA11

Don't Forget the Patella: CT and MRI Imaging Spectrum of Patellar Injuries

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #11

FDA Discussions may include off-label uses.

Awards
Certificate of Merit

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TEACHING POINTS

• There is a wide range of patellar injuries and the radiologist must be aware of them, because a misdiagnosed can ends with femoro-patellar instability.• Computed tomography imaging substantially aid in the identification of patellar injuries on a qualitative and quantitative way. • Familiarity with imaging abnormalities and patterns of involvement in different patellar injuries allows the radiologist to suggest the correct diagnosis and impact management.

TABLE OF CONTENTS/OUTLINE

1. Discuss the clinical relevance of detection and characterization of the patellar injury. 2. Recognize the CT as a tool of particular value when imaging patellar anomalies. 3. To evaluate the imaging findings in normal and abnormal patella.4. Illustrate classic examples of the different patellar imaging variations

MK306-ED-MOA12

Fascia Disorders Around the Body

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #12

Awards
Certificate of Merit

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TEACHING POINTS

The purpose of this study is to discuss the 5 main causes of fascia abnormalities, showing the imaging findings of these alterations in the different fascia of the body, and its differential diagnoses.

TABLE OF CONTENTS/OUTLINE

REVIEW OF DISEASES RELATED TO FASCIA DIVIDED IN THE 5 MAIN CAUSES: - OVERUSE / ATRICTION: iliotibial band syndrome, plantar fasciitis and complications such as rupture and Baxter neuropathy; - IATROGENIC AND NON-IATROGENIC TRAUMA: acute trauma of the plantar fascia, fascia lata and deltotrapezial fascia and iatrogenic trauma due to surgery and drug infiltration; - SUPERFIAL AND DEEP FIBROMATOSIS: Plantar fibromatosis or Ledderhose disease; Dupuytren contracture or palmar fibromatosis; Desmoid-type fibromatoses; - INFECTIOUS: Necrotizing fasciitis and tuberculous fasciitis; - MISCELLANEOUS: Nodular fasciitis, eosinophilic fasciitis, calcific deposits.

MK355-SD-MOA1

MRI Texture Analysis of Synovial Fluid as a Predictive Biomarker for Synovitis and OA Severity

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #1

Participants
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PURPOSE

It is well known clinically and by imaging that increased synovial joint fluid correlates with severity of osteoarthritis (OA). In recent years, image texture analysis has been used to evaluate various internal structures with a focus on neoplasms. Since synovial fluid chemical analysis can predict OA complexity, we sought to evaluate whether joint fluid texture on MR can be used as a biomarker for synovitis and OA severity.

METHOD AND MATERIALS

Fifty one adult patients (mean age: 57 years; 29 female, 22 male) with knee radiographs and fluid weighted knee MRI taken within 90 days of each other were retrospectively identified with exclusion criteria including acute trauma. Blinded scoring of knee OA severity was performed by a fellowship trained MSK Radiologist following the Kellgren-Lawrence classification guidelines. Through a semi-automated segmentation algorithm and 3D fluid texture analysis utilizing Life Image Feature Extraction software, a total of 45 texture features were analyzed for predictive value. Using receiver operating curve (ROC) and area under curve (AUC) analysis, we categorized patients with KL scores 0-1 into a none-minimal disease group and KL scores 2-4 into a moderate-severe disease group. Statistical analysis was performed through R version 3.4.4.

RESULTS

Our test group was composed of 5, 11, 18, 16, and 1 patients with KL grades 0, 1, 2, 3, and 4, respectively. The features most highly correlated with OA severity include synovial fluid compacity ($p = 0.01$) and volume ($p = 0.04$). The compacity and volume of synovial fluid had AUC values of 0.74 and 0.70, respectively. Other features that demonstrated significant correlation include grey level co-occurrence matrices which measure textures from voxel pair arrangements ($p = 0.05$-0.11, AUC = 0.67-0.69).

CONCLUSION

For the first time, texture analysis has been applied to synovial fluid and appears to be a biomarker for synovitis and OA severity.

CLINICAL RELEVANCE/APPLICATION

Patients clinically diagnosed with osteoarthritis may benefit from computational joint fluid texture analysis to determine disease severity and progression, management, response to treatment/therapy, and to assist in surgical planning.

MK356-SD-MOA2

Talar Osteochondral Lesion of the Ankle: A Meta-Analysis of Diagnostic Performance of Magnetic Resonance Imaging

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #2

Participants
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PURPOSE

Osteochondral lesions of the talus (OLT) is defined as a separation of a fragment of articular cartilage which could be accompanied by the underlying subchondral bone. Previous studies have reported that magnetic resonance imaging (MRI) could offer comprehensive evaluation of the intra-articular lesions of the ankle. However, the overall evidence regarding the performance of MRI in diagnosing OLTs remains to be determined. Thus, in this study, we intend to investigate diagnostic performance of MRI in diagnosing OLTs, using arthroscopy or surgery as the standard of reference

METHOD AND MATERIALS

A comprehensive literature search (until March 2019) was performed and original research studies reporting diagnostic performance of MRI and magnetic resonance arthrography (MRA) in the detection of OLTs were included. Pooled values of sensitivity and specificity were calculated using fixed or random effect models based on the level of heterogeneity

RESULTS

Out of 887 identified records, 9 studies (424 MRI examinations) were included. None of the studies reported the diagnostic performance of MRA or 3T MRI. One study was performed with 1 T scanner and the rest were performed by 1.5 T scanner. Pooled values of sensitivity, specificity and diagnostic odds ratio (DOR) were 74.9% (95% confidence interval (CI): 57.8%-86.7%), 94.9% (95% CI: 57.3%-99.6%) and 56.0 (95% CI: 3.58-875.9), respectively. Pooled estimates of positive and negative likelihood ratios were 14,7 (1.2-181.6) and 0.26 (0.14-0.48), respectively. High degree of heterogeneity was observed for sensitivity (I2 =88%) and specificity (I2 =88%)

CONCLUSION

MRI has high level of specificity in detecting abnormality in a normal cartilage, however this modality doesn't have high sensitivity to rule out osteochondral lesions of talus. Given the paucity of current literatures, future investigation of the diagnostic performance for other advanced imaging modalities such as MRA and 3 T MRI for OLT diagnosis are warranted in future studies

CLINICAL RELEVANCE/APPLICATION

MRI exams performed with 1.5 T or lower scanners are limited in providing data for correct diagnosis of OLTs, thus, the decision to perform surgery should not be solely based on MRI findings

MK357-SD-MOA3

CT-Guided Core Needle Bone Biopsy in the Workup of Non-Spinal Osteomyelitis: Is it Necessary for Diagnosis and Treatment?

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #3

Participants
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PURPOSE

To examine the diagnostic yield of bone biopsy in the setting of potential non-vertebral osteomyelitis and its role in management.

METHOD AND MATERIALS

A retrospective review of thirty-five bone biopsies performed by a single institution for suspected osteomyelitis. Data collected and analyzed from these cases included biopsy location, wound culture, bone culture and pathology results, preoperative MRI and antibiotic therapy prior to and after culture results. Culture results were presented as negative or positive, which was used as the primary outcome for diagnostic yield. Nine of the thirty-five cases were excluded from analysis due to incomplete culture results or unknown use of antibiotic therapy. A total of twenty-six cases were included in the final analysis.

RESULTS

Of the twenty-six cases reviewed, 30.8% were diagnostic of an organism on culture. Of the eight positive cases, six had a change in antibiotic therapy based on the bone culture results. Of the eight cases with positive bone culture results, six had identical wound culture results. MRI positive findings for osteomyelitis showed a statistically significant association with antibiotic therapy ($p = 0.0004$) versus no significance seen with culture positive results ($p = 0.428$).

CONCLUSION

From our study, image-guided biopsy is a relatively low-yield procedure. In most cases, bone biopsy plays a minor role in management decisions as approximately 70% of biopsies were negative with no change in treatment. Based on our review, MRI and wound culture is possibly adequate to diagnose osteomyelitis with little value added when biopsy was performed. This is supported by other recent radiology literature and counters the clinical literature; which strongly suggests bone biopsy for diagnosis.

CLINICAL RELEVANCE/APPLICATION

Our research suggests there is a discord between radiology and clinical literature concerning the expected yield of bone biopsy and culture, as well as the importance of a biopsy in clinical decision making. This could be an avenue for the creation of general consensus guidlines between musculoskeletal radiology and clinical specialty societies in cases of suspected non-vertebral osteomyelitis cases.

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MK379-SD-MOA4

The MOCART 2.0 (Magnetic Resonance Imaging of Cartilage Repair Tissue): Knee Score and Atlas

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #4

Participants
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PURPOSE

Since the first introduction of the MOCART score, a widely used semi-quantitative scoring system for the morphological assessment of cartilage repair tissue, significant progress has been made with regard to both surgical treatment options as well as magnetic resonance imaging (MRI) of such defects. Thus, the aim of this study was to introduce the MOCART 2.0 knee score - an incremental update on the original MOCART score - that incorporates this progression.

METHOD AND MATERIALS

The degree of defect filling is now assessed in 25% increments. Severity of surface damage is determined in reference to cartilage repair length rather than depth. The signal intensity of the repair tissue is scored as minor abnormal or severely abnormal on a proton density-weighted TSE sequence only and differentiates between hyperintense and hypointense signal alterations. The assessment of the variables 'subchondral lamina', 'adhesions' and 'effusion' was removed and replaced by the newly introduced variable 'bony defect or bony overgrowth'. Four independent readers (two expert readers and two radiology residents with limited experience) assessed the 3 Tesla MRI examinations of 24 patients after cartilage repair using the new MOCART 2.0 knee score. Inter-rater and intra-rater reliability was assessed using intraclass correlation coefficients (ICCs).

RESULTS

The overall intra-rater (ICC = 0.88, $p < 0.001$) as well as the inter-rater (ICC = 0.84, $p < 0.001$) reliability of the expert readers was almost perfect. Based on the evaluation sheet of the MOCART 2.0 knee score, the overall inter-rater reliability of the inexperienced readers compared to expert reader 1 was moderate (ICC = 0.45, $p < 0.01$). With the additional use of the atlas, the overall inter-rater reliability of the inexperienced readers was substantial (ICC = 0.63, $p < 0.001$).

CONCLUSION

The MOCART 2.0 knee score was updated to account for important changes in the past decade and demonstrates almost-perfect inter- and intra-rater reliability in expert readers. In inexperienced readers use of the atlas may improve inter-rater reliability.

CLINICAL RELEVANCE/APPLICATION

The new semi-quantitative MOCART 2.0 score may provide standardized morphological assessment in multi-center cartilage repair surgery trials and will improve structured reporting of cartilage repair MR examinationsin clinical routine.

MK382-SD-MOA7

Calcaneofibular Ligament Anatomy Under Different Ankle Positions

Monday, Dec. 2 12:15PM - 12:45PM Room: MK Community, Learning Center Station #7

Participants
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PURPOSE

To investigate the anatomical changes of the calcaneofibular ligament (CFL) under different ankle positions and obtain basic data to use in functional CFL assessments, injury diagnoses, and determination of treatment effects.

METHOD AND MATERIALS

We enrolled 10 healthy volunteers (10 ankles) with a mean age of 27.8 years and no history of ankle disease. We took ankle images (neutral position, maximum dorsiflexion, and maximum plantar flexion) using a 3-T MRI and 3-dimensional fast imaging employing steady-state acquisition cycled phases (3D FIESTA-C). We processed the 3D images of the CFL, peroneal muscle tendons, fibula, and calcaneus at a workstation, and measured CFL variables.

RESULTS

In all positions, the CFLs showed a gently curving course with the peroneal muscle tendons as a fulcrum. The tortuosity angle was significantly smaller in plantar flexion (30.0° ± 7.4°) than in the neutral position (41.7° ± 8.3°).

CONCLUSION

Our 3D MRI images showed that, in all positions, the CFLs were curved due to the influence of the peroneal muscle tendons. With maximum plantar flexion, the CFL tortuosity angles were small, which is probably due to CFL tension. This should be considered when diagnosing CFL injuries and evaluating treatment outcomes.

CLINICAL RELEVANCE/APPLICATION

Clarification of the normal CFL functional anatomy will aid to diagnose CFL injuries and may facilitate accurate evaluations of treatment outcomes.

MS223-ED-MOA1

Pictorial Review of Non-Gynecologic Pelvic Pain: Ultrasound First!

Monday, Dec. 2 12:15PM - 12:45PM Room: MS Community, Learning Center Station #1

Participants
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TEACHING POINTS

Ultrasound (US) is often the first imaging exam used to evaluate patients with pelvic pain, particularly in women with suspected gynecologic pathology. However, numerous non-gynecological entities can be clinically indistinguishable from gynecologic pelvic pain. Prompt recognition of these findings on US is critical as early detection can reduce the morbidity and mortality. After review of this exhibit, the learner will be able to do the following: Discuss the advantages of US in the diagnosis of non-gynecological pelvic pain Recognize sonographic findings of various non-gynecological entities that can present with acute or chronic pelvic pain Describe US techniques for optimal visualization of these entities

TABLE OF CONTENTS/OUTLINE

Introduction US technique (transducers; use of grayscale, color, power, and spectral Doppler imaging; graded compression technique, sono-palpation, imaging in different positions) Gastrointestinal: appendicitis, diverticulitis, epiploic appendagitis, inflammatory bowel disease, small bowel obstruction Genitourinary: urolithiasis (includes discussion of twinkle artifact & utility of ureteral jets) Miscellaneous: canal of Nuck cyst/hydrocele, mesenteric lymphadenitis, groin hernia, peritoneal carcinomatosis, pelvic congestion syndrome Conclusion

NM127-ED-MOA6

Emergent Findings on PET/CT

Monday, Dec. 2 12:15PM - 12:45PM Room: NM Community, Learning Center Station #6

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TEACHING POINTS

Review incidental emergent findings on clinical PET/CT (F18-FDG, Ga68-Dotatae, C11-Choline, F18-Fluciclovine [FACBC]). Illustrative imaging examples showcasing the PET and CT findings of a variety of emergent findings. Review the clinical relevance of emergent findings on PET/CT in light of the molecular basis and mechanism of action of the tracer used. Highlight the importance of carefully evaluating the cross sectional imaging on the CT obtained for attenuation correction (CTAC).

TABLE OF CONTENTS/OUTLINE

1. Present a brief overview of normal distribution and physiologic uptake of commonly used clinical PET agents (F18-FDG, Ga68-Dotatae, C11-Choline, F18-Fluciclovine PET/CT). 2. Demonstrate emergent and important incidental findings unrelated to the underlying malignancy, with case examples including acute cholecystitis, complicated appendicitis, discitis, hydronephrosis, fractures, hemorrhagic brain metastases, pneumoperitoneum, etc. 3. Highlight the importance of careful and systematic review of the cross sectional imaging on the CT obtained for attenuation correction (CTAC) in addition to the PET findings. 4. Review the importance of early communication and appropriate follow-up of emergent findings which may impact patient outcome based on ACR guidelines.

NM128-ED-MOA7

Finding the Target for Therapy by Imaging: A Comprehensive Review of the Theranostics (Re)Emerging in Nuclear Medicine

Monday, Dec. 2 12:15PM - 12:45PM Room: NM Community, Learning Center Station #7

Awards
Magna Cum Laude
Identified for RadioGraphics

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TEACHING POINTS

I. Understand the concept of theranostic, emphasizing the nuclear medicine perspective. II. Discuss the main theranostic procedures in nuclear medicine practice and the role of diagnostic imaging in selecting patients. III. Theranostic thinking is important to push imaging to a new level in nuclear medicine, since additional molecular features, prognostic and quantitative information will be required to better select appropriated treatments.

TABLE OF CONTENTS/OUTLINE

1. The rational of theranostics 2. Bringing theranostics to nuclear medicine context 3. Classical theranostic procedures in nuclear medicine a. 131I for Thyroid Differentiated Carcinoma b. 131I-mIBG for neural crest derived neoplasia c. Bone-seeking radiopharmaceuticals for bone pain palliation 4. Newer theranostic procedures in nuclear medicine a. SSTR PET/CT and PRRT: starting a new era in nuclear medicine theranostic b. PSMA-ligand radiopharmaceuticals c. Newer bone- seeking agents: new results to an old need d. Hepatic radioembolization under the theranostic point of view e. Other less frequent theranostic procedures 5. Perspectives: think each new diagnostic radiopharmaceutical as a theranostic

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NM206-SD-MOA1

Diagnostic Performance FDG PET/CT-Guided Metabolic Biopsies in Thoracic Lesions

Monday, Dec. 2 12:15PM - 12:45PM Room: NM Community, Learning Center Station #1

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PURPOSE

Conventional image-guided sampling is subjected to sampling error. In this prospective study, we aimed to establish the diagnostic values of the automated robotic arm (ARA) assisted FDG PET/CT-guided biopsies in thoracic lesions.

METHOD AND MATERIALS

From December 2014 to January 2019, patients with thoracic cavity lesions were recruited for FDG PET/CT guided biopsy. All patients underwent diagnostic PET/CT scan prior to PET/CT-guided percutaneous biopsy. The biopsies were done using a dedicated automated-robotic-arm assisted PET/CT-guided biopsy device on the same day of diagnostic PET/CT scan. The real-time tissue sample was retrieved after confirming the needle tip to the target lesion. The procedure-related complications, radiation exposure to the interventionist were also recorded. The histopathology reports were reviewed for accuracy of the procedure. For confirmation of negative results, clinical or imaging follow-up was done.

RESULTS

The study included 392 patients of thoracic lesions for PET/CT guided biopsy. Of these 310/392 (79.1%) were lung lesions, 72/392 (18.4%) mediastinal lesions and 10/392 (2.5%) pleural-based lesions. The lesions were successfully targeted 384/392 (97.9%) and yielded a pathological diagnosis. In the remaining eight patient repeat biopsy confirmed the diagnosis. Of these 236/392(60.2%) patients had prior inconclusive CT guided biopsies and PET-guided biopsy confirmed the pathological diagnosis in 230/236 (97.4%) patients. Of the 384 lesions which were targeted successfully, 310 were malignant, 70 benign and four had no disease even on follow up. The results were true positive in 378 lesions, false-positive in none, true negative in four and false-negative in eight. The procedure showed sensitivity, specificity, PPV, NPV and accuracy of 98.9%, 100%, 100%, 66.7%, and 98.9%, respectively. No immediate complications or delayed life-threatening events were observed.

CONCLUSION

PET/CT guided percutaneous biopsy of metabolically active thoracic lesions with ARA assistance accurate method for pathological diagnosis and shown a high diagnostic performance. It is highly practical and useful approach in patients with a previous inconclusive biopsy.

CLINICAL RELEVANCE/APPLICATION

FDG PET-guided biopsy has shown high diagnostic values especially in the patients with prior inconclusive CT guided biopsy to establish a conclusive pathological diagnosis and helped in further treatment planning

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NM207-SD-MOA2

The Role of FDG-PET/CT in the Staging and Restaging of Cholangiocarcinoma: Results of a 10-Year Analysis

Monday, Dec. 2 12:15PM - 12:45PM Room: NM Community, Learning Center Station #2

Participants
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PURPOSE

To evaluate the accuracy of FDG-PET/CT in the initial staging and restaging of cholangiocarcinoma (CCA), as well as its utility in response to therapy.

METHOD AND MATERIALS

Over the last decade a total of 88 patients diagnosed with CCA underwent FDG-PET/CT for either initial staging prior to surgery, for follow-up after therapy (chemotherapy, immunotherapy, or radiofrequency ablation), and for suspicion of recurrence (on clinical grounds or elevation of tumor markers).

RESULTS

In 86 of the 88 patients, FDG accumulated in the primary tumor, yielding a sensitivity of 97.7%. The SUV max ranged from 2.9 to 19.8. Intrahepatic metastases were seen in 25 patients, abdominal metastatic lymphadenopathy was seen in 33 patients, and distant metastases were seen in 48 patients. The latter group included lung, bone, splenic, adrenal, and peritoneal metastases. In 8 patients, the hypermetabolic abdominal lymph nodes were not enlarged by CT or MRI criteria. The bone metastases in 4 patients were either not seen or were outside the field of view on MRI or diagnostic CT, and the splenic metastases of one patient were not well-defined on CT. For staging, follow-up PET/CT demonstrated either improvement or progression of disease.

CONCLUSION

CCA and its metastases are highly FDG avid. Therefore, FDG-PET/CT is a highly sensitive imaging modality for the detection of primary and metastatic CCA.

CLINICAL RELEVANCE/APPLICATION

FDG-PET/CT is invaluable in the staging and restaging of cholangiocarcinoma, as well as determining response to therapy, thereby impacting patient management.

Printed on: 10/29/20

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NM208-SD-MOA3

Fluorine-18 Labeled Hydroxyphenethylguanidines: Prospective PET Imaging Agents for the Detection and Localization of Adrenergic Malignancies

Monday, Dec. 2 12:15PM - 12:45PM Room: NM Community, Learning Center Station #3

Participants
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PURPOSE

While metaiodobenzylguanidine (MIBG), labeled with I-123 or I-131, is frequently used for single photon imaging of adrenergic tumors, it suffers from poor spatial resolution and sensitivity due to reversible uptake and trapping. The PET radiotracers 3-[18F]fluoro-*p*-hydroxyphenethylguanidine ([18F]3F-PHPG) and 4-[18F]fluoro-*m*-hydroxyphenethylguanidine ([18F]4F-MHPG) undergo norepinephrine transporter-mediated uptake and irreversible vesicular trapping, presenting an opportunity to address the inherent limitations of MIBG scintigraphy scans and visualize neuroendocrine tumors not amenable to detection with radiolabeled somatostatin analogues.

METHOD AND MATERIALS

Retrospective analysis was conducted in subjects previously imaged with [18F]3F-PHPG and [18F]4F-MHPG (4 whole body scans in healthy controls, 7-8 scans in heart failure patients for each tracer). For scans with one or both adrenals in the field of view, volumetric regions of interest (VOI) were drawn around the glands, with localization confirmed by corresponding CT when available. Tracer accumulation was quantified as maximum standardized uptake value (SUVmax) by PMOD (version 3.8).

RESULTS

Two adrenal glands were clearly visualized in 6/10 cases for [18F]3F-PHPG and 7/9 cases for [18F]4F-MHPG in images acquired approximately 60 minutes post-injection. SUVmax values were modest, averaging 6.44 ± 3.14 for [18F]3F-PHPG and 2.94 ± 0.78 for [18F]4F-MHPG (mean ± SD). The SUVmax ranges are comparable to those of 18F-fluorodopamine in normal control subjects (Timmers et al., 2007). In healthy control subjects, who underwent whole body imaging, background uptake in the abdominal region was lower for [18F]3F-PHPG compared to [18F]4F-MHPG. The time-activity profile of both tracers suggests specific uptake and trapping in the adrenal gland.

CONCLUSION

[18F]3F-PHPG and [18F]4F-MHPG localize in the human adrenal gland, supporting further characterization of their ability to detect malignancies characterized by overexpression of the norepinephrine transporter, including neuroendocrine tumors (e.g. pheochromocytoma, paraganglioma) and neuroblastoma.

CLINICAL RELEVANCE/APPLICATION

[18F]3F-PHPG and [18F]4F-MHPG localize in the human adrenal gland, supporting further characterization of their ability to detect malignancies characterized by overexpression of the norepinephrine transporter, including neuroendocrine tumors (e.g. pheochromocytoma, paraganglioma) and neuroblastoma.

NM230-SD-MOA5

Inflammation in Acute Aortic Intramural Hematoma: CTA and PET/CT Correlation

Monday, Dec. 2 12:15PM - 12:45PM Room: NM Community, Learning Center Station #5

Participants
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PURPOSE

CT angiography (CTA) is the first-line test in the diagnosis of acute aortic syndrome. The pathogenesis and natural history of aortic intramural hematoma (IMH) remains unclear. The presence of intimal lesions in the acute phase and a high metabolic activity in PET/CT have been described as predictors of adverse events. Our objectives are: To describe the presence of contrast enhancement in the aortic wall of acute IMH in the diagnostic CTA. To evaluate the intensity and heterogeneity of 18FDG uptake in PET/TC and its evolution during follow-up. To correlate the intensity and heterogeneity of contrast enhancement with the 18FDG uptake.

METHOD AND MATERIALS

12 patients were diagnosed with an acute type B IMH in a CTA performed for acute aortic syndrome at a median of 2.5 days from symptoms onset and were managed conservatively. A 18FDG PET/TC was performed in the subacute phase. The target to blood ratio (TBR) was defined as the relation between the SUVmax of IMH and the SUVmean of the blood pool, and regional heterogeneity as the SUVmax difference between the most and the least metabolically active aortic regions. Aortic wall enhancement was defined as the corrected HU difference between late and unenhanced CT acquisitions in the diagnostic CTA. Morphological characteristics of the IMH were also recorded (aortic diameter, IMH thickness and presence of ulcers)

RESULTS

In the diagnostic CTA, IMH thickness and aortic diameter were 10.1±5 mm and 41±7.3 mm, respectively, while 75% of patients presented ulcers. Aortic wall enhancement was 82%. SUVmax and TBR of IMH at the most active aortic region were 5.4±1.3 and 3.1±0.7. Regional heterogeneity was 31. There was no correlation between TBR and the thickness of IMH or the number of ulcers at the diagnostic CTA. TBR and aortic wall enhancement at the most active aortic region were correlated (Pearson r=0.72, p=0.008). Aortic wall enhancement was lower in the least metabolically active regions in comparison to the most active regions.

CONCLUSION

Aortic wall enhancement in the diagnostic CTA of IMH was correlated to 18FDG uptake in PET/CT and may be an inflammatory marker. Furthermore, contrast enhancement mirrored the regional variations in metabolic activity.

CLINICAL RELEVANCE/APPLICATION

Diagnostic CTA in patients with type B IMH can demostrate inflammatory activity in aortic wall and correlated to 18FDG uptake in PET/CT

NM232-SD-MOA4

18F-Fluciclovine PET/CT in Primary Staging of Prostate Cancer

Monday, Dec. 2 12:15PM - 12:45PM Room: NM Community, Learning Center Station #4

Participants
Erik M. Velez, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
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PURPOSE

18F-fluciclovine positron emission tomography (PET) has been approved for imaging evaluation of patients with biochemical recurrence of prostate cancer, yet data is limited for its potential utility in primary staging. We present our early experience with 18F-fluciclovine PET/CT for primary staging of prostate cancer.

METHOD AND MATERIALS

Patients with biopsy proven prostate cancer underwent 18F-fluciclovine PET/CT at the discretion of the urologist between 2018-2019. All studies were interpreted by a board-certified nuclear radiologist according to established criteria and the ordering clinician was made aware of the results. Findings were compared to conventional imaging and a review of the clinical notes was performed to assess changes in clinical management. Based on extent of disease, patients were categorized into local disease - confined to the prostate, regional- metastases to pelvic lymph nodes, and distant- metastases to lymph nodes outside the pelvis or other organs.

RESULTS

7 patients underwent 18F-fluciclovine PET/CT at the time of primary staging of prostate cancer. The median age was 72 (interquartile range [IQR]: 14) years and the median serum PSA level was 12.0 (IQR 29.4) ng/mL. Based on conventional imaging 3 patients (43%) had local disease, 2 patients (29%) had regional disease, and 2 patients (29%) had distant disease. 18F-fluciclovine PET/CT and conventional imaging results were discordant in 5 patients (71%), with the detection of regional disease in 2 patients thought to have only local disease and detection of distant disease in 1 patient with regional disease on conventional imaging. In addition, 1 patient with presumed distant disease (sclerotic bone lesion with increased uptake on bone scintigraphy) was downstaged to local disease after negative 18F-fluciclovine PET/CT and 1 patient was downstaged from regional disease to local disease. Discordant 18F-fluciclovine PET/CT findings resulted in change of management in all 5 patients.

CONCLUSION

18F-fluciclovine PET/CT is contributory to primary staging of prostate cancer, which may lead to management change. Additional investigations are needed to assess the impact of 18F-fluciclovine PET/CT in primary staging of prostate cancer.

CLINICAL RELEVANCE/APPLICATION

18F-fluciclovine PET/CT may offer a more accurate means of staging prostate cancer compared to conventional imaging, ensuring patients receive appropriate upfront therapy.

NR335-ED-MOA10

A Genetic Mutation By Any Other Name (Is Still a Genetic Mutation): An Update on Molecular Diagnostics and Neurologic Disease

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #10

Participants
Christopher Heald, MD, Winston-Salem, NC (*Presenter*) Nothing to Disclose
Michael E. Zapadka, DO, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Sachs, MD, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Goals: 1) Review foundational knowledge of chromosomes, inheritance patterns, gene functions, and mutagenesis to facilitate an improved understanding of genetic mutations relating to neurologic disease (pathogenic variants). 2) Provide a brief history of scientific advances in genetics and molecular diagnostic technology underlying our current understanding of pathogenic variants and neurologic disease. 3) Provide concrete examples of and detailed information about neurologic diseases -- many of which have historically been referred to by potentially confusing eponyms and acronyms -- caused by (and possibly better referred to as) pathogenic variants. 4) Highlight specific clinical and imaging features relevant to the radiologist.

TABLE OF CONTENTS/OUTLINE

1. Background a. Foundational knowledge b. Relevant history 2. Illustrative examples of pathogenic variant-neurologic disease pairs including genetic, clinical, and imaging information as well as annotated figures a. ABCD1 b. ASPA c. ATM d. ATP7B e. EIF2B f. EML1 g. GALC h. GCDH i. GFAP j. GLI3 k. GNAQ l. HTT m. LRPPRC n. MLC1 o. NF1 p. NF2 q. NOTCH3 r. PANK2 s. PLP1 t. PRNP u. PTEN v. SUOX w. TSC2 x. VHL 3. Summary and Conclusions

NR336-ED-MOA11

Congenital Spinal Anomalies: What the Neurosurgeon Wants to Know

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #11

Participants
Jonathan E. Jo, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Traditional classification system for congenital spinal anomalies is complex. The majority of congenital spinal anomalies can be categorized and identified with a simplified approach based on assessment of the skin, fat, and spinal cord. There are several important features of congenital spinal anomalies that inform surgical management.

TABLE OF CONTENTS/OUTLINE

1. Traditional classification system for congenital spinal anomalies 2. Simplified approach: three questions to diagnose the majority of congenital spinal anomalies a. Skin: open or closed dysraphism b. Fat: presence of fat and location c. Cord: conus position, hemicord, cyst or syrinx 3. What the neurosurgeon wants to know: a. Segmental level of spinal dysraphism informs which nerve roots will be involved b. FIESTA/CISS imaging to assess degree of involvement of cauda equina nerve roots c. Dermal sinus tract/dermoid d. Extent of vertebral body segmentation abnormality and involvement of the retroperitoneum or mediastinum

NR337-ED-MOA12

Gadolinium Deposition in Brain: An Updated Review

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #12

Participants
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TEACHING POINTS

•Describe different classes of gadolinium based contrast agents (GBCA) used for MR imaging and their salient biochemical characteristics. •Review literature discussing gadolinium deposition in brain. •Learn histological, clinical and commercial impact of gadolinium deposition.

TABLE OF CONTENTS/OUTLINE

1. Review different classes of GBCA and their biochemical characteristics. These classes include: nonionic linear, ionic linear, nonionic and ionic macrocyclic agents 2. History of gadolinium deposition research: when was it first discovered? 3. Methods used to demonstrate deposition of gadolinium in brain: •Imaging studies: dentate nucleus and globus pallidus signal intensity compared to pons or middle cerebellar peduncle. •Autopsy studies establishing presence of gadolinium in the brain tissue 4. Difference in gadolinium deposition based on the characteristics of contrast agent used. 5. Histological and clinical impact of gadolinium deposition. 6. Regulatory changes regarding gadolinium use: FDA vs European Medicines Agency 7. Avenues for further research: •Long term follow up to determine functional effects of gadolinium deposition. •Host factors affecting gadolinium deposition in brain, including the healthy vs diseased brain and renal function. 8. Summary of all relevant clinical information.

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NR370-SD-MOA1

Deep-Learning Reconstruction Improves Quality of Clinical Brain and Spine MR Imaging

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #1

Participants
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PURPOSE

Conventional MR image quality can be limited by signal-to-noise ratio (SNR) and artifact. K-space apodization trades off spatial resolution to avoid truncation (ringing) artifacts. Deep learning-based reconstruction methods promise to improve images by reducing noise and eliminating certain artifacts. We evaluated the performance of a new DL Recon method without k-space apodization on brain and spine exams, focusing on perceived SNR, CNR, resolution and elimination of ringing artifacts.

METHOD AND MATERIALS

The investigational DL Recon leverages a deep convolutional residual encoder network trained on a >10K image database to create images with enhanced SNR and spatial resolution. 28 patients were scanned using clinical brain (3T-7, 1.5T-4) or spine (3T-12, 1.5T-5) protocols at 1.5T or 3T. K-space data was reconstructed with both conventional and DL Recon (tuned to 75% noise reduction). Two neuro-radiologists independently rated 93 pairs of conventional and DL images side by side. Ratings were based on overall IQ, lesion conspicuity, perceived SNR and resolution, CNR, image texture and artifact using a 5-point Likert scale (5=Excellent, 1=Non-diagnostic). Wilcoxon signed-rank test was used to compare the ratings and inter-rater reliability between readers was assessed using Bennett S Score.

RESULTS

DL showed statistically significant improvement over conventional images in overall image quality (4.74±0.49 vs 3.27±0.70, $p<0.05$), lesion conspicuity (4.65±0.49 vs 3.24±0.52, $p<0.05$), contrast (4.59±0.61 vs 3.50±0.59, $p<0.05$) perceived resolution (4.66±0.61 vs 3.36±0.59, $p<0.05$), perceived SNR (4.72±0.60 vs 3.33±0.53, $p<0.05$), image texture (4.66±0.60 vs 3.13±0.38, $p<0.05$). Ringing artifacts were equivalent between DL and conventional recon using equivalency margin of 0.5 and two-sided confidence interval of 95%. There was substantial inter-rater agreement with an average S score of 0.66.

CONCLUSION

DL provided superior overall IQ with higher perceived SNR and CNR compared to the conventional method. DL produced higher perceived spatial resolution and reduced truncation artifact as well as k-space apodization did. Future work will assess whether this technique can accelerate acquisitions while preserving quality.

CLINICAL RELEVANCE/APPLICATION

Deep learning based reconstructions can provide superior MR image quality than conventional reconstruction methods.

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NR371-SD-MOA2

Contrast-Enhanced Black-Blood MRI Sequence is Superior to T1 Spin Echo Sequence in Automated Detection of Contrast-Enhanced Brain Lesions by Convolutional Neural Networks

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #2

Participants
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PURPOSE

Detection of contrast enhanced (CE) brain lesions (BL) may be a particular challenge due to small lesions in the size of brain vessel diameters. MRI black blood (BB) sequences suppress background contrast, thus facilitating detection of CE lesions for human readers. Deep learning (DL) bears the potential to detect BL comparable to human experts. Thus, we compared the performance of convolutional neural networks (CNN) for the detection of BL on BB and T1 spin echo (SE) MR images.

METHOD AND MATERIALS

We retrospectively analyzed a subgroup of 184 patients receiving CE BB and T1 SE for BL analysis. A pretrained CNN (Inception V3, Google, Mountain View, CA, USA) was retrained with a customized monolayer classifier using either T1 (n=12, 24) or BB (n=13, 22) scans of BL and physiological brain scans without any annotation (e.g. bounding boxes). For every patient presenting BL, we added every 2D MRI axial slide depicting the lesions to the input and discarded the remaining slices. Each lesion that was included had an identical BL and T1 image available. For the control group, complete slide sets of healthy patients were included (total number of included slide images: n=34, 475 for T1 and n=83, 2430 for BB) to ensure that every potential layer with a lesion has a corresponding one without lesion available for DL.

RESULTS

CE T1 SE-based training resulted in a validation accuracy of 80%, whereas BB image retraining showed a validation accuracy of 99% ($p<0.01$). Within the first 250 training steps, there was no significant difference in validation accuracy between BB and T1 SE based models. The first significant differences between the models could be determined at more than 290 training steps ($p<0.05$). Beyond, up to 1000 training steps, CNN performance improved significantly on BB sequences ($p<0.05$), but not for T1 SE sequences.

CONCLUSION

Performance of automated AI based analysis of BL is significantly effected by the input data. This study shows that BB MRI imaging is a highly effective input for CNNs for dection of BL as compared to standard CE T1 SE MRI imaging. The objective performance of our CNN on BB sequences suggests BB for radiological analysis of BL.

CLINICAL RELEVANCE/APPLICATION

This work shows the superiority of the BB sequence over conventional sequences in the context of automated small lesion detection using CNN on contrast enhanced MRI data which suggests that BB can be recommended for automated brain lesion detection.

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NR372-SD-MOA3

How to Process High-Resolution Steady-State Cerebral Blood Volume Maps Using Ferumoxytol, an Off-Label MR Contrast Agent?

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Ferumoxytol, an iron oxide nanoparticle can be used off label as an MRI contrast agent. Due to its long blood pool phase, it can visualize the intravascular space. In the brain, high resolution steady state cerebral blood volume mapping (SS-CBV) is feasible by calculating the changes in transverse relaxation rates (ΔR2*), that is assumed to be proportional with contrast agent concentration. ΔR2* maps may be processed from multiecho T2*-weighted acquisition using two methods; 1) Calculating the R2* maps by curve fitting of multiple echos, and subtraction of pre and post contrast R2* maps (R2*post-R2*pre), or 2) echo averaging and applying the formula of (Ln(SIpre)-Ln(SIpost))/TR, where SI denotes the signal intensities and TR the repetition time. The latter method provides visually superior CBV maps. In this study we tested our hypothesis that ΔR2* values are comparable between these two techniques.

METHOD AND MATERIALS

Brain MRIs of 22 subjects with various cerebral pathologies, enrolled in a currently recruiting clinical trial (NCT03270059) were analyzed. T2*-weighted multiecho fast field echo (mFFE) images were acquired before and after 4mg/kg ferumoxytol for the purpose of SS-CBV mapping. Signal intensities of co-registered mFFE images were recorded in the regions of CSF, normal appearing thalamus, white matter, and enhancing lesion before and after ferumoxytol. ΔR2* was calculated and compared in various regions between the two methods using paired T-test.

RESULTS

No significant difference was found between the two processing methods in ΔR2* values within the CSF, white matter, thalamus or enhancing lesion (p=0.75, p=0.28, p=0.59, p=0.63 respectively).

CONCLUSION

Multi-echo T2* weighted images can be processed using curve fitting, or echo averaging methods and both techniques result in similar ΔR2* values.

CLINICAL RELEVANCE/APPLICATION

This presentation discusses methods to process high resolution steady state CBV maps, that could be incorporated in clinical MR image processing applications.

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NR394-SD-MOA4

Problems in Imaging of Thoracolumbar Spine Fractures

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #4

Participants
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PURPOSE

The categorization of thoracic and lumbar spine fractures is a subject of ongoing debate. Many classification schemes have been proposed. The two most commonly used today are the Denis and the TLICS. Both describe the vertebral body fracture in the same way, but Denis emphasizes the middle column of the spine, while TLICS emphasizes the posterior ligamentous complex (PLC) and neurologic status. The value of any classification system is its ability to direct treatment and predict outcomes. The purpose of this study was to compare Denis and TLICS and ascertain the impact of classification on fracture treatment.

METHOD AND MATERIALS

Review of radiology records identified 64 patients (67 separate injury levels) who underwent MRI for acute spinal trauma at a single institution between January 2014 and December 2017. The initial and follow-up imaging studies were reviewed by two radiologists by consensus. Fractures were categorized by level, number of vertebrae, mechanism of injury, neurologic status, TLICS and Denis classification, and treatment. The vertebral body morphology, status of ligaments, neurologic status, and alignment on initial MRI and follow-up imaging were recorded.

RESULTS

TLICS grade did not predict treatment or likelihood of development of deformity. Likelihood of development of deformity did correlate to Denis grade. We found that kyphosis at the injured level worsened more than 10 degrees in 26 injuries; 7 were TLICS 1-3, 6 were TILCS 4, 13 were TLICS 5, 1 was TLICS indeterminate, 1 was Denis 1, 12 were Denis 2, and 14 were Denis 3. There was poor correlation between Denis and TLICS systems. TLICS grade was often difficult to determine, and there was significant interobserver variability between original and retrospective radiology interpretations.

CONCLUSION

TLICS is of limited utility in evaluation of thoracolumbar spine injuries. There was some correlation between Denis grade and development of deformity.

CLINICAL RELEVANCE/APPLICATION

Radiologists should be aware of the limitations of current classification systems in predicting patient outcomes.

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NR395-SD-MOA5

Prospective Motion Correction Brain MRI Using an External Tracking System

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Head motion can be a major problem in particular in acquiring high-resolution 3D MR sequences such as magnetization-prepared radio-frequency pulses and rapid gradient-echo (MPRAGE). With recent advances in combining real-time correction with new navigator and external tracking mechanisms rigid-body motion in all 6 degrees of freedom can be quantified (1). In this prospective study we aimed to assess the efficiency of a motion-tracking system in reducing motion-related artifact.

METHOD AND MATERIALS

Patients who referred for routine brain MRI studies were prospectively imaged using a 3.0T magnet (Skyra, Siemens). Imaging protocol included 3D MPRAGE (TR/TE/FA: 1890ms/3.25ms/9° acquisition time ~ 6 min), once routinely and once after turning on the motion tracking system using a motion tracking system consisting of a quad camera apparatus installed inside the MRI scanner above the isocenter (KinetiCor Inc.). The images obtained using the cameras were processed and motion data in 6 DOF (3 translation, 3 rotations) were calculated and transmitted in the form of network packets to the scanner. This data was then incorporated into the MRI sequence which updates the image acquisition in real time based on the most recent head pose data available. MPRAGE images with and without motion correction were assessed independently and by 2 board certified neuroradiologists using a 5 grade scoring scale (figure). Interobserver agreement was assessed using a weighted kappa test. Discrepancies were resolved by consensus and the difference between images quality scores with and without motion correction was tested using a Wilcoxon Rank-Sum test.

RESULTS

A total of 69 patients were included. There was a good interobserver agreement (k=0.74, 95%CI 0.64-0.83) between 2 neuroradiologists for scoring the motion artifact. Using dichotomized image quality scores, 19 routine MPRAGE scans (27%) were deemed non-diagnostic (score 3, 4) while only 10 motion-corrected MPRAGE scans (14%) were rated non-diagnostic. The overall image quality scores were higher (p=0.022) in motion corrected studies.

CONCLUSION

The described motion-tracking system can be used effectively in clinical practice reducing motion artifact and improving imagine quality of 3D MPRAGE sequence.

CLINICAL RELEVANCE/APPLICATION

Described motion correction system has the potential to improve the overall image quality and increase MRI throughput by reducing motion artifact.

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NR396-SD-MOA6

Automated Volumetric Assessment of Multiple Sclerosis Disease Burden and Activity with Artificial Neural Networks

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #6

Participants
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PURPOSE

To evaluate the potential of artificial neural networks (ANN) for automated volumetric assessment of multiple sclerosis (MS) disease burden and activity.

METHOD AND MATERIALS

We used a single-institutional dataset from 334 patients with MS at any disease stage to develop an ANN for automated segmentation of FLAIR and contrast-enhancing (CE) lesions on MRI. Independent testing of the ANN was performed in a single-institutional longitudinal dataset with 82 patients (median number of exams: 3). The performance of the ANN was evaluated by calculating f1 score, positive predictive value (PPV) and sensitivity for the detection of both FLAIR and CE lesions. The data was analyzed by using a volumetric threshold for lesion detection to maximize f1 values. Additionally, benchmarking of the ANN was performed by training and testing on the ISBI 2015 public challenge data, to independently evaluate network performance.

RESULTS

The total DICE score for the segmentation of FLAIR and CE lesions was 0.833/0.878 in the training set cross-validation and 0.846/0.908 in the test set, respectively. The concordance correlation coefficient CCC showed values above 0.95 for both the datasets. The analysis of the training set for a volumetric threshold yielded an optimal working point of 14mm3 for CE, and 7mm3 for FLAIR. The lesion detection capabilities of the ANN resulted in a mean f1 score of 0.867 and 0.879 for FLAIR lesions, and 0.636 and 0.751 for CE lesions in training and test set, respectively. The ANN yielded a sensitivity of 0.742 and a PPV of 0.743 for the detection of CE lesions in the training set cross-validation, and 0.862 and 0.889 for FLAIR lesions in the same cohort. Performance in the longitudinal test set for the same metrics was 0.850 and 0.809 for CE lesions, and 0.831 and 0.944 for FLAIR lesions. In the ISBI 2015 Challenge public dataset, benchmarking of the ANN against other available methods resulted in an overall score of 93.030, reaching the first place on the leaderboard at the time of entry in the challenge.

CONCLUSION

Our results highlight the capability of ANN for quantitative state-of-the-art assessment of lesion load on MRI and potentially enable a more accurate assessment of disease burden in patients with MS.

CLINICAL RELEVANCE/APPLICATION

ANNs can potentially simplify procedures for evaluation of disease burden and activity in patients with MS.

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NR397-SD-MOA7

Incidence of Post-Lumbar Puncture Headaches Requiring Epidural Blood Patch After Fluoroscopic Guided Lumbar Puncture

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #7

Participants
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PURPOSE

The aim of this study was to determine the incidence of post-lumbar puncture headaches severe enough to warrant an epidural blood patch following fluoroscopic guided lumbar puncture.

METHOD AND MATERIALS

Retrospective analysis was performed on 388 fluoroscopic guided lumbar punctures in adults at a tertiary care teaching hospital from 7/1/2018 to 3/31/2019. Patient inclusion criteria included age between 18 and 90 years old; male or female; and both outpatients and inpatients. All lumbar punctures were performed in the prone position utilizing fluoroscopic guidance by attending radiologists or diagnostic radiology residents under direct supervision. Lumbar punctures were performed for diagnostic, therapeutic, myelographic, and nuclear medicine purposes. Medical chart review for each patient to identify lumbar puncture related complications, specifically the need to perform an epidural blood patch, extended up to 30 days post-procedure.

RESULTS

Of the 388 fluoroscopic guided lumbar punctures performed during the study period, 10 also required an epidural blood patch in the post-procedure course. This calculates to a 2.6% incidence of post-lumbar puncture headaches that are severe enough to warrant the intervention of a blood patch.

CONCLUSION

This single center retrospective analysis shows that following fluoroscopic guided lumbar puncture performed in the prone position there is a 2.6% incidence of post-lumbar puncture headaches requiring the intervention of an epidural blood patch over a nine-month period.

CLINICAL RELEVANCE/APPLICATION

Knowing the incidence of post-lumbar puncture headaches requiring epidural blood patch after fluoroscopic guided lumbar puncture allows the radiologist to provide accurate informed consent.

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NR398-SD-MOA8

Quantifying Tissue Microstructure Non-Gaussianity in the Presence of Fiber Dispersion

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #8

Participants
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PURPOSE

Diffusion kurtosis imaging (DKI), although capable of quantifying non-Gaussian diffusion in tissue microenvironments, is affected by fiber dispersion. In this paper, we introduce a method called microscopic diffusion kurtosis imaging (μDKI) that disentangles quantification of non-Gaussian diffusion from orientation dispersion and hence allows more specific tissue characterization at the microscopic level.

METHOD AND MATERIALS

Key to our method is the observation that the spherical of the diffusion signal is independent of the fiber orientation distribution (Kaden et al., 2016). We derive the relationship between the spherical mean and the per-axon kurtosis parameters. The method is validated using the diffusion MRI data of a healthy adult, acquired using 9, 12, 17, 24, 34, and 48 non-collinear gradient directions respectively for b = 500, 1000, 1500, 2000, 2500, 3000 s/mm2.

RESULTS

DKI is significantly affected by fiber dispersion. Experiments using synthetic data show that fractional anisotropy (FA) drops from 0.7 to 0.4 when there are two crossing fibers and to almost 0 when there are three or more crossing fibers. Similarly, radial kurtosis (RK) falls from 3 to 1.5 and to less than 1. Unlike DKI, μDKI is robust to fiber dispersion, giving FA and RK values that are consistent with the ground truth of regardless of the number of crossing fibers.Applying μDKI to in-vivo data indicates that in general RK and FA are higher, and AK is lower than DKI, notably in regions with significant fiber dispersion. DKI gives a dark band in the FA and RK maps when there is fiber dispersion, giving the false impression of isotropic diffusion. μDKI, on the other hand, yields results that are more spatially consistent.

CONCLUSION

We have presented here a method for characterizing microstructural non-Gaussianity unconfounded by orientation heterogeneity. We have demonstrated that our method is more accurate and consistent than conventional DKI in the presence of fiber dispersion.

CLINICAL RELEVANCE/APPLICATION

DKI is used widely to provide more insights into stoke, tumor, Parkinson's disease, and attention-deficit hyperactivity disorder. Our analysis indicates that DKI, unlike μDKI, can be misleading in the presence of fiber dispersion.

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NR399-SD-MOA9

Normative Values of Brain MRS Metabolites in Early Childhood

Monday, Dec. 2 12:15PM - 12:45PM Room: NR Community, Learning Center Station #9

Participants
Fabricio G. Goncalves, MD, Philadelphia , PA (*Presenter*) Nothing to Disclose
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PURPOSE

MRS is a helpful MR modality in assessment of certain neurometabolic and neurodevelopmental disorders. Normal MRS spectra have been well-defined in older children and adults. However, many of these disorders present and are evaluated during early childhood. MRS spectra of children evolve during early brain maturation and the normal spectrum appears as disease based on criteria derived from older individuals. Easily accessible normal values according to the age of the child being evaluated is not widely available to radiologists interpreting these studies. The main purpose of this study is to provide a guideline for the normal MRS metabolite values across an age spectrum early in life, so deviations from normal can be more readily identifiable and prevent misinterpretation of the MR spectroscopy.

METHOD AND MATERIALS

MR spectra from 60 children ranging in age from 0 to 200 months were obtained. Patients had a normal brain MRI. Quality control measures were applied and suboptimal spectra due to various artifacts were excluded. The spectra were analyzed on a standard processing platform and quantitative analysis was also performed using LCModel software. Metabolite values across the age rage were evaluated. The major metabolities included were n-acetyl-aspartate (NAA), choline (Cho), creatine(Cr), myoinositol (mI), and lactate (L). Minor metabolities were also evaluated if the spectra were of high qualitiy. Average values and confidence intervals were calculated across the age range. Non-linear regression models for assessment of changes over time time were constructed for each metabolite.

RESULTS

Plots of change in the major metabolities across the early years of life were depicted with confidence intervals. There was a predicted increase in NAA and descrease in Cho. Very small amounts of lactate were present normally. Changes in other metabolities were also depicted. A general estimation of the changes in the metabolities could be derived.

CONCLUSION

MRS values change dramatically in the first few years of life. Knowing the normal values in the early stages of life is challenging. Having a set of normal values with an indication of the normal variation based on a young patient's age is very helpful to the interpreting physician using MR spectroscopy in selected patients.

CLINICAL RELEVANCE/APPLICATION

Normative quantitaive brain MRS metabolities is of paramount importance in the evaluation of neurodegenerative processes in children.

OB175-ED-MOA1

Adenomyosis in Pregnancy: Diagnostic Pearls and Pitfalls

Monday, Dec. 2 12:15PM - 12:45PM Room: OB Community, Learning Center Station #1

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Chelsea Pyle, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Kyle K. Jensen, MD, Portland, OR (*Presenter*) Nothing to Disclose
Bryan R. Foster, MD, Portland, OR (*Abstract Co-Author*) Consultant , BotImage Inc
Erika J. Schneble, DO, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Roya Sohaey, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Karen Y. Oh, MD, Portland, OR (*Abstract Co-Author*) Research Consultant, FUJIFILM Holdings Corporation

TEACHING POINTS

1. Adenomyosis has a varied appearance in pregnancy 2. Adenomyosis can mimic other uterine pathology, including ecoptic pregnancy 3. Accurately recognizing adenomyosis in pregnancy can affect patient management

TABLE OF CONTENTS/OUTLINE

1. Pathogenesis of adenomyosis 2. Brief imaging review of adenomyosis in the nongravid uterus - US and MRI 3. Presentation of varying appearances of adenomyosis during pregnancy - diffuse, focal, cystic 4. Discussion of adenomyosis as a mimic of fibroids, ectopic pregnancy, infiltrative 'masses,' placental abnormalities 5. Pregnancy outcomes and management in the setting of adenomyosis

OB176-ED-MOA2

7 Tips to Tell It's Twisted: Pearls and Pitfalls in the Diagnosis of Pelvic Adnexal Torsion

Monday, Dec. 2 12:15PM - 12:45PM Room: OB Community, Learning Center Station #2

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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Mindy M. Horrow, MD, Philadelphia, PA (*Abstract Co-Author*) Spouse, Employee, Merck & Co, Inc
Hailey Choi, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Dorothy J. Shum, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

By viewing this exhibit, the learner will be able to: 1. Understand the definition, epidemiology, symptoms of adnexal torsion and clinical implications for timely diagnosis and mangement. 2. Suspect torsion in the setting of acute pelvic pain (and nausea and vomiting) by appreciating several key imaging findings on US and CT 3. Indentify mimics and pitfalls of ovarian torsion, in particular, the confusing role of Doppler on US

TABLE OF CONTENTS/OUTLINE

Clinical background and statistics of adnexal torsion: (A) Definition; (B) Epidemiology; (C) Symptoms; (D) Implication for timely diagnosis and management Multimodality imaging findings of adnexal torsion: (A) Ovarian edema: enlarged size, peripheralizaton of follicles, adjacent free fluid, swollen surrounding ovarian parenchyma; (B) Target and whirlpool sign; (C) Abnormal positioning: two ovaries on one side, ovary too high, uterine tilting; (D) Assicuated lesions: physiologic, neoplasia; (E) Doppler US findings; (F) Enhancement and attenuation/signal characeristcs on CT/MR Pifalls and mimics: (A) Hemorrhagic cysts; (B) Solid ovarian neoplams; (C) Ovarian stimulaiton syndrome/Hyperreactio luteinalis; (D) Edema due ot adjacent inflammatory process Summary with case examples

PD173-ED-MOA6

Before and After: Review of Fetal MR Imaging with Postnatal Follow-Up

Monday, Dec. 2 12:15PM - 12:45PM Room: PD Community, Learning Center Station #6

Participants
Muhammad Naeem, MBBS, Saint Louis, MO (*Presenter*) Nothing to Disclose
Andrew B. Wallace, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Karen A. Caudill, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Become familiar with the common indications for magnetic resonance imaging (MRI) of the fetal body (excluding central nervous system). 2. Recognize the imagine findings of common entities diagnosed by fetal MRI. 3. Understand key fetal MRI findings that alter management during gestation, at delivery, and after birth.

TABLE OF CONTENTS/OUTLINE

I. Scanning Technique II. Imaging of Common Entities A. Neck and Upper Airway 1. Teratoma 2. Lymphatic malformation 3. Hemangioma 4. Congenital high airway obstruction syndrome 5. Facial cleft 6. Congenital goiter B. Thorax: 1. Congenital diaphragmatic hernia (CDH) 2. Congenital lobar overinflation 3. Cystic pulmonary airway malformation 4. Pulmonary sequestration 5. Foregut duplication cyst C. Abdomen and Pelvis: 1. Adrenal hemorrhage 2. Sacrococcygeal teratoma 3. Prune belly 4. Posterior urethral valves 5. Congenital Wilms tumor 6. Meconium peritonitis 7. Imperforate anus 8. Small bowel atresia 9. Mesenchymal hamartoma 10. Omphalocele 11. Gastroschesis III. Key findings that alter management A. Airway obstructing & ex utero intrapartum treatment (EXIT) procedure B. Observed-to-expected lung-to-head ratio (O/E LHR) & CDH C. Observed-to-expected total fetal lung volume (O/E TFLV) & CDH D. Percent liver herniation & CDH

Printed on: 10/29/20

PD174-ED-MOA7

Superficial Soft-Tissue Lesions with High Vascular Density on Sonography in Pediatric Patients: More Than Just Hemangiomas

Monday, Dec. 2 12:15PM - 12:45PM Room: PD Community, Learning Center Station #7

Participants
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TEACHING POINTS

The most frequently encountered soft tissue lesion showing high vascular density in the pediatric age group is an infantile hemangioma. These usually have a very typical presentation of bluish skin discoloration with rapid postnatal proliferation and subsequent involution. Other lesions may show similar sonographic appearance but do not necessarily fit the clinical picture of infantile hemangioma. The purpose of this exhibit is to illustrate the differential diagnoses of superficial lesions in the pediatric population showing high vascular density on sonography, similar to that of hemangiomas and to to know when to consider further imaging and/or biopsy.

TABLE OF CONTENTS/OUTLINE

Benign henmangioma 'mimicers' including syringocystadenoma papilliferum, wart ,cutaneous fibrous histiocytoma, and cranial fasciitis and malignant lesions including plexiform fibrohistiocytic tumor and neuroblastoma skin metastases

PD206-SD-MOA1

Accuracy of Transperineal Sonography for Determination of the Type of Imperforate Anus

Monday, Dec. 2 12:15PM - 12:45PM Room: PD Community, Learning Center Station #1

Participants
Daniel Fadaei Fouladi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Reza Ataei, Tabriz, Iran (islamic Rep. Of) (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To determine the accuracy of transperineal sonography in determining the type of imperforated anus.

METHOD AND MATERIALS

After being approved by the Ethics Committee of our university (No. 90/3-1/1) a total of 44 neonates with imperforated anus were examined by ultrasonography using a 7-10 MHz linear array transducer operated by an experienced radiologist. The distance between distal rectal pouch and perineum was measured in all patients. Surgical findings were considered as the gold standard.

RESULTS

The study group comprised 24 boys and 20 girls with the median age of 3 days (1-5 days). Based on intraoperational findings, low and high type anomalies were present in 24 and 20 patients, respectively. Accordingly, the sensitivity, specificity, positive predictive value and negative predictive value of transperineal sonography in detecting low type anomaly were 83.3% (95% confidence interval, CI, 62.6%-95.3%), 75% (95%CI, 50.9%-91.3%), 80% (59.3%-93.2%) and 79% (54.4%-94%), respectively. The corresponding values for detecting high type anomaly were 75% (95%CI, 50.9%-91.3%), 83.3% (95%CI, 62.6%-95.3%), 79% (54.4%-94%) and 80% (59.3%-93.2%), respectively.

CONCLUSION

In neonates with imperforated anus transperineal sonography is a safe and rather accurate modality in determining the type of the anomaly.

CLINICAL RELEVANCE/APPLICATION

In experienced hands transperineal sonography could be considered as a safe and relatively accurate method in differentiating high and low types of imperforated anus.

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PD230-SD-MOA4

Does Liver Biopsy with Larger Needles and Tract Embolization in Liver Transplant Patients have a Higher Complication Rate?

Monday, Dec. 2 12:15PM - 12:45PM Room: PD Community, Learning Center Station #4

Participants
Ahmad I. Alehaideb, MBBS, Toronto , ON (*Presenter*) Nothing to Disclose
Joao G. Amaral, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to assess the sample adequacy, diagnostic accuracy and complication rate of liver biopsies with two needle sizes in patients with liver transplant.

METHOD AND MATERIALS

A retrospective case - control review for 73 biopsies in pediatric liver transplant patients with tract embolization comparing a 15 G coaxial / 16 G needle (24 cases) versus a 17 G coaxial/ 18 G needle (49 controls) from January 2007 to March 2018. Sample quality, diagnostic yield, hemoglobin variation after the procedure and complications were assessed.

RESULTS

73 biopsies were reviewed 42 female (57.5 %) and 31 male (42.5%) . The average age was 9 years (range 0.2 - 18 years) and weight was 32.8 kg (the range 3.6 -74.2 kg). The most common primary diagnosis was liver transplant post biliary atresia (45.2 %, n= 33). The transplant liver were either whole liver (n = 20 patients, 27.4 %) or split graft (n=53 patients, 72.6 %). The average graft age is 213.8 weeks (0.7 - 888 weeks). The majority of liver biopsy procedure was performed under general anesthesia (n = 41) 56.16% The control group was (n = 49) 67.1 % and the case group was (n= 24) 32.9%. The average number of passes was 2.45 and 2.43 cores. the average number of gel foam pledget were used 2.19 (max= 4 , min =1). The average Hgb level for case group before the procedure is 140.1 g /L , and after the procedure is 134.5 g/L (delta = 5.4 g/ L) and for the control group is the average before the procedure is 106.6 g/L and after the procedure 100.8 g/ L (delta = 5.8 g/ l). The maximum amount of blood loss from the case group 27 g/ L. one severe allergic reaction in the control group , otherwise no other complications. The samples were evaluated by the pathologist for the adequacy and diagnostic yield. All samples were adequate, the average sample length 1.8 cm (the max = 4 cm, min = 0.84 cm). All the samples were diagnostic except for one sample from the control group. The number of negative samples were 22 , 12 samples were indeterminate and 39 samples were positive for rejection.

CONCLUSION

Liver biopsy using larger biopsy needle in a co axial fashion followed gel foam pleget it is a safe procedure with no major complication.

CLINICAL RELEVANCE/APPLICATION

using larger needle (16 G) provides larger smaple with accurate disgnosis and staging and it is safe with the use of co axial needle followed by tract embolization.

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PD231-SD-MOA5

Accuracy and Precision in Pediatric Chest Radiograph Interpretation: A Comparison of Radiology Subspecialists

Monday, Dec. 2 12:15PM - 12:45PM Room: PD Community, Learning Center Station #5

Participants
Peter Hoeksema, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Lisa Betz, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Karyn A. Ledbetter, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Small airways disease (SAD) is a common pathology seen in pediatric patients. In suspected cases of SAD/RSV/bronchiolitis, chest radiographs are often ordered to diagnose disease and to rule out other conditions, such as bacterial pneumonia. While SAD and pneumonia have unique radiographic features, the threshold to diagnose such findings may depend on radiologist experience and training background. The purpose of this study is to compare subspeciality radiologist precision and accuracy in diagnosing normal, SAD, and bacterial pneumonia on pediatric chest radiography.

METHOD AND MATERIALS

An IRB-approved retrospective review of all stat pediatric chest radiographs obtained in patients aged 6 months to 6 years over a one year period was performed. An emergency radiologist, chest radiologist, and pediatric radiologist at similar stages of their careers assigned a diagnosis of normal, SAD or pneumonia to each of 100 randomly selected qualifying cases. Two to four weeks later, this process was repeated with the 100 cases presented in a different order. Intra-radiologist agreement was then assessed.

RESULTS

Overall intra-radiologist agreement held a kappa value of 0.67, indicating "good" agreement. Intra-radiologist precision was 78% for the chest radiologist, 85% for the emergency radiologist, and 79% for the pediatric radiologist. For all cases, accuracy was 68%, 66% and 65.5% for the pediatric, chest and emergency radiologist, respectively.

CONCLUSION

Our findings demonstrate that there is no statistically significant difference in the precision or accuracy with which radiologists of different subspecialties but similar levels of training interpret pediatric chest radiographs. Nevertheless, both overall precision and accuracy were lower than anticipated, which appears to be primarily due to inconsistency in diagnosing SAD. Future studies comparing radiologists in different stages of their careers and comparing staff and resident radiologists are currently in progress and will allow for more complete characterization of this study's conclusions.

CLINICAL RELEVANCE/APPLICATION

Mid-career staff radiologists have similar levels of precision and accuracy in basic pediatric chest radiograph interpretation regardless of subspecialty training.

PH129-ED-MOA7

MR Image Artifacts: RF Coil Related or Not?

Monday, Dec. 2 12:15PM - 12:45PM Room: PH Community, Learning Center Station #7

Participants
Wing-Chi E. Kwok, PhD, Rochester, NY (*Presenter*) Nothing to Disclose

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TEACHING POINTS

Image artifacts related to RF coils can affect the diagnostic evaluation of MRI and may indicate patient safety risk if they are caused by coil malfunction, and so it is important to correctly identify them. However, there are other image artifacts that may sometimes be mistaken to be related to RF coils. The aims of this presentation are to: (1) learn about image artifacts that are related to RF coils and artifacts that resemble them, (2) learn how to quickly distinguish these two types of artifacts, (3) learn the mitigations when those image artifacts appear, and (4) improve workflow, image quality and patient safety as a result.

TABLE OF CONTENTS/OUTLINE

This presentation will cover: (1) artifacts caused by RF coil malfunctions, including signal detection failure and RF decoupling failure, (2) artifacts related to the use of RF coils, such as poor coil connection to scanner, parallel imaging and artifacts from signal uniformity correction, (3) artifacts that may appear to be RF coil related but actually are not, such as fat suppression failure, RF interference and motion artifact. The presentation will show examples of the above artifacts, and discuss how they may affect image quality, image interpretation and patient safety. It will also discuss how to distinguish coil-related artifacts from unrelated ones and ways to mitigate the artifact problems.

PH130-ED-MOA6

Oncological Applications of Diffusion Kurtosis in the Genitourinary System: How, When, and Why?

Monday, Dec. 2 12:15PM - 12:45PM Room: PH Community, Learning Center Station #6

Participants
Lidia Alcala, MD, Jaen, Spain (*Abstract Co-Author*) Nothing to Disclose
Juan A. Retamero, MD,MSc, Granada, Spain (*Presenter*) Nothing to Disclose
Teodoro M. Noguerol, MD, Jaen, Spain (*Abstract Co-Author*) Nothing to Disclose
Sandra Baleato Gonzalez, MD, PhD, Santiago de Compostela, Spain (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD,PhD, Jaen, Spain (*Abstract Co-Author*) Speaker, Canon Medical Systems Corporation; Speaker, Koninklijke Philips NV; Speaker, Siemens AG

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TEACHING POINTS

Describe the physical basis and technical adjustments of diffusion Kurtosis Review the clinical applications of Diffusion Kurtosis in the assessment of focal lesions of the genitourinary system Highlight the added value of diffusion kurtosis to clinical MRI protocol in genitourinary imaging

TABLE OF CONTENTS/OUTLINE

1. Introduction 2.Definition of Diffusion Kurtosis 3. Technical adjustments 3. Advanced modeling of diffusion signal decay 4. Clinical applications of Kurtosis in the genitourinary system - Renal masses - Endometrial adenocarcinoma and other uterine masses - Cervical carcinoma - Ovarian lesions - Bladder carcinoma 5. Conclusions

PH131-ED-MOA8

Ultra-High Field (7T) Two-Dimensional Correlation Spectroscopy to Study Brain Tumors

Monday, Dec. 2 12:15PM - 12:45PM Room: PH Community, Learning Center Station #8

Participants
Sanjeev Chawla, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Gaurav Verma, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Suyash Mohan, MD, Philadelphia, PA (*Presenter*) Grant, NovoCure Ltd Grant, Galileo CDS, Inc
Sumei Wang, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Laurie A. Loevner, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Harish Poptani, PhD, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is: 1. To overview the limitations of conventional one-dimensional (1D) proton MR spectroscopy methods 2. To understand the need and importance of two-dimensional correlation spectroscopy (2D-COSY) sequence 3. Present the salient features of 2D-COSY sequence 4. To discuss the potential utility of 2D-COSY in characterization of brain tumors

TABLE OF CONTENTS/OUTLINE

1. Basic Principle of 2D-COSY • Description of pulse sequence • Concepts of J-modulation • Coherence transfer 2. Benefits and challenges of ultra-high field (7T) MR system for proton MR spectroscopy • Signal to noise ratio • Chemical shift dispersion • Bo and B1 field inhomogeneity • Magnetic susceptibility effects • SAR issues 3. Implementation of 2D-COSY on 7T • Phantom studies • Post-processing of 2D-COSY spectra 4. Assessment of reproducibility and reliability of 2D-COSY on normal human subjects • Magnetic shimming modules • Water suppression modules • Identification and quantification of metabolites 5. Potential clinical applications of 2D-COSY in brain tumors • Emphasize the significance of key metabolites in studying brain tumors

PH226-SD-MOA3

The Optimal Scanner Settings for Clinical CEUS Imaging with High-Frequency Transducers

Monday, Dec. 2 12:15PM - 12:45PM Room: PH Community, Learning Center Station #3

Participants
MacIej Piskunowicz, MD, PhD, Gdansk, Poland (*Presenter*) Nothing to Disclose
Anush Sridharan, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Laura Poznick, BA, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Silvestro, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Misun Hwang, MD, Ellicott City, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Nowadays more and more of contrast-enhanced ultrasound (CEUS) examination is performed with linear probes. However, CEUS image quality often is suboptimal mainly due to the insufficiency of the signal from microbubbles. We can increase the quantity and quality of the signal coming back to the probe by increasing the volume of ultrasound contrast agent (UCA) or by improving the response from bubbles by increasing mechanical index (MI). The objective of this study was to determine the optimal level of MI for linear probes to obtain the best signal to noise ratio and improve the imaging quality and to avoid extensive destruction of UCA microbubbles.

METHOD AND MATERIALS

For purposes of this in vitro study, a phantom model was built. The small chamber in size 5'x7'x3' was made from acrylic sheets and filled up by the polysiloxane. At a depth of 1.2' under polysiloxane, a 'vessel' was created with a 0.23' mm diameter. The vessel was connected to a small mixing chamber filled with normal saline and then to cyclic flow pump as a circuit to maintain flow through the system. For this study, we used ultrasound systems and probes of two different manufacturers (GE, Philips). For the study, 0.1 ml of SonoVue™/Lumason™ was added to the normal saline in the mixing chamber. The transducer was placed on the ultrasound phantom on the surface to visualize the vessel. Once the UCA was visualized within the vessel, measurements were taken for different MI values beginning from 0.06 up to 0.24 as well as for at least two different presets of frequencies available for each transducer. The microbubbles intensity over time was measured for each transducer and frequency.

RESULTS

The examples of results are presented for GE ultrasound system Logiq e9 (probe 9L and C2-9 for general and high resolution presets). The form of presentation of the results are figures and tables. Placing the remaining figures and tables in the abstract exceeds the possibilities of abstract content.

CONCLUSION

Increasing MI to the range 0.12-0.16 improves the intensity of the signal obtained from the linear and convex transducers without increasing the noise and extensive destruction of UCA. The increment in signal is more appreciable for the medium frequencies than for high frequencies.

CLINICAL RELEVANCE/APPLICATION

For CEUS examinations we found the MI of 0.12-0.16 to be optimal in the signal and the imaging quality which is well below the safety limit.

PH228-SD-MOA5

Task Based MTF Comparison Between a New Deep Learning Based CT Reconstruction and Current Iterative Methods

Monday, Dec. 2 12:15PM - 12:45PM Room: PH Community, Learning Center Station #5

Participants
Timothy P. Szczykutowicz, PhD, Madison, WI (*Presenter*) Equipment support, General Electric Company; License agreement, General Electric Company; Founder, Protocolshare.org LLC; Medical Advisory Board, medInt Holdings, LLC; Consultant, General Electric Company; Consultant, Takeda Pharmaceutical Company Limited
Brian E. Nett, PhD, Wauwatosa, WI (*Abstract Co-Author*) Employee, General Electric Company
Jie Tang, PhD, Madison, WI (*Abstract Co-Author*) Employee, General Electric Company
Jiang Hsieh, PhD, Waukesha, WI (*Abstract Co-Author*) Employee, General Electric Company

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PURPOSE

With filtered back projected image reconstruction, spatial resolution performance is not dependent on image contrast or noise/dose. Existing iterative methods have been shown to produce spatial resolution that is dependent on image contrast or noise/dose. Here, we characterize the contrast and dose dependence of TrueFidelity (GE Healthcare), a new deep learning image reconstruction (DLIR) approach.

METHOD AND MATERIALS

We imaged the CT number insert region of an ACR CT Accreditation phantom 5 times at 0.625 mm slice thickness. We imaged at dose levels of 16, 8, and 4 mGy using 120 kV, 80 mm collimation, and 0.992:1 pitch. Images were reconstructed using 6 methods: filtered back projection (FBP), two levels of a statistical iterative reconstruction (ASiR-V), and three levels of the vendor's new deep learning (DLIR) approach. The ASiR-V level was chosen based on a vendor recommendation (AR50, 50%). The tasked based modulation transfer function (MTF task) methodology was used to obtain contrast dependent spatial resolution for air, polyethylene, bone, and acrylic.

RESULTS

The 50% and 10% MTF task values for all DLIR strengths were all comparable to FBP and all ASiR-V levels. The 10% MTF task at 8 mGy for FBP was 0.69/0.65/0.65/0.66 for poly/air/acrylic/bone respectively. The 10% MTF task at 8 mGy for 50% ASiR-V was 0.7/0.65/0.68/0.66 for poly/air/acrylic/bone respectively. The 10% MTF task at 8 mGy for medium strength DLIR was 0.71/0.69/0.69/0.69 for poly/air/acrylic/bone respectively. All reconstruction methods showed a decreased performance, as expected, when the focal spot switched from medium to large between the 8/4 and 16 mGy levels respectively.

CONCLUSION

ASiR-V and TrueFidelity DLIR do not exhibit contrast or dose dependent spatial resolution as do some other advanced model based methods.

CLINICAL RELEVANCE/APPLICATION

Unlike other advanced CT algorithms, this deep learning method did not exhibit contrast or noise/dose dependencies with respect to spatial resolution.

PH229-SD-MOA2

Impact of Imaging Conditions on Localizer-Based Water Equivalent Diameter Estimation and on Dose Modulation

Monday, Dec. 2 12:15PM - 12:45PM Room: PH Community, Learning Center Station #2

Participants
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Xinhui Duan, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Xinming Liu, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Water equivalent diameter (WED) is a sound patient-size descriptor, and CTs use localizers to determine WED and to guide dose modulation. Localizer-based WED estimation requires a calibration to relate localizer pixel values to attenuation. We investigated how imaging conditions affect the WED calibration and dose modulation performance.

METHOD AND MATERIALS

We acquired localizer and axial images of ACR and body CTDI phantoms on 11 CT models from GE, Siemens, Philips, and Canon. We estimated calibration parameters (slope and intercept) by associating axial images with the corresponding localizer lines using custom built software. Experiments were conducted under combinations of kV, mA, orientation, and imaging kernel of localizer radiographs, and axial kV. In separate experiments, the ACR phantom and body CTDI phantom (iso-centered) were imaged together on table top. We repeatedly acquired 120kV-helical scans with dose modulation, after taking localizers at varied kV and mA levels, to examine their impact on dose modulation.

RESULTS

Calibration slope and intercept depends on localizer kV on all CTs. E.g., on a Canon A-One CT, slope changed from 1.47 to 1.64 for localizers from 80 to 135 kV. Using calibration of 120kV localizers, we simulated errors in WED estimation caused by using unmatched calibrations: WED from 80kV- ~ 135kV-localizers deviated from the truth by 1-5% for the body CTDI phantom and 1-7% for the ACR phantom. Localizer mA and directions have small impacts on calibrations and WED results. Calibration also depends on localizer kernels for Canon CTs. For the A-One, WED calibration slopes under Sharp- and STD-kernels were identical (diff. < 0.01%) but differed from the Soft-kernel slope by 55%. Using the Sharp-kernel calibration, WED from Soft-kernel localizers deviated from the truth by 35% for the CTDI phantom and 42% for the ACR phantom. Localizer kV affected dose modulation performance. On a GE CT750HD, comparing to the CTDIv (11.65 mGy) of a baseline condition (120kV-localizer), CTDIv from the same helical scans after 80kV-, 100kV-, 140kV-localizers were 12.43 (+7%), 11.98 (+3%), and 11.41 mGy (-2%). Localizer mA did not affect dose modulation.

CONCLUSION

Localizer kV and image kernels have stronger impacts on WED calibration and dose modulation than other factors.

CLINICAL RELEVANCE/APPLICATION

Using the same kV and image kernel for localizers may improve consistency of dose modulation and WED estimation.

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PH230-SD-MOA1

Advanced Reconstructions Outperform Respect to Traditional Iterative Reconstructions in State-of-the-Art Non-Digital PET/CT Scanners

Monday, Dec. 2 12:15PM - 12:45PM Room: PH Community, Learning Center Station #1

Participants
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PURPOSE

The aim of this work was to describe the impact of advanced reconstruction techniques of resolution and noise modelling on the image quality of current TOF and non-TOF state-of-the-art non -digital PET/CT scanners (GE Disc. IQ, GE Disc. 710, Siemens mCT flow, Phlips Ingenuity TF).

METHOD AND MATERIALS

A cylindrical 68Ge phantom was used (Ecklert&Ziegler, Valencia, California). The activity concentrations of the radioactive epoxy was measured with a radionuclide calibrator tested against a NIST traceable source and were respectively 11.21 kBq/ml and 39.71 kBq/ml at reference time. Nominal Sphere to Background Ratio (SBR) was 3.54. Seven spheres with nominal internal diameters (ID) of 6, 10, 13, 17, 22, 28, 37 mm were placed in the uniform background region. Acquisition time was adjusted according to the age of the phantom to meet 1.5 min per frame and reconstructed with variable reconstruction parameters (iterations, subset, Gaussian filter) with traditional (OSEM) and by combining advanced modalities, when present: PSF, TOF, TOF+PSF, NSM. Recovery Coefficient (RC) was calculated as the ratio of maximum activity concentration in each sphere respect to maximum activity concentration in the larger (ID=37mm) sphere.

RESULTS

For each reconstructed modality and PET/CT scanner, RC were averaged on different reconstruction parameters for increasing sphere ID. OSEM: IQ 0.34 0.47 0.65 0.78 0.89 0.92 1.00; 710 0.30 0.56 0.64 0.84 0.91 0.93 1.00; mCT 0.31 0.49 0.59 0.84 0.86 1.00 1.00. TOF: 710 0.31 0.61 0.69 0.82 0.91 0.94 1.00; mCT 0.32 0.50 0.59 0.86 0.91 1.00 1.00; Ing 0.32 0.45 0.69 0.88 1.04 1.00 1.00. PSF: IQ 0.31 0.47 0.68 0.84 0.91 0.92 1.00; 710 0.29 0.54 0.67 0.91 0.95 0.95 1.00; mCT 0.30 0.48 0.59 0.90 0.91 0.99 1.00. TOF+PSF: 710 0.29 0.61 0.77 0.90 0.94 0.94 1.00; mCT 0.31 0.50 0.62 0.93 0.94 0.99 1.00; Ing 0.30 0.43 0.69 0.90 1.08 1.04 1.00. NMS IQ 0.32 0.46 0.69 0.89 0.95 0.92 1.00; 710 0.29 0.82 0.97 0.94 0.98 1.03 1.00

CONCLUSION

The RC obtained with the four state-of-the-art non-digital PET/CT scanners demonstrate that modern PET/CT scanner outperforms respect to older ones. Higher differences are recorded for smaller spheres. Applying more advanced reconstruction techniques progressively enhances RC, NSM reconstruction being the most promising algorithm.

CLINICAL RELEVANCE/APPLICATION

Advanced reconstructions outperform respect to traditional iterative reconstructions in state-of-the-art non-digital PET/CT scanners

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QI004-EB-MOA

Integration of Referring Physician Survey into the Electronic Medical Record (EMR): 2 Year Experience, Challenge and Improvement of Imaging Report Opportunities

Monday, Dec. 2 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

Our Institution is a non-profit academic healthcare center founded in 1853. It has a network of two hospitals with 785 total beds (200 for intensive care), 41 operating rooms, 800 home care beds, 25 outpatient clinics and 150 associated private practices. Its work team is made up of 9237 people: 3400 medical doctors, 3337 members of the health staff and 2,500 people from the administrative sectors. Since 1998, the Institution has run an in-house-developed health information system (HIS), which includes clinical and administrative data. It has been certified by both The Joint Commission International and the HIMSS as level 7 in the Electronic Medical Record Adoption Model. Although verbal feedback sometimes exists, we lacked an objective record of the satisfaction of the referring physicians with respect to the imaging reports of the studies carried out. With the intention to provide feedback to our radiologists so they could improve their reports to be more useful to the referring physician we create a standard survey of the key clinicial providers of the radiology department to understand their perceptions, their needs, and suggestions for improvement of the radiology reports. This projects reports the process and results of the referring physician satisfaction survey 2 years after implementation.

METHODS

In this high-productivity context we developed with the IT department a volunteer quality satisfaction referring physician survey that could be completed directly from the EMR to capture improvement opportunities and achieve initial 'customer' feedback. The survey was therefore short. It is a survey form filled in by the referring physician who requests the imaging test. This survey is located next to the received imaging report. It consists of the following seven questions with 5 scale-Likert-like choices (1: not at all, 3 neutral, 5: excellent) and a last suggestion box to be completed with free text. 1-Was the imaging report clearly structured and organized? 2-Was the report brief and concise? 3- Were the most significant clinical/surgical findings completely described? 4-Did the report provide the information that was requested? 5- Did it contain the images and reconstructions that you needed in the report? 6- Was the report timely? 7- Was the imaging study of the quality you expected? 8- A suggestion box to complete with free text Once the surveys are completed, the quality improvement officer consults the management board to verify if surveys were loaded and classifies them and send them to the head of subspecialty. When at least one question is rated 1, 2 or 3 the survey is classified within that parameter. The head of subspecialty reviews the surveys together with the signing radiologist and the rest of the subspeciality team under the concept of peer learning. The feedback loop closes internally by archiving the survey. Externally a kind and constructive feedback email is send to the referring physician.

RESULTS

A total of 673 were completed (264 in 2017 and 409 in 2018, 13% increase from one year to the next). 18.5% of responses were labeled score 4 and 5 (mean; 30, median: 22 and range: 59) while the majority (57.5%) was rated score 1, 2 or 3 (mean:64.5, median: 36.5 and range: 169). When the answers to the questions are rated score 4 and 5 we send a congratulation to the signing radiologist with a motivating purpose to his/her daily work. When the answers are from score 1 to 3, the case is analyzed under the concept of peer learning. The distribution of qualifications may be seen in figure 1. Cases scored 1 to 3 were taken as opportunities for improvement for the entire team involved. We classify as "Doesn't apply" those cases in which referring physicians click by mistake the survey without wishing to complete it. When making the contact with them they explain that they completed anything to exit the survey. Unqualified responses correspond to those cases in which the referring physician only write comments in free text without answering the questions.

CONCLUSION

The work of the radiologist often lacks objective feedback from the referring physician. So far this QI project stimulated dialogue with referring physicians and meaningful radiology peer learning. It allowed us to improve processes, study protocols, lack of individual attention and attemption to standardize/structured the reports into templates. However, the feedback survey continues to be used most commonly as a "complaint line". We are working to achieve greater adherence of the referring physicians to complete the survey.

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QI009-EB-MOA

High-Fidelity Simulation Training for Radiological Emergencies: A Multidisciplinary Approach

Monday, Dec. 2 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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Eleanor Powell, MBBS, Cardiff, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Our purpose was to develop and introduce a focussed and multidisciplinary simulation course to train radiology healthcare professionals to manage common medical emergencies that may be encountered in their everyday practice. Recently, the Royal College of Radiology have stated the importance of incorporating simulation in radiology training and the GMC-approved RCR curriculum. They have suggested identifying areas where simulation may be beneficial, especially in a multi-disciplinary setting, and incorporating this into their training as part of their professional development. Life-threatening medical emergencies are uncommon in the radiology department, but when encountered, pose a significant challenge to radiology healthcare professionals. We developed a high-fidelity simulation course for radiology staff focusing on early recognition and intervention for three medical emergencies which may be encountered. To select the most relevant clinical scenarios to include, we reviewed the critical incident log for the radiology department at University Hospital of Wales, Cardiff. There had been 18 medical emergency incidents over the preceding year - the most common being loss of consciousness/airway and anaphylaxis.

METHODS

A mixed group of radiology healthcare professionals, including consultants, registrars, nurses and radiographers attended a three-hour simulation course consisting of a mix of lectures, skill stations and simulation scenarios. The participants were divided into four equal groups and invited to attend the course, which was provided free of charge. The simulation faculty comprised two anaesthetists, one radiologist and a simulation laboratory facilitator. Training included basic management of cardiac arrest, anaphylaxis and contrast agent reactions and airway obstruction. The programme was specifically designed for radiology healthcare professionals by a dedicated team of anaesthetists, radiologists and simulation technicians. Before attending the course, the participants completed a short battery of questions which assessed their existing knowledge and perceived confidence with dealing with these clinical scenarios. These questions were asked again immediately after completing the course and then again six months later to assess the retention of the new skills and knowledge gained. The pre- and post-test results were analysed by combining all test results and the McNemar test was used to compare correct responses.

RESULTS

Thirty-two radiology healthcare professionals attended the course over four different sessions. The groups consisted of 4 radiology consultants, 8 radiology registrars, 6 nurses, 8 radiographers and 6 healthcare assistants. The average pre- and post-course knowledge scores were 17/36 and 29/36 respectively, with an average difference between scores of 10 ($p < 0.0001$). The average pre- and post-course scores for perceived confidence of managing the clinical scenarios were 4 and 7 out of a possible 10, respectively. Areas of knowledge that showed particularly marked improvement were of the airway equipment available and possible airway manoeuvres. After the results were collected and analysed for the first two sessions, we then introduced an airway skills breakout workshop to focus particularly on this area which delegates were initially struggling with. After the introduction of the airway workshop, there was an improvement in perceived confidence with managing an obstructed airway. The questionnaires collected six months later were completed by 23 of the delegates. These showed an average knowledge score of 24 which showed a decreased of 5 from the scores taken initially after the course was completed. The average perceived confidence score was 7 which remained the same.

CONCLUSION

Simulation training is a well-validated teaching methodology for rehearsing low frequency, high acuity events in a supportive and safe environment. Our results show a statistically significant improvement in knowledge scores and perceived confidence across the multi-disciplinary team to manage common medical emergencies. This study demonstrates that embedding high fidelity simulation training into the radiology curriculum enables healthcare professionals to build confidence, improve knowledge, as well as enhancing teamwork skills, communication and prioritisation. The follow up results show that the improvements in clinical knowledge and skills were partially retained over a six-month period, however there was some decrease in knowledge scores. This suggests that regular update training sessions would be of benefit to maintain these skills and we will aim for this to be integrated into practice as part of the continued professional development.

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QI010-EB-MOA

QI: Pediatric Appendicitis Ultrasound Across A Quaternary Health System

Monday, Dec. 2 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

Pediatric patients with right lower quadrant pain routinely are evaluated by CT across our quaternary Health System as our current ultrasound (US) was believed to be ineffective as a screening tool. Concern over increased radiation dose led to an initiative to improve right lower quadrant (RLQ) US. Our goals were to improve technical skill of the sonographers and to increase confidence in the reporting of pediatric ultrasound by the clinicians.

METHODS

In an effort to improve the diagnostic accuracy of pediatric right lower quadrant ultrasound across the health system for the diagnosis of appendicitis, we first provided didactic and technical education to the ultrasound technologists. A pediatric radiologist and lead ultrasound technologist, from another Children's hospital with a successful appendicitis ultrasound program, were invited to provide hands on instruction. A didactic lecture and live demonstration of ultrasound methods was provided to all ultrasound technologists across the enterprise. Attendance was mandatory. Pediatric surgeons and pediatric Emergency Department (ED) staff were encouraged to attend. Further education was provided to pediatric radiology and ED staff including our goals of decreased CT use and how to read/interpret the new structured reporting. An updated technique was sent to sonographers requiring at least 20 minutes of scan time. A new structured report was created using the Nationwide Children's Hospital scale. All radiologists were advised to use the new macro which automatically populated at the start of dictation. Ultrasound cases were reviewed at the end of the month and discrepancies between CT and/or surgical outcome with ultrasound report were sent to the lead sonographers for review. Additionally, discrepancies were reviewed with the interpreting radiologist.

RESULTS

Methods for clustered proportions were used to compare the new structured report to the old template with respect to the proportion of cases requiring a follow up CT. The sensitivity and specificity of the structured report versus old template were estimated after correcting for verification bias. Pathology results were used as the reference standard when possible; CT results were used otherwise. This sample consisted of 804 ultrasounds (from 793 patients) performed between October 2017 and December 2018. The patient's mean age at the time of US was 10.6 years (standard deviation: 4.3 years, range: 0 - 18 years). The proportion of ultrasounds being read with the new structured report steadily increased over time (Figure 1). The proportion of ultrasounds requiring a follow up CT was significantly lower when the new structured report was used (141/656 = 21%) compared to when the old template was used (46/148 = 31%)(p=0.021). Of the 804 ultrasounds, 247 had a reference standard result (100 surgery, 147 CT). Patients who were positive on US were much more likely to have a reference standard result (98/103=95%) compared to patients who were negative or indeterminate on US (149/701=21%). After making a statistical correction for this verification bias, sensitivity and specificity were 21% and 99% with the old template (diagnostic odds ratio: 23.2) and 42% and 96% with the new template (diagnostic odds ratio: 17.4). (Table 1)

CONCLUSION

As a quaternary health system with multiple hospitals and sonographers, we faced the challenge of uniform improvement across the enterprise. How do we train general sonographers, particularly if their pediatric population is limited? An additional challenge was in the reporting of the ultrasound. We needed all radiologists reading the ultrasounds, pediatric and general, overnight and daytime, to be comfortable with the sonographers and to provide definitive reports. All radiologists needed to commit to the new structured report to gain the confidence of our clinicians. The use of structured reporting improved and the use of CT following RLQ US decreased. A limitation of this study includes a selection bias because only cases with higher clinical concern or US features concerning for appendicitis went on to CT or surgery. Additionally there is a paucity of surgical/pathologic correlation and limited number of CT's. The assessment of the accuracy of US results is subject to imperfect gold standard bias (CT is an imperfect reference standard).

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QI028-EB-MOA

RESPECT - Radiology Employees Striving for Productive and Effective Communication

Monday, Dec. 2 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Awards
Quality Improvement Reports Award
Identified for RadioGraphics

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

Effective teamwork is predicated on good communication between team members. Recently, the technologists in our department reported an increasing number of negative interactions between radiologists and frontline staff which include imaging technologists, child life specialists, and reading room assistants. A baseline survey identified that only 45% of technologists would describe their interactions with radiologists as very good or excellent. The purpose of this improvement work was to change the culture in our department, with the specific goal of increasing the percentage of technologists who describe their interactions with radiologists as very good or excellent from 45% to 90% by the end of June 2019.

METHODS

A multi-disciplinary improvement team was created. The team included radiologists and technologists from all divisions in the department as well as child life specialists and reading room assistants. Based on the comments obtained from the initial and subsequent surveys, the team identified three main areas of focus: in-person interactions, telephone interactions, and trainee interactions. Three subgroups were then formed. Each sub-group worked to identify some of the root causes for negative interactions, and then initiated a series of interventions to attempt to reduce the frequency of negative interactions and increase the frequency of positive interactions. The subgroup focusing on in-person interactions worked to clarify the roles of radiologists during conference hours and shift changes, and created a mechanism for technologists to provide radiologists feedback on behaviors that lead to negative interactions. The telephone interaction subgroup worked to reduce the overall number of telephone calls in the reading room, created a script for technologists and radiologists when making phone calls and answering phone calls respectively, and created shadowing opportunities for technologists to better understand the radiologists' workflow and how multiple phone calls can affect that workflow. Finally, the trainee interactions subgroup worked to create opportunities for the trainees to shadow technologists to better understand the technologist's work and to make a personal connection with the technologist. In addition, this group is working to redesign a component of the departmental orientation for departmental trainees. Improvement was assessed through a departmental survey sent to technologists every three weeks, on average.

RESULTS

Over the course of this improvement project, multiple surveys were sent to the 180 departmental staff. On average, there were 50 respondents per survey for a mean response rate of 28%. The percentage of technologists who describe their interactions with radiologists as very good or excellent increased from 45% to 76%. Through this improvement work, we identified two root cause problems. First, a power-gradient exists between radiologists and front-line staff. Second, as workloads have increased, and the department has become distributed over multiple physical locations, there are fewer informal interactions between radiologists and technologists. The combination of factors has prevented radiologists and front-line staff from knowing each other on a personal level. Because of this, small interpersonal shortcomings, such as tone of voice, lack of eye-contact, or failure to identify oneself (including last name and role) when answering the phone have greater importance and are more likely to cause a negative interaction.

CONCLUSION

Quality improvement methodology can be used to improve culture. Through a series of interventions, we have been able to improve the percentage of technologists who describe their interactions with radiologists as very good or excellent.

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QI108-ED-MOA1

Use of a Novel Web-based Tool to Improve Communication Between the Emergency Department and Radiology

Monday, Dec. 2 12:15PM - 12:45PM Room: QR Community, Learning Center Station #1

Participants
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PURPOSE

Streamlining communication between radiology and other departments is critical for ensuring timely and appropriate care. With increasing radiologic subspecialization, radiology physicians may work in geographically disparate parts of the department. At our hospital, we anecdotally observed that a significant portion of incoming phone calls were misdirected to incorrect destinations. This resulted in wasted time, increased interruptions, and delays in care because the referring clinicians could not efficiently navigate the radiology department staffing structure. Our quality improvement project involved the development of a web-based tool that would allow the emergency department (ED) to more efficiently contact the appropriate radiology station in a timely manner and reduce misdirected phone calls.

METHODS

Surveys were sent to both the radiology residents and ED clinicians (attendings, residents, physician assistants) to assess how frequently phone calls were misdirected. Radiology residents were asked which stations received the most misdirected phone calls, and in those circumstances, which desk the caller requested. ED clinicians were asked which stations they were looking for when they were told they called the wrong station, and were also given a series of questions to assess their knowledge of commonly called radiology stations (Plain Film, CT Body, Ultrasound, Neuoradiology, Pediatrics, and Overnight). ED and radiology physicians worked together to design an easy-to-use, intranet-based tool informing ED clinicians about the appropriate destination by subspecialty and hour of the day. After the tool was implemented for six months, surveys were again sent to radiology residents and ED clinicians asking the same questions as before in order to assess for any significant change in response. Additional questions were added to the ED survey to assess awareness of the new tool.

RESULTS

An interactive, editable schedule with numbers was made available through the ED intranet, allowing for flexibility with changes in reading room numbers and/or new staffing parameters (Figure 1). Previously, there was a static image of radiology numbers in this space, which was unable to be changed and included multiple incorrect and defunct numbers. Additionally, the list defaulted to a 'radiology pager,' which is ordinarily carried by a resident responsible for plain films. Numbers included in the new intranet tool were all pertinent reading room stations, all scheduling desks, and all technologist workspaces. Different schedules were provided for weekdays and weekends. Initial survey results showed that prior to the intervention, 74% of radiology residents said they received misdirected phone calls at least twice a day, compared to 57.9% of ED respondents who experienced this problem at least once a day (Tables 1 and 2). This number dropped to 58.4% of radiology residents ($p=0.37$) and 17.9% of ED respondents ($p<0.01$) on follow-up surveys 8 months after the tool was established. After the establishing the new tool, 82.1% of ED respondents were aware of the new intranet contact tool and used it to contact Radiology (Figure 2). On the series of questions that assessed the ED respondents' knowledge of radiology numbers, after the intervention, over 50% of respondents knew the correct answer or answered correctly using the call sheet; this resulted in statistically significant increases in accuracy for Body, Neuroradiology, and Pediatric radiology stations (Table 3). 50% of radiology residents believed there was a reduction in the number of misdirected phone calls from the ED.

CONCLUSION

Our tool was successful in accomplishing multiple goals. Firstly, we were able to gain acceptance of the new tool by over 80% of ED respondents. Secondly, we were able to reduce the number of misdirected phone calls based on the subjective perception of ED respondents and radiology residents. Thirdly, we objectively improved the ED respondents' behavior pattern in contacting the radiology department by either calling the correct number or using the call tool. However, a few limitations were recognized. The number of respondents differed before and after intervention, limiting statistical analysis. The tool itself is limited as certain subgroups were not included; for example, the ENT reading room was not given as there was a concern it would be difficult for the clinician to determine the distinction of ENT cases from Neuroradiology cases. Each of the surveys had an open-ended box to give comments concerning radiology and ED communication, which raised additional concerns that can be addressed in the future. Going forward, we hope to be able to expand use of this tool throughout the hospital in order to provide more timely and efficient care by reducing wasted time on the phone.

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QI109-ED-MOA2

Offering Diagnostic Imaging Services in Public Hospitals: A Successful Public-Private Partnership Model

Monday, Dec. 2 12:15PM - 12:45PM Room: QR Community, Learning Center Station #2

Participants
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PURPOSE

The state government implementing the presented diagnostic imaging project faced numerous challenges in delivering public health services, including low availability of imaging technology, a rapidly growing demand for imaging tests, low bed turnover and hospital overcrowding. In addition, the state did not have the financial, logistical, and agile resources to handle new investments in imaging equipment and their maintenance, or the required human resources such as an adequate number of radiologist specialists to deliver test imaging results timely and efficiently. The purpose of the diagnostic imaging project was to improve the availability, operations and maintenance of diagnostic imaging services in publicly administered hospitals, thus increasing bed turnover rate and reducing the long waiting times for patients.

METHODS

To address the aforementioned health service challenges, the state government engaged with the private sector in a public-private partnership (PPP) to provide citizens access to imaging and telemedicine services, including Magnetic Resonance Imaging (MRI) and Computed Tomography (CT), X-ray and Mammography through the public healthcare system. While the PPP model has been propagated as one of the most effective approaches for establishing diagnostic services in some countries (Brazil, India, Moldova), data on PPP success has been limited. In this imaging PPP, a guaranteed global payment was legally institutionalized as a mechanism to attract private actors to participate in the project and to avoid state government delays or defaults in payments. The presented PPP agreement defines 10 quality and 7 availability indicators to be met by the private partner and to guarantee higher efficiency, measured through the number of exams delivered, number of exams that required the patient to come back, number of cancelled appointments as well as waiting times. If the aforementioned 17 key performance indicators pre-defined in the PPP contract are not met, the government can enforce penalties in the form of payment deductions. All employees, including receptionists, technicians, nurses as well as remote radiologists are hired and managed by the private partner.

RESULTS

In our PPP case, the radiology sectors of 11 public hospitals were remodeled and received new equipment, with a total private investment in infrastructure and operating equipment of over US$30 million. Whereas there were previously only 2 available MRI scanners in public hospital in the state, the PPP installed 6 new MRI scanners. As such, the diagnostic imaging PPP increased the availability of MRI and achieved an enormous improvement in access to diagnostic exams for both inpatients and outpatients who depend on the public health care system. The average number of MRI scans performed in the state in 2018 was almost 8-fold compared to the reported numbers of MRI scans before the PPP implementation in 2011 while the average number of CT scans performed in 2018 was more than 2-fold compared to the reported CT scans performed in 2011. The PPP accomplished availability of diagnostic exams not only through the investment in new equipment but also through preventive equipment maintenance and repairs which are not timely dealt with in the bureaucracy of publicly administered hospitals, thus contributing to the inefficient use of even the minimal resources that might be available. Immediately before the project started, the state of the radiology sectors in the implementing hospitals was precarious with respect to outdated x-ray and CT equipment as well as experienced less than optimal equipment maintenance. CT scanners in different cities were reported to be out of service anywhere from 2-6 months either due to the need of an x-ray tube, software configuration or a fuse replacement. These CT scanners were the only ones available in their respective cities, highlighting the impact of lack of health care services on the local population. While it is hard to document the direct impact of the PPP on average length of stay, bed turnover and therefore hospital cost, it has been reported that prior to this project, hospitalized patients took up to 20-30 days to perform CT or MRI exams and the reports took 7-10 days to be released. Some hospitals only had reports for 10-20% of the diagnostic exams performed. Currently, most patients admitted to PPP hospitals perform their exams on the day they are prescribed. All exams have their reports released within 2 hours (urgent care), 12 hours (regular inpatient) or 2 days (outpatient).

CONCLUSION

Our case provides evidence that the diagnostic imaging PPP is an innovative model of health care delivery which has been able to increase the availability of diagnostic radiology services in the state and achieve an enormous improvement in access to imaging diagnostic exams for patients who depend on the public sector for health services, performing more than 1 million diagnostic exams in less than 4 years, free of charge to patients.

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QI110-ED-MOA3

Emergency Radiology Workflow During a Simulated Mass Casualty Incident (MCI) in a Level 1 Trauma Centre: Importance and Learning Points

Monday, Dec. 2 12:15PM - 12:45PM Room: QR Community, Learning Center Station #3

Participants
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PURPOSE

To simulate an MCI scenario and examine the Emergency Radiology workflow. An MCI is a scenario where there is a large number of casualties in a short period of time. The role of radiology is to image patients in a rapid efficient manner and to communicate relevant findings quickly and accurately. The purpose of planning for MCIs is to anticipate these scenarios and optimise preparedness. A simulated MCI can act as a road test for the Emergency radiology team, the workflow, the CT protocol and the network. It can help estimate maximum capacity as well as establish where delays happen.

METHODS

trauma CT scans in rapid succession in Level 1 trauma centre with Emergency Radiology. A single CT scanner adjacent to the trauma bay was used to acquire all scans. Standard Rapid Imaging in Trauma Protocol (RIPIT) used in all cases comprising non contrast CT head, CT angiogram arch to vertex with cervical spine reformats, CT angiogram of chest, abdomen and pelvis with thoracic and lumbar spine reformates and portal venous CT of abdomen and pelvis. Radiology service provision and CT workflow simulated to as close as realistic as possible. A volunteer was used in place of a patient for transfer from trauma bay to CT, spinal lift onto CT table, scan positioning and set-up. An anthropomorphic phantom was substituted in place of the volunteer for scan acquisition. Following acquisition the volunteer was then repositioned on the table and transfer from the scan table to trolley and back to trauma bay performed. Actual CT data from the acquisition including multi-planar reformats were sent to PACS. The time taken for each step in the process was documented for each 'patient'. All Emergency Radiology participants took part in a post-exercise debrief. Data were analysed using GraphPad Prism 8.

RESULTS

The mean time in CT scan room was 8.45 min (range 7.72-9.75 min), with a derived maximum capacity of 6 patients per hour. Transfer times to and from the CT table were quick, less than 1 minute in all cases. The mean time spent on CT table was 7.65 min (range 7.13-8.62 min) and the mean actual scan time was 5.92 min (range 5.27-6.48min). The first CT images were available on PACS within an average of 12.83 min (range 3.37-18.6 min, median 16.18 min) but on the dedicated CT workstation within 3.78 min (range 3.17-4.57 min). Time to the complete set of images to PACS was extremely variable, ranging from within 43 min to 205 min (median 163.5 min). This wide range was partially due to the sequence of sending from the scanner to PACS and partially due to progressive network delays with increases in queued data.

CONCLUSION

In an MCI scenario, up to 6 patients can be scanned within an hour using the standard trauma protocol. Overall, times for patient transfer, scan acquisition and initial image transfer were quick however images transfer to PACS was prohibitively long. This is something we had suspected but had not previously quantified in our institution. This has dataset become the driving force behind network upgrades in our institution. To date, a new dedicated server for the emergency CT scanner has been installed and network hardware installation in in progress. Front and back-end software improvements are also being made. We have a repeat simulated MCI exercise planned for May 4th to test improvements to date using identical methodology with a subsequent exercise in late summer 2019 once all improvements are in place. We have also critically reviewed the protocol we use in MCI events in terms of the necessary components of the protocol and the multiplanar reformats that are required for, at least, the initial read. We have developed a 'disaster protocol' which is a streamlined version of a RIPIT and hope to test this also at the next MCI simulation. This simulated MCI scenario demonstrated that, even in Level 1 trauma sites with an established Emergency Radiology division and proven algorithms for polytrauma imaging, there is potential for optimisation of workflows. Simulations allow for team familiarity with the MCI algorithm, streamlining of processes and workflows, and, in this case, demonstration of previously unrecognised stumbling blocks to efficiency that may have remained occult without this real-time practice.

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RO217-SD-MOA2

Learning Curve for Image-Guided Brachytherapy of Cervical Cancer

Monday, Dec. 2 12:15PM - 12:45PM Room: RO Community, Learning Center Station #2

Participants
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PURPOSE

In our institution, image-guided brachytherapy (IGBT) was introduced in 2015. The learning curve for IGBT of cervical cancer was examined.

METHOD AND MATERIALS

Between April 2015 and December 2017, 40 patients with cervical cancer was treated with IGBT in our institution. Of these, 14 patients (stage I-II, 6; III-IV, 8) were treated in 2015, and 26 patients (stage I-II, 11; III-IV, 15) were treated in 2016-2017. In principle, IGBT prescribed by D90 combined with external beam irradiation of 50.4 Gy in 28 fractions was administered.

RESULTS

Follow-up time was 4-43 months (median 21 months). With regard to treatment outcomes of 2015 and 2016-2017, 2-year overall survival rates were 77% and 95% respectively (p=0.0914), 2-year failure-free survival rates were 55% and 85% respectively (p=0.0295), and 2-year intra-pelvic control rates were 69% and 96% respectively (p=0.0173).

CONCLUSION

Intra-pelvic control rates was significantly poor in patients who received IGBT in the year of introduction of IGBT. This might be owing to the learning curve for IGBT. When switching from two-dimensional brachytherapy based on point-A doses to three-dimensional brachytherapy based on the concept of high-risk clinical target volume, sufficient caution is required.

CLINICAL RELEVANCE/APPLICATION

There is a learning curve for new treatment modalities such as image-guided brachytherapy, and caution is required at the time of introduction.

UR180-ED-MOA7

Leave No Nephron Behind: A Review of Nephrometry Scoring Systems

Monday, Dec. 2 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #7

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TEACHING POINTS

1. Review current management options for renal cell carcinoma. 2. Compare three different nephrometry scoring systems for renal tumors: R.E.N.A.L, P.A.D.U.A., and C-Index. 3. Discuss application of these scoring systems to guide renal tumor management and predict clinical outcomes. 4. Review multiple multimodality renal tumor cases

TABLE OF CONTENTS/OUTLINE

1. Background a. Current management of renal cell carcinoma b. Comparison of surgical and ablative therapies 2. Review of nephrometry scoring systems (Slide 1) a. R.E.N.A.L. b. P.A.D.U.A. c. C-Index 3. Use of scoring systems in preoperative/pretreatment planning (Slide 2) and review of nephrometry outcomes literature 4. Case examples with nephrometry scoring and clinical implications (Slides 3-5)

UR193-ED-MOA8

When, Where, and Why We Make Mistakes: Tips for Avoiding Errors in Genitourinary Exams

Monday, Dec. 2 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
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TEACHING POINTS

The process of radiologic image interpretation is very complex and errors or discrepancies are uncomfortably common. How to minimize mistakes is what every radiologist pursues in daily practice. A commonly used delineation divides radiologic error into cognitive (or interpretative) and perceptual errors. Perceptual errors are far more common, and occur when the radiologist fails to identify the abnormality, while cognitive errors occur when an abnormality is identified but the reporting radiologist fails to correctly understand or report its significance. The purpose of this exhibit is (1) to discuss perceptual and cognitive errors, focusing in genitourinary radiology, in a case-based approach of errors encountered at a large academic hospital and (2) to review how to minimize this errors.

TABLE OF CONTENTS/OUTLINE

(1) When? (a) traps of nonenhanced scan and wrong protocols (b) fail to consult prior imaging studies and clinical history. (2) Where? (a) blind spots (b) fail to consult reconstructions, phases or sequences. (3) Why? (a) satisfaction of search errors (b) satisfaction of report errors (c) anchoring bias. (4) A case-based approach focusing on how to reduce errors: kidney, collecting system, adrenal, bladder, prostate, retroperitoneum and female and male reproductive system.

VI001-EB-MOA

Identification of Forearm Muscles with Dynamic Ultrasound Imaging for Botulinum Toxin Injection and Image Guided Botox Injections

Monday, Dec. 2 12:15PM - 12:45PM Room: VI Community, Learning Center Hardcopy Backboard

Participants
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TEACHING POINTS

1. Utilization of Botox in stroke patietns with upper extremity spasticity. 2. Utilization of botox in interventional radiology setting.

TABLE OF CONTENTS/OUTLINE

Botulinum toxin (BoNT) is a neurotoxic protein produced by the Clostridium botulinum. It prevents the release of the neurotransmitter acetylcholine from axon endings at the neuromuscular junction and thus causes flaccid paralysis. Specifically in medicine, injection of botulinum toxin for muscle spasticity has been described in cases of multiple sclerosis, cervical myelopathy and, stroke. Injections in other muscle dystonias like belly dancer dystonia and chronic pelvic pain has also been reported. Ultrasound guided Botox injection has been previously described in the literature and several advantages reported over blind injection including decreased pain and decreased dose. In this exhibit we will describe dynamic ultrasound imaging of forearm muscle groups for accurate localization and maximum efficiency. We will allso summarize our interventional radiology clinic experience with BoNT. TOC: 1.Botox, mode of action, dosages and current utilization 2. Image guided Botox injection in various dystonias including stroke related upper extremity. 3. Dynamic US imaging of forearm to differentiate between profundus and superficialis muscle groups. 4. Example of usage in other dystonias.

Printed on: 10/29/20

VI132-ED-MOA8

All About and How We Do Prostate Artery Embolization (PAE): Indication, Optimal Preparation, Technique, Imaging Analyses, and Complications

Monday, Dec. 2 12:15PM - 12:45PM Room: VI Community, Learning Center Station #8

Awards
Identified for RadioGraphics

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TEACHING POINTS

1. Management of benign prostatic hyperplasia (BPH) 2. Indications for PAE 3. Pre procedure relevant clinical and imaging features 4. Vascular anatomy and its variations: MRI and Digital Subtraction Angiography (DSA) 5. PAE technique: common difficulties and how to overcome them 6. Post PAE imaging features and pitfalls 7. Early and late complications 8. Innovations and future directions

TABLE OF CONTENTS/OUTLINE

MANAGEMENT OF BPH - Epidemiology, clinical concepts, guidelines and treatment KEY CONCEPTS - Vascular anatomy and glandular aspects: illustrations with imaging correlation. IMAGING ANALYSIS: WHAT EVERYONE NEED TO KNOW - Advantages and disadvantages of each modality - Preparation. - Imaging protocols and how to optimize it - Difficulties and how to overcome them - Systematic approach to evaluate ultrasound, MRI and CT - Suggestion of a template reporting system PAE TECHNIQUE - Preparation. - The PErFecTED Technique - Difficulties and how to overcome them PAE FOLLOW-UP - Success Criteria and Clinical follow up - Suggestion of a standard follow up POST PAE - Expected imaging features and pitfalls - Early and late complications CASE-BASED DIDACTICS - Challenging cases FUTURE DIRECTIONS - What's on the horizon

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VI206-SD-MOA1

The Efficacy and Safety of Magnetic Resonance-Guided High-Intensity Focused Ultrasound Ablation of Pedunculated Subserosal Leiomyoma

Monday, Dec. 2 12:15PM - 12:45PM Room: VI Community, Learning Center Station #1

FDA Discussions may include off-label uses.

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PURPOSE

To evaluate the efficacy and safety of magnetic resonance-guided high-intensity focused ultrasound (MRgHIFU) ablation as an alternatively noninvasive therapy for patients with pedunculated subserosal leiomyoma.

METHOD AND MATERIALS

This prospective study was approved by institutional review board. Over 3 years (from July 2015 to December 2018), 148 women with symptomatic leiomyoma underwent MRgHIFU at two centers. Of these women, 12 patients mean age 40 years (32-48y) had a single pedunculated subserosal fibroid. During treatment, these pedunculated fibroids were targeted, while sparing the stalk connection between the fibroid and the uterus. Contrast-enhanced T1-weighted MR images were obtained immediately after the treatment to measure the nonperfused volume ratio (NPVr) and to check stalk viability. Changes in tumor volume, diameter of the stalk, patient symptoms and adverse events were evaluated 6 months after treatment.

RESULTS

The mean volume of uterine fibroids was 142mL (82-222) and the mean NPV ratio was 82% (60-94). MR imaging follow-up at 6 months presented a 42% (18-60) reduction in the volume of the treated fibroids ($P<0.05$). All pedunculated subserosal fibroids remained connected to the uterus at 12-month post-treatment. The mean diameter of the stalk reduced from 2.8cm to 2.1cm with a mean 25% reduction ratio ($p<0.05$). The transformed symptom severity score improvement ratio at 6-month and 12-month post-treatment was 79% and 91%, respectively. There were no severe adverse events during the 12 months of follow-up.

CONCLUSION

The results in this study suggest that MRgHIFU could be an alternatively safe and efficacious method for pedunculated subserosal fibroids alternative to conventional surgeries. Further larger population studies with longer follow-up should be carried out to validate these results.

CLINICAL RELEVANCE/APPLICATION

MRgHIFU should be considered as an alternatively noninvasive treatment for patients with pedunculated subserosal fibroids without significant adverse events.

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VI225-SD-MOA2

MRI Markers of Disease Activity and Predictors of Progressive Arterial Disease in Takayasu Arteritis

Monday, Dec. 2 12:15PM - 12:45PM Room: VI Community, Learning Center Station #2

Participants
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PURPOSE

The aim of our study is to clarify the capability of MRI to assess disease activity in Takayasu arteritis (TA); moreover, to identify MRI features of disease vascular progression.

METHOD AND MATERIALS

In this longitudinal prospective study, we enrolled 75 TA patients who underwent an MRI examination yearly on a clinical 1.5 T MR scanner. We studied the supra-aortic trunks, the aorta and the visceral vessels with a standardized protocol, including PD black blood sequences, 3D high resolution T1-weighted sequences before and 10 minutes after contrast administration, and a first pass MRA. We measured arteritic lesions by wall thickness, lenght, percentage of stenosis or dilation; we further calculated differences in SNR and CNR measured for each lesion on pre and post contrast sequences. 222 MRI examination for a total number of 1506 lesions were analyzed by two indipendent radiologists, blinded to the patient's clinical status. Clinical and laboratory data were also collected.

RESULTS

In a *per lesion* analysis, lesion thickness correlated with several activity measures, as thicker lesions were present in patients with active disease according to NIH ($p<0.001$) and PGA of activity ($p<0.001$), in patients with higher CRP ($p<0.001$) and ESR ($p<0.002$). Similarly, higher arterial wall enhancement, assessed by ΔCNR, correlated with clinical activity scores, as well as with CRP ($p<0.001$). Both wall thickness and ΔCNR were higher in patients with active disease. Percentage of stenosis or dilation failed to correlate with clinical activity score or CRP levels, while correleted with damage score ($p<0.017$), thus reflecting the vascular extension of the disease. Moreover, lesions undergoing progression in the MRI follow-up were less frequent in patients undergoing steroid theraphy ($p<0.003$) and were long, thick, causing severe stenosis or dilation ($p<0.001$); higher ΔCNR at baseline MRI was predictive of vascular progression ($p<0.011$).

CONCLUSION

MRI is able to assess TA disease activity, demonstrating boh the luminal remodelling and the global vascular extension of TA; moreover arterial wall tickeness and enhancement can be used as imaging predictors of vascular progression during the MRI follow-up.

CLINICAL RELEVANCE/APPLICATION

MRI is useful tool for the evaluation of TA and should be integrated in the follow-up, for a better management of the patient.

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VI226-SD-MOA3

Accuracy and Performance Evaluation of a Smartphone-Based Augmented Reality Needle Guidance Platform

Monday, Dec. 2 12:15PM - 12:45PM Room: VI Community, Learning Center Station #3

Participants
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PURPOSE

To assess the accuracy and performance of a smartphone-based Augmented Reality (AR) guidance platform to facilitate CT-guided percutaneous needle placement.

METHOD AND MATERIALS

A needle guidance AR smartphone application was developed using Unity and Vuforia SDK platforms to display a planned needle trajectory on an iphone7 in real-time. An acrylamide-based phantom was utilized and containing multiple 2mm target beads embedded at 16cm depths. A 3D reference marker attached on the phantom is used to orient and track the phantom's pre-procedural CT image with the smartphone. Two experienced interventional radiologists (IR) performed 3 needle insertions in the phantom via CT-guided cognitive freehand (FH) and 3 insertions via AR guidance. Success was defined as a needle inserted within 5mm of a target bead. Needle placement was adjusted until success was achieved for each target. Each IR was allowed to take and view CT scans similar to their practice with human subjects. Total time and the number of CT scans required to achieve success were recorded, and results from both guidance methods were statistically compared.

RESULTS

For IR 1, the average time per successful needle placement using CT-guided FH compared to AR guidance was 16.8±8 min and 5.3±0.8 min ($p<0.05$), respectively. The average number of CT scans required to achieve success was 2.7±0.6 via CT guidance and 0±0 via AR guidance ($p<0.01$). For IR 2, the average adjusted time per successful needle placement using CT-guided FH compared to AR guidance was 9.4±2.2 min and 6.7±1.5 min ($p<0.05$), respectively. The average number of CT scans required was 1.3±0.6 using CT guidance and 0±0 using AR guidance ($p<0.05$). For each navigation task using AR guidance both operators required only a single insertion attempt to successfully navigate a needle tip to within 5mm of its intended target.

CONCLUSION

These data suggest that using this novel AR guidance platform in procedures requiring cognitive CT-guided freehand could reduce the number of intermittent CT scans and expedite procedural times.

CLINICAL RELEVANCE/APPLICATION

The AR application can effectively facilitate needle guidance in percutaneous procedures when real time imaging is not available, such as lung intervention. It may shorten operational time and reduce radiation dosages to patients and physicians.

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VI230-SD-MOA5

The Feasibility of Adaptive Statistical Iterative Reconstruction-V for Reducing Radiation Dose and Contrast Agent in CT Portal Venography with 'Three-Low' Technique

Monday, Dec. 2 12:15PM - 12:45PM Room: VI Community, Learning Center Station #5

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PURPOSE

To explore the feasibility of adaptive statistical iterative reconstruction-V(ASIR-V) for reducing radiation dose and contrast agent in CT portal venography(CTPV) with 'Three-Low' technique.

METHOD AND MATERIALS

Sixty patients with Revolution CT portal venography were randomly divided into group A and group B.Patients in group A were examined with conventional scanning, pre-setted ASIR-V ratio 0%,tube voltage 120kV,contrast agent dose 450mgI/kg,and were reconstructed with filtered back projection(FBP).Patients in group B were scanned with 'three low' technique,pre-setted ASIR-V ratio 40%,tube voltage 100kv,contrast agent dose 350mgI/Kg,and were reconstructed with 0%ASIR-V(FBP) to 100%ASIR-V with interval 10%ASIR-V.The CT values and standard deviation of the main branch of portal vein(MPV),left branch of portal vein(LPV),right branch of portal vein(RPV) were respectively measured to calculate the signal to noise ratio(SNR) and contrast to noise ratio(CNR).The subjective scores of image quality were obtained by two radiologists blindly with a 5-point system.

RESULTS

The general data showed no statistical difference between two groups(P>0.05).The effective radiation dose(2.36±0.57mSv) and contrast agent(21.47±3.67g) of group B were reduced by 38.9% and 19.13% than those in group A(3.86±1.80mSv and 26.55±2.91g)(P<0.05).There was no significant difference in the CT values among 12 groups images(P > 0.05)(Table 1).The SD values in group B decreased gradually while SNR and CNR increased gradually with the increase of ASIR-V ratio(P <0.05).The SD values of group B with 40% -100% ASIR-V were lower while the SNR and CNR values were significantly higher than those in group A (P <0.05)(Table 1 and Table 2).The subjective scores with 50%-100%ASIR-V in group B were higher than those in group A (P <0.05),among which the 80% ASIR-V reconstruction images obtained the highest score(P <0.05)(Table 3).

CONCLUSION

In CTPV with 'Three-Low' technique,50%-100%ASIR-V reconstruction can significantly reduce image noise and improve image quality, among which the 80%ASIR-V reconstruction can obtain the best portal venography,while the radiation dose and contrast agent reduce by 38.9% and 19.13% respectively than conventional scanning.

CLINICAL RELEVANCE/APPLICATION

In CTPV with 'Three-Low' technique,ASIR-V reconstruction can reduce radiation dose and contrast agent while 50%-100%ASIR-V reconstruction can maintain the image quality that meet clinical diagnosis.

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VI233-SD-MOA4

Quantitative Inflammatory and Imaging Biomarkers for the Prediction of Tumor Response to DEB-TACE in HCC

Monday, Dec. 2 12:15PM - 12:45PM Room: VI Community, Learning Center Station #4

Participants
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PURPOSE

To investigate the prognostic value of quantifiable laboratory and imaging features for tumor response in hepatocellular carcinoma (HCC) treated with drug-eluting beads transarterial chemoembolization (DEB-TACE).

METHOD AND MATERIALS

This IRB-approved retrospective study included 51 patients with treatment-naïve HCC (m/f 41/10) who received DEB-TACE (2012-2018). All patients underwent a laboratory work-up prior to treatment, including complete and differential blood count, liver function tests, and alpha-fetoprotein levels. Neutrophil-to-Lymphocyte-Ratio (NLR) and Platelet-to-Lymphocyte-Ratio (PLR) were calculated based on the differential blood count. Additionally, contrast-enhanced magnetic resonance imaging (MRI) was obtained prior to and 1 month after treatment. On T1-weighted triphasic MRI, PyRadiomics-based feature extraction was performed to quantify morphologic tumor characteristics such as sphericity indicating invasive tumor growth, and enhancement dynamics. Tumor response was assessed according to 3D quantitative European Association for the Study of the Liver (qEASL) criteria and correlated with baseline imaging and laboratory markers. Statistics included Pearson correlation and linear regression with alpha level adjusted to multiple testing.

RESULTS

Baseline laboratory values and immunologic scores were predictive of tumor response to DEB-TACE. Specifically, patients with increased NLR, PLR, or alkaline phosphatase levels were less likely to respond to therapy ($p=0.016$, $p=0.005$, $p<0.001$, respectively). As opposed to laboratory markers, quantitative radiomic imaging features at baseline did not predict tumor response. However, baseline tumor sphericity correlated with the systemic inflammatory status before treatment. Specifically, increased NLR and PLR were found in patients with less spherical and more invasively growing tumors ($p=0.009$, $p=0.003$, respectively).

CONCLUSION

This study demonstrates the prognostic value of quantitative laboratory (AP) and particularly immunologic biomarkers (NLR, PLR) at baseline to predict tumor response to DEB-TACE. Additionally, those inflammatory markers were also associated with imaging features indicative of tumor invasiveness before treatment.

CLINICAL RELEVANCE/APPLICATION

Readily available inflammatory biomarkers can be applied to achieve a quantifiable characterization of the tumor and systemic immune response and thus, personalize patient selection for DEB-TACE in HCC.

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AI022-EB-MOB

Dual Output V-Net CNN: A Virtual Iodinated Contrast Media Injection in Chest CT Toward a New Cardiac Risk Assessment

Monday, Dec. 2 12:45PM - 1:15PM Room: AI Community, Learning Center Hardcopy Backboard

Participants
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Conclusion

The training process plays the role of physician's visual learning; as training goes on, the quality of predictions improves. These algorithms could be used in the entire population of patients undergoing thoracic CT to extract cardiac information that would otherwise be lost.

Background

The coronary calcium score is a typical example of imaging biomarker extracted from a contrast-free Computed Tomography (cfCT) that improves the prediction of the cardiovascular risk. However, other potential biomarkers, such ventricular volumes and myocardial thickness, can be obtained only with the use of contrast medium injection as in CT Angiography (CTA) scans. Expert clinicians, after viewing several CTA develop the ability to transfer information about the shapes and positions of left atrium (LA) and left ventricle (LV) onto an image where they are not visible, thanks their prior knowledge and visual imagery. Aim of this work is to develop a deep neural network able to mimic the human visual learning, to create synthetic CTA images and evaluate the LA and LV size, starting from cfCT scans.

Evaluation

The study was conducted on 200 patients with the following datasets: a cfCT , a CTA and a multiclass mask labelled with the regions of entire cardiac area, LA and LV. Patient volumes were splitted in 150 cases to train the model, 10 cases for its validation and 40 for the performance evaluation. A fully convolutional V-Net architecture was customized with dual output layers to simultaneously produce both the increase in X-ray attenuation due to the CM injection in the cardiac chambers and the segmentation masks of the LA and LV. To guarantee the correct learning of both outputs we have adopted a combined loss function composed by two terms. The Mean Absolute Error (MAE) guided the generation of contrast enhanced volumes, while the categorical cross-entropy contributed to the segmentation of LA and LV chambers.

Discussion

After 1200 training epoch the model is able to generate synthetic CTA images with a great similarity and contrast dynamics compared to CTA (MAE=27±14HU) and a good overlap between the prediction output and the target heart masks (IOU=0.94±0.02).

AI023-EB-MOB

A Conversational Natural Language Processing (NLP) Model used to Scale Quality Improvement (QI) Processes for Tracking Radiologist Follow-Up Recommendations

Monday, Dec. 2 12:45PM - 1:15PM Room: AI Community, Learning Center Hardcopy Backboard

Participants
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Conclusion

Conversational NLP can be used to predict reporting radiologists' intention of making follow-up recommendations and worrisome findings. This novel application of NLP sets a precedent for how AI can be used to scale QI processes. This model can be used to dramatically streamline current efforts to identify patients lost to follow-up.

Background

Radiologists frequently play a critical role in the management of patients by directing the next steps of care through recommendations made within their reports. Up to 70% of patients are lost to follow-up, contributing to 10% of patient deaths resulting from inaccurate or delayed diagnosis. NLP is used to derive meaningful information from textual data, and has historically been used within the clinical domain to enhance the use of data contained within electronic medical record systems. Unlike traditional NLP approaches, *conversational* NLP - the same technology used by Apple's Siri® and Amazon's Alexa™ - does not use pretrained vectors for learning textual intentions. Instead, it learns intentions and ranks the similarities between them to derive meaning in the domain for which the model was trained (e.g. radiology reports).

Evaluation

Our model has been trained on 260 (130 positive, 130 negative) radiology report impressions using a long short-term memory neural network architecture with TensorFlow to recognize the intent of radiologists to make follow-up recommendations and report worrisome findings. Our application has a user-friendly interface which allows users to upload comma-separated value and Microsoft® Excel files containing radiology reports for analysis. Each report is analyzed by interpreting the impressions. The interpretation yields two binary results, *follow_up/no_follow_up* and *worrisome/not_worrisome*, and a confidence probability for the result.

Discussion

Our application has closed many gaps in care and dramatically scaled our institution's QI program for tracking patients who are found to be lost to follow-up. This is a process that required many hours of manual chart review, but is now partially automated, allowing human resources to be dedicated to reaching out to patients in need of intervention through follow-up.

AI037

Automated Detection and Localization of Large Vessel Occlusion on CTA of the Head Using Deep Learning Systems

Monday, Dec. 2 12:45PM - 1:15PM Room: AI Community, Learning Center

Participants
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Haris I. Sair, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Tocagen

PROGRAM INFORMATION

This invited poster is an example of the exciting work in the artificial intelligence domain being supported by the RSNA R&E grant program. Visit each one, AI027 through AI039, to learn about the latest updates.

Printed on: 10/29/20

AI211-SD-MOB1

CT Image Retrieval Based on Morphological Similarities in Diffuse Lung Diseases Using a Deep Convolutional Neural Network

Monday, Dec. 2 12:45PM - 1:15PM Room: AI Community, Learning Center Station #1

Participants
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PURPOSE

When radiologists encounter diagnostic difficulties, the retrieval of images from cases with a confirmed similar morphology may provide clinically useful information. Our CT image retrieval system uses a deep convolutional neural network (DCNN). The retrieved query images featured morphologically similar lesions and their 3D distribution (Figure). We investigated the clinical applicability of our system for the diagnosis of diffuse lung diseases (DLDs).

METHOD AND MATERIALS

We extracted 20 query- and 500 test cases from our institute's CT database. Two board-certified radiologists consensually reviewed the 520 scans and determined the nature and distribution of DLDs based on 5 DLD categories. The results represented the gold standard for the lesional nature. The 20 query cases included 4 with lesion consolidation, 4 with diffuse ground glass opacity (GGO), 4 with honeycomb features, 4 with granular shadows, and 4 with emphysema. The test cases included 49 with consolidation, 93 with GGO, 49 with honeycombing, 75 with granular shadows, 55 with emphysema, and 179 with normal lungs. From the test cases we retrieved those that exhibited categorical similarities with the query cases and calculated the mean precision value for each category. Precision was defined as the fraction of accurately categorized test cases.

RESULTS

The mean precision value for the correct categorization of the test cases was 0.79 (average: consolidation = 1.00, GGO = 0.46, honeycombing = 0.97, granular shadows = 0.51, emphysema = 1.00). The precision for the correct categorization of DLDs was lower for GGO and granular shadows than for the other 3 categories.

CONCLUSION

CT image retrieval based on specific morphological characteristics was feasible for the imaging diagnosis of DLDs.

CLINICAL RELEVANCE/APPLICATION

CT image retrieval based on morphological similarities may yield diagnostically helpful information.

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AI255-SD-MOB3

Automatic Detection of Critical Findings in Brain MRI Exams Using Residual Convolutional Neural Networks

Monday, Dec. 2 12:45PM - 1:15PM Room: AI Community, Learning Center Station #3

Participants
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CONCLUSION

A 3D CNN-based approach can enable satisfactory detection of critical brain MRI findings, using low-density T2-weighted data, and sets a benchmark for 'red-flagging' applications that communicate critical, urgent, and unexpected significant radiological findings.

Background

Existing machine learning approaches to detect unexpected and abnormal findings in brain imaging have predominantly focused on CT rather than multimodality MRI. The aim of this study was to develop a fully convolutional neural network (CNN) for detection of critical findings in routine head MRI examinations and hence facilitate the reporting prioritisation.

Evaluation

We designed a 3D-CNN consisting of multiple layers of convolution filters, combined with residual connections to boost the classification performance. The model was trained, using TensorFlow, in a dataset of 2450 anonymised T2- and T2-FLAIR-weighted images from routine head MRI exams (1.5 & 3T scanners). The processing was done in GPU using NVIDIA's Cuda™. The proposed approach demonstrated model accuracy >95% (95% CI: 94.3-97.7%), yielding 96% sensitivity (95% CI: 93.2-97.7%), 94% specificity (95% CI: 88.3-96.9%) and area under the curve (AUC) of 0.98 (95% CI: 0.97-0.99).

Discussion

The proposed methodology is robust and versatile based on low-density, single modality MR images, which are abundant in the real-world datasets. The 3D-CNN showed satisfactory performance to assist the radiologist in report-triaging of randomly arriving MRI cases in large volume centres or networks of (tele)radiology practices, which usually have different requisition - delivery mechanisms. The early detection of significant unexpected - abnormal findings (such as mass lesions, hydrocephalus, hemorrhage, stroke) can help reduce the turnaround reporting time and variability of patient waiting, and increase the patient safety by communicating and acting upon critical findings in a timely fashion. Larger cohorts with more modalities (DWI, T1w, contrast-enhanced-T1w) might show comparatively better diagnostic performance and ought to be investigated in diverse clinical settings. A comparison of the 3D Convolution with 2D ConvNets to leverage 'knowledge transfer' might be also considered.

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AI257-SD-MOB2

Transfer Learning Approach to Generalize a State-of-the-Art Prostate Segmentation Model

Monday, Dec. 2 12:45PM - 1:15PM Room: AI Community, Learning Center Station #2

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PURPOSE

Deep learning models have not yet been widely adopted into radiology practice, in part due to poor performance across multiple centers. Herein, we evaluate the performance of fine-tuning (i.e. transfer learning) a prostate segmentation model achieving state-of the-art developed at one expert center at multiple external cohorts.

METHOD AND MATERIALS

The training set consisted of a total of 658 prostate MRIs acquired at 3T from a single center with whole gland prostate segmentation performed on T2W axial series by a single expert radiologist (>10 years). Deep learning-based segmentation was performed using AH-Net, a combined 2D/3D convolutional neural network architecture developed for 3D medical imaging segmentation tasks. The benchmark single-center dataset was split into 72%/28% training/validation sets for model training, which utilized 3D data augmentation incorporating various noise, intensity, and spatial-based transformations combined with Adam optimization and a learning rate of 0.0001. Following benchmark training, transfer learning was used to fine-tune the model on 6 heterogeneous datasets not included in the initial model training consisting of 5 external cohorts and one unseen cohort from a benchmark center. For each additional cohort, data were split into 40%/10%/50% training/validation/testing. The Dice similarity coefficient was utilized to evaluate model performances.

RESULTS

The benchmark model achieved a Dice score of 93.9% on the validation set, compared with the current state-of-the-art of 91.5%. Data from the external cohorts were variable in size (N=10-75), magnet strength (1.5T vs. 3T), and acquisition protocols. The overall Dice similarity coefficient across all independent samples was 92.3%, with a range of 90.7% on a dataset fine-tuned with only 4 samples to 93.8% for a center fine-tuned with 22 samples.

CONCLUSION

The combination of a deep learning architecture designed for 3D MRI data (AH-Net), 3D data augmentation, and a large high-quality benchmark training dataset demonstrated state-of-the-art results for prostate gland segmentation at T2W MRI. Fine-tuning of this benchmark model on external cohorts maintained excellent performance despite domain size and quality differences.

CLINICAL RELEVANCE/APPLICATION

Fine-tuning of models on a small mount of center-specific data is a potential methodology for transferring state-of-the-art models across centers.

BR200-ED-MOB7

Unusual Breast Implant-Associated Complications and Pathology Correlation

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #7

Participants
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Jorge Palomar Ramos, Madrid , Spain (*Abstract Co-Author*) Nothing to Disclose
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Maria Jose Ciudad Fernandez, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

- To review the unusual complications associated with breast implants.- To show the radiological findings at the multimodality imaging typically used to evaluate these complications with a combination of mammography, US, MRI, and PET-CT. - To highlight the importance of correct management of a late periprosthetic seroma to diagnose breast implant-associated anaplastic large cell lymphoma. - To revise the pathological findings of these rare complications.

TABLE OF CONTENTS/OUTLINE

Breast implants frequently are used to reconstruct or augment breast and are associated with common complications that mainly include early peri-implant fluid collection or hematoma, infection, capsular contracture, and rupture. Other adverse effects less common are late seroma and infection, silicone-induced granuloma of breast implant capsule, fibromatosis, and breast implant-associated anaplastic large cell lymphoma(BIA-ALCL). We present cases of all these rare complications diagnosed at our institution showing the main radiological findings and their pathological correlation.One of the most worrisome complications is BIA-ALCL that usually manifests as a late seroma. Because of that, the correct management of late seroma is essential for the early diagnosis of BIA-ALCL. We review the management of late seroma and its differential diagnosis.

BR201-ED-MOB8

A Pictorial Review of Breast Procedures Complications

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #8

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TEACHING POINTS

Describe and illustrate some complications of percutaneous breast biopsies; Review the management principles for the main complications (Hemorrhage and hematoma; Infecction; Arteriovenous fistula; Pseudoaneurysms; Infection complications; Milk fistula) of percutaneous breast biopsies.

TABLE OF CONTENTS/OUTLINE

Percutaneous breast biopsy is a simple and minimally invasive procedure that is widely used as a diagnostic tool for pathologic evaluation of suspicious breast lesions. Complications are not common, and the majority of these complications are minor, although some can have clinical consequences. Discuss the epidemiology, work-up and treatment of main complications of percutaneous breast biopsies. Imaging appearance by modality (MRI, ultrasound and mammography) of percutaneous breast biopsies. Describe the management and prognosis of patients who present with this diagnosis. Review our institution's cases of complications after percutaneous breast biopsy. Identify the best ways to prevent this complication.

BR202-ED-MOB9

RECIST Applied to Breast MRI: The Real Life

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #9

Awards
Certificate of Merit

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TEACHING POINTS

• To prepare breast radiologists to evaluate neoadjuvant treatment response on breast magnetic resonance imaging (MRI). • To present Response Evaluation Criteria in Solid Tumors (RECIST) version 1.1 used for this assessment. • To ilustrate each RECIST category through clinical cases from our institution. • To present tips to reduce interobserver variability applying literature review.

TABLE OF CONTENTS/OUTLINE

• Brief description of Response Evaluation Criteria in Solid Tumors (RECIST) version 1.1 • Brief introduction of the importance of MRI in assessing neoadjuvant chemotherapy response in breast cancer patients. • Present main neoadjuvant treatments available up to date. • Possible effects on neoadjuvant treatment on breast cancer imaging. • Target selection and presentation of all patterns of neoadjuvant treatment response in breast MRI according to RECIST 1.1 criteria. • Illustrative cases of breast tumor response: o Complete response o Partial response o Stable disease o Progressive disease o Lymph nodes assessment • Tips and tricks • Limitations of RECIST 1.1 criteria for breast cancer

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BR230-SD-MOB1

Positive Predictive Value for Malignancy of the Molecular Breast Imaging Lexicon

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #1

Participants
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PURPOSE

Evaluate the positive predictive values (PPVs) for malignancy of a validated molecular breast imaging (MBI) lexicon.

METHOD AND MATERIALS

Patients with a positive (BI-RADS analogous categories 0, 3, 4, 5, or 6 with a finding contralateral to the known malignancy) dual-detector CZT MBI performed from 8/2005-8/2017 were retrospectively reviewed. Lesion type [mass vs. non-mass uptake (NMU)], distribution, intensity, and number of views on which the lesion was seen were recorded based on a published gamma breast imaging lexicon, and correlated with follow-up imaging and/or pathology. The association of each characteristic with malignancy was tested by a mixed effects logistic regression model. Additionally, a multivariable model was constructed with lesion type (mass vs. NMU), number of views the lesion was observed on, and lesion intensity.

RESULTS

in 550 patients with a positive MBI, 634 lesions were detected of which 26% (n=165) were malignant and 74% (n=455) benign. The majority were NMU (549/634, 87%). The PPV for malignancy was significantly associated with assessment category [5% for category 0 (n=80), 2% for category 3 (n=214); 40% for category 4 (n=293), 87% for category 5 (n=46), p<.0001]; lesion type (73% for mass lesions vs. 19% for NMU; p<.0001); lesion distribution [multiple regional 0% (0/4); regional 4% (5/115), 4%; focal 21% (77/373); diffuse 33% (4/12), 33%; segmental 38% (17/45); p<.0001]; and intensity of lesion uptake [15% (45/306) for mild; 22% (49/221) for moderate (OR 0.94, 0.55-1.61); and 66% (71/107) for marked (OR 3.22, 1.62-6.42); p=0.0006]. If a lesion was seen on a single MBI view, 6% were malignant (5/88); 2 views, 16% (33/207); 3 views; 15% (12/82); 4 views, 45% (114/256), p=0.0007.

CONCLUSION

Lesions described as masses, and those with marked intensity radiotracer uptake have the highest predictive value for malignancy on MBI, with segmental uptake demonstrating the highest PPV for NMU. Multiple regional and regional uptake have low PPVs for malignancy, and may be appropriate to place in a category 3 (short-term follow-up) assessment.

CLINICAL RELEVANCE/APPLICATION

Understanding the predictive features of MBI lexicon descriptors will improve radiologist interpretation of MBI exams, and allow appropriate management and follow-up of patients.

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BR231-SD-MOB2

Automatic 3D Segmentation of Breast MR T1 Images Using 3D Convolutional Neural Network

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #2

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PURPOSE

To develop and evaluate a deep learning based algorithm for the breast fibroglandular tissue (FGT) and background parenchymal enhancement (BPE) volume segmentation and classification in breast MR images

METHOD AND MATERIALS

Total 711 women (mean age, 55.2 years; range 26 - 89 years) who were diagnosed with invasive breast cancer and underwent preoperative breast MR, between 2014 and 2017 were enrolled in this study. Manual segmentation was performed for the breast and FGT regions. BPE region was determined by thresholding using the subtraction image and segmented FGT mask. For classification, two radiologists independently assessed the categories of FGT and BPE of contralateral breast by consensus. Deep learning based algorithm was designed to segment and measure the volume of whole breast, FGT, and BPE and classify FGT and BPE grade. 594 patients were used for development (training and validation sets), and 117 patients for evaluation (test set). Dice similarity coefficients (DSC) and Spearman correlation analysis were used to compare the segmental results, and kappa statistics were performed for classification results.

RESULTS

The range of DSC values for breast and FGT were 0.88-0.94 (mean 0.91±0.03), 0.73-0.94 (mean 0.83±0.10), respectively. The correlation coefficient between manual segmentation and deep learning were 0.98 for breast, 0.93 for FGT, and 0.96 for BPE, respectively. Agreement in classification between deep learning based algorithm and radiologists in test set were good for FGT (k = 0.65; 95% confidence interval [CI]: 0.51, 0.78) and moderate for BPE (k = 0.46; 95% confidence interval [CI]: 0.32, 0.59).

CONCLUSION

This deep learning based algorithm can provide reliable segmentation and classification results for FGT and BPE in breast MR images.

CLINICAL RELEVANCE/APPLICATION

FGT and BPE are known as risk factors for breast cancer and are associated with poor prognosis. Deep learning based algorithm can provide quantitative and objective information of FGT and BPE.

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BR232-SD-MOB3

Shear Wave Elastography for Early Prediction of Response to Neoadjuvant Chemotherapy in Patients with Invasive Breast Cancer

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #3

FDA Discussions may include off-label uses.

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PURPOSE

This study was designed to evaluate the performance of shear wave elastography (SWE) parameters in predicting the pathological response to neoadjuvant chemotherapy (NAC) of invasive breast cancer.

METHOD AND MATERIALS

The prospective study recruited 90 eligible patients from Aug 2016 to Dec 2018. SWE was performed before biopsy (time point t0, elasticity E0), after the first and second, fourth cycles of anthracycline-based or anthracycline/taxane-based NAC, and compared to a pre-NAC baseline scan. Tumor stiffness was assessed by quantitative SWE velocity. SWE parameters measured included changes in bidimensional tumor size on SWE time, quantitative SWE velocity, the relative changes in them after the first and second, fourth NAC cycles were considerd as the variables[Δt1, Δt2, Δt4]. The pathological response was classified according to the residual cancer burden (RCB) protocol, RCB-0 (pCR, 0); RCB-I (minimal residual disease, 0-1.36); RCB-II (moderate residual disease, 1.36-3.28); and RCB-III (extensive residual disease,>3.28). The group of major histological response (MHR) include RCB-0 and RCB-I, the group of non-major histological response (NMHR) include RCB-II and RCB-III. Correlations between SWE variables and RCB scores were evaluated. The predictive diagnostic performances of SWE parameters, and the predictive RCB (predRCB) score determined by a linear regression model were compared. Besides, this study compared performance of shear wave elastography parameters and lesion size in the grey-scale ultrasonic image and magnetic resonance image in predicting the pathological reponse to neoadjuvant chemotherapy of invasive breast cancer.

RESULTS

SWE variabls were significantly different among the MHR and the NMHR groups. The SWE variables of Δt2 had significantly better diagnostic performance than other variables regarding predicting the pathological. Tumor size on SWE time had significantly diagnostic performance earlier than conventional ultrasound and MRI.

CONCLUSION

Our resullts suggest that SWE can be potentially used as an early predictor of tumor therapy response during NAC for invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

(dealing with shear wave elastography)'SWE can predict the pathological response to NAC of invasive breast cancer earlier than morphological change.'

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BR254-SD-MOB4

Impact of Native and Artificially Improved AI-Based CADx on Breast US Interpretation

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #4

Participants
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PURPOSE

In an enriched case set, our purpose was to assess the impact of native computer-assisted diagnosis (CADx) as well as the impact of CADx with improved sensitivity or specificity on breast ultrasound (US) interpretive performance.

METHOD AND MATERIALS

Orthogonal paired US images of 319 lesions identified on screening were assembled, including 88 (27.6%) cancers (median size 7 mm, range 1 to 34). Nine MQSA-qualified radiologists with 0.5 to 25 years' experience in breast imaging served as observers. Each radiologist reviewed the images in random order and provided a BI-RADS assessment without then with CADx (Koios Medical, Piscataway, NJ). This was done in three modes: 1) native CADx (with output benign, probably benign, suspicious, or malignant); 2) high sensitivity mode; and 3) high specificity mode. For the latter 2 modes, output/score from CADx was artificially modified while constraining the AUC at approximately 0.9 for the CADx alone, with binary output of benign or malignant. Four radiologists began reading in mode 2 and five in mode 3. AUC by reader by mode was determined.

RESULTS

CADx alone had AUC of 0.82 (95% CI: 0.77-0.89). For mode 1, native CADx, average AUC was 0.82 (range 0.76 to 0.84) without CADx and 0.82 (range 0.77 to 0.85) with CADx cues; five readers had slight increase (one least experienced reader significantly improved) and four slight decrease in AUC (none statisitically significant). For mode 2, high sensitivity, all readers' AUCs increased after the CADx cues: average AUC was 0.83 (range 0.78 to 0.86) before CADx cues and increased significantly to 0.88 (range, 0.84 to 0.90) after CADx, $p = 0.0002$. For mode 3, high specificity, again all readers' AUCs increased after CADx cues: average AUC was 0.82 (range, 0.76 to 0.84) before CADx cues and increased significantly to 0.89 (range, 0.87 to 0.92) after CADx, $p < 0.0001$.

CONCLUSION

CADx alone currently performs at about the same level as an experienced radiologist. Once the performance of CADx was artificially improved, radiologist performance significantly improved in each of high sensitivity and high specificity modes.

CLINICAL RELEVANCE/APPLICATION

Further improvement of AI-based US CADx is needed. Radiologist performance interpreting breast US can be improved by CADx if the CADx performs at an AUC approximately 0.08 higher than the radiologist alone.

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BR255-SD-MOB5

Relative Mammographic Density Quantification: Deep Learning and Elo Rating

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #5

Participants
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PURPOSE

To build a quantifiable deep learning model, high-quality annotations such as segmentation are generally needed. In this study, we aim to develop a quantitative method to measure breast densities that can be readily understood and adopted by clinicians via two methods not using quantity annotations: 1) a deep-learning regression model that quantifies mammographic density as population percentile, and 2) Elo rating of breast density calculation.

METHOD AND MATERIALS

We collected density classifications described in 131,468 mammograms that were archived from 2006 to 2012 at our hospital for the purpose of calculating a median percentile value of each category. Using the median density percentile value of each density, we built a residual convolutional neural network for regression. To train a regression model, we randomly selected and downloaded 10,000 cases of mammograms (1000, 4000, 4000 and 1000 cases for each category) which have all four views to train a deep learning model. We also selected 200 additional random cases of mammographic exams to test and evaluate deep learning predictions. To evaluate this model, we designed an Elo rating system by comparing two exams' densities (Elo rating used to be used in sports to compare various types of players). Totaling 2000 matches, they were performed by four experts to obtain Elo ratings of 200 test cases. We calculated Spearman's rank coefficient (Spearman's ρ) between the regression results and the Elo ratings to evaluate the model.

RESULTS

The median percentiles of density A, B, C, and D are 3.92, 30.04, 73.21 and 97.10, respectively. Mean Elo ratings of density A, B, C and D were 757±450, 1235±412, 1987±325 and 2352±360, respectively, with the test cases. There was a strong correlation between predictions of the Deep learning model and the Elo ratings (Spearman's $\rho = 0.929$, $p<0.001$).

CONCLUSION

We quantified mammographic density by deep learning regression without quantity annotation.

CLINICAL RELEVANCE/APPLICATION

By providing a quantitative scale of breast density, this model can readily be used by clinicians as a guidance. And Elo ratings are applicable to other medical problems with vague definitions.

BR256-SD-MOB6

Assessment of Residual Breast Cancer After Neoadjuvant Chemotherapy by Using Texture Analysis of Dynamic Contrast-Enhanced MRI

Monday, Dec. 2 12:45PM - 1:15PM Room: BR Community, Learning Center Station #6

Participants
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PURPOSE

To assess the ability of texture analysis(TA) on dynamic contrast enhanced (DCE) MRI in identifying residual cancer of on pre-operative contrast-enhanced MRI in evaluation of residual tumor after neoadjuvant chemotherapy(NAC) for mass-like breast cancer.

METHOD AND MATERIALS

Consecutive breast cancer patients who received NAC before operation were enrolled. Regions of interests covering the entire enhanced areas of tumor site were drawn to extract parameters, including volumes and 17 TA features acquired separately on subtractive images of early and late phases to pre-enhanced phase on MR DCE sequences by using a house made radiomics software developed on 3D slicer platform. Comparison of features were made between pathologic complete response (pCR) and non-pCR groups. Multivariate cox regression and receiver operating characteristic (ROC) curve were used to select useful features and to assess the overall diagnostic abilities and among different molecular subtypes.

RESULTS

Totally 112 patients (42 pCR and 70 non-pCR) with mass-like breast cancer on initial MR were enrolled and grouped as pCR(42 cases) and non-pCR (70 cases). Further analysis divided the cohort by residual tumor volume(V) as V=0, 0=0.5cm3. Multivariate regression analysis on group with 0 **CONCLUSION**

TA is a useful tool to depict tumor heterogeneity in post-treatment mass-like breast cancer patients. By stratification of residual volume and combination of uniformity, maximal and mean of enhancement on DCE late phase, MR ability to identify complete response is significantly improved in sensitivity and overall accuracy.

CLINICAL RELEVANCE/APPLICATION

MR has the potential ability to identify complete response and assese treatment

CA161-ED-MOB8

The Puzzle of Describing Congenital Heart Disease: Recognizing the Individual Pieces and Connecting Them Together using Anderson's Sequential Segmental Analysis

Monday, Dec. 2 12:45PM - 1:15PM Room: CA Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
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TEACHING POINTS

Complex congenital heart disease (CCHD) is usually described using one of two "languages": Van Praagh's segmental approach (VPSA) and Anderson's sequential segmental analysis (ASSA).- Although some aspects of VPSA were incorporated into ASSA, like dividing the heart analysis in three main segments (atria, ventricles and great arteries), ASSA innovates by emphasizing the connection between these pieces over their spatial relationship.- Radiologists should determine which approach is preferred by their referring physicians in order to report CCHD in an unambiguously, accurately and succinctly way.- This review contemplates ASSA, that, even though not brief, is certainly simple enough, using a schematic puzzle model for better understanding.

TABLE OF CONTENTS/OUTLINE

WHAT DEFINES A CARDIAC CHAMBER? Specific anatomic aspects of the cardiac structures STEPS OF THE ASSA: comparing schematic puzzle with imaging examples- Atrial segment: atrial situs and venoatrial connections- Ventricular segment: atrioventricular connections and valve morphology, ventricular topology, ventriculoarterial connection, arterial valve and infundibular morphology.- Great arteries: aortic topology in relation to pulmonary trunk, aortic and pulmonary anatomy.- Associates anomalies: atrial and ventricular septal defects, pulmonary and abdominal anomalies.CONCLUSION

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CA209-SD-MOB1

What is The Linear Mid-Wall LGE of The Ventricular Septum Seen in Cardiac MRI?

Monday, Dec. 2 12:45PM - 1:15PM Room: CA Community, Learning Center Station #1

Participants
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Teruhito Mochizuki, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In terms of late gadolinium enhancement (LGE) MRI, the extent and pattern of LGE varies according to the underlying pathological process and contributes therefore to establish the correct diagnosis in cardiac disease. However, we often see nonspecific linear LGE of the basal septum in the short axis view, leading to misdiagnosis. We made the hypothesis that such LGE is part of anterior septal perforator arteries being portrayed. The purpose of this study is to compare the linear LGE found in the basal septum at MRI with the anterior septal perforator arteries identified by coronary CT angiography (CTA).

METHOD AND MATERIALS

We retrospectively selected 148 patients, who underwent retrospective ECG-gated coronary CTA and comprehensive cardiac MRI with the image session period between coronary CTA and MRI within one year. We assessed LGE which is linear in the basal septum in the short axis view, observable at 1.5 cm or more and at 2 short axis slices or more. As for coronary CTA, we made the same short axis view as MRI and compared the presence and length of the anterior septal perforator arteries with LGE.

RESULTS

Finally, 111 patients were analyzed. Among the 111 cases analyzed, there were 55 cases in which LGE satisfying the conditions were observed in the septum and 56 cases in the case of not admitted. Among 55 cases with LGE recognized in the septum by MRI, anterior septal perforator arteries were shown in 53 cases in the same part by CTA (96.4%). On the other hand, in 56 cases in which LGE was not observed in the septum by MRI, anterior septal perforator arteries were identified in only 39 cases in CTA (69.6%). A linear regression analysis revealed that there was good agreement between LGE and CTA for all measurements. The average CTA length of cases with anterior septal perforator arteries consistent with the LGE part was 21.3±8.4 mm. On the other hand, for cases in which LGE was not observed, the average length in CTA was 10.2±8.3 mm ($p<0.01$).

CONCLUSION

The nonspecific linear LGE observed in the basal septum in the short axis image by MRI is likely to see anterior septal perforator arteries running in the same area.

CLINICAL RELEVANCE/APPLICATION

This finding may be pitfall in cardiac MRI interpretation in differentiation from other cardiomyopathy, especially mid-wall fibrosis in dilated cardiomyopathy.

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CA210-SD-MOB2

Detection of Left Atrial Appendage Thrombi by Third-Generation Dual-Source Dual-Energy CT: Iodine Concentration versus Conventional Enhancement Measurements

Monday, Dec. 2 12:45PM - 1:15PM Room: CA Community, Learning Center Station #2

Participants
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PURPOSE

The purpose of this study was to compare the diagnostic performance of Dual-energy computed tomography (DECT)- derived iodine concentration (mg/ml) with conventional enhancement measurements (HU), in detecting left atrial appendage (LAA) thrombi and differentiating thrombi from circulatory stasis in atrial fibrillation (AF) patients referred for catheter ablation.

METHOD AND MATERIALS

Consecutive patients were prospectively recruited and scanned using a third-generation dual-source CT system in dual-energy mode. Regions of interest were placed inside the filling defect in the LAA and ascending aorta (AA) of the same sections, to determine iodine concentration and the LAA/AA HU ratio. The diagnostic performance of iodine concentration and LAA/AA HU ratios were compared using transesophageal echocardiography (TEE) as the reference standard.

RESULTS

Among 302 patients, 10 thrombi and 27 cases with spontaneous echo contrast (SEC) were detected by TEE. Diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value of iodine concentration were superior to those of LAA/AA HU ratios (iodine concentration: 99.7%, 100%, 99.7%, 90.9%, and 100% vs. LAA/AA HU ratios: 96.0%, 100%, 95.9%, 45.5%, and 100%) in detecting LAA thrombi. The area under the receiver operating characteristic curve of iodine concentration (0.996; 0.898-1.000) was significantly larger than that of the LAA/AA HU ratio (0.881; 0.733-0.964) in differentiating thrombi from circulatory stasis ($P<0.05$).

CONCLUSION

DECT-derived iodine concentration was associated with improved diagnostic accuracy compared with conventional enhancement measurements in detecting LAA thrombi and differentiating thrombi from circulatory stasis in AF patients.

CLINICAL RELEVANCE/APPLICATION

DECT-derived iodine concentration (mg/ml) was superior to conventional enhancement measurements (HU) in detecting LAA thrombi and differentiating thrombi from circulatory stasis in patients with AF.

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CA211-SD-MOB3

Prediction Model for Aortic Stenosis Severity Based on Aortic Valve Calcium on Cardiac Computed Tomography: Incorporation into Radiomics and Machine Learning

Monday, Dec. 2 12:45PM - 1:15PM Room: CA Community, Learning Center Station #3

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PURPOSE

We aimed to develop a model that can predict severe aortic stenosis (AS) using the computed tomography (CT) radiomic features of aortic valve calcium (AVC) and machine learning algorithm.

METHOD AND MATERIALS

We retrospectively enrolled 408 patients who underwent cardiac CT scan from March 2010 to August 2017 and had echocardiographic exams (231 patients with severe AS on echocardiography [severe AS group] and 177 patients without severe AS [non-severe AS group]). Datasets were divided into training sets (312 patients) and validation sets (96 patients) with a reference of specific time point. On the non-contrast cardiac CT scan, volume of AVC was calculated and a total of 128 radiomic features of AVC were extracted. Three feature selection methods (least absolute shrinkage and selection operator [LASSO] using 5-cross validation, Random Forest [RF], and XGBoost) were assessed for their performance in the diagnosis of severe AS, using c-index. The performances of the radiomics models were compared with the prediction model based on AVC volume.

RESULTS

The radiomic score derived from LASSO was significantly different between severe AS group and non-severe AS group (median 1.37 vs. 0.19, $p<0.001$). Radiomics prediction model based on features selection by RF showed the highest c-index 0.8632 (95% confidence interval [CI] 0.7822-0.9443) in the validation set, followed by model based on XGBoost (c-index 0.8655, 95% CI 0.7893-0.9417) and LASSO (c-index 0.857, 95% CI 0.7762-0.9377). Radiomics models based on the feature selection methods of RF and XGBoost showed higher predicted probability of severe AS compared with a model based on AVC volume only (c-index 0.8618, 95% CI 0.7762-0.9376 in the validation set), although it was not statistically significant ($P>0.05$ for all).

CONCLUSION

Radiomic feature of AVC performs better than AVC volume for prediction of severe AS.

CLINICAL RELEVANCE/APPLICATION

By applying radiomics and machine learning to the aortic valve calcium score, it may allow to distinguish severe AS better in patients with limited assessment from echocardiography, such as patients with low-flow, low-gradient AS.

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CA234-SD-MOB4

Feasibility of Ultra-Low Contrast Dose and Low Radiation Dose for CT Angiography of Left Atrium and Pulmonary Veins with 80kV and ASIR-V

Monday, Dec. 2 12:45PM - 1:15PM Room: CA Community, Learning Center Station #4

Participants
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PURPOSE

To evaluate the feasibility of achieving ultra-low contrast dose and low radiation dose for CT angiography (CTA) of the left atrium (LA) and pulmonary veins (PV) using 80kV and adaptive statistical iterative reconstruction (ASIR-V) on a 16 cm wide-detector CT.

METHOD AND MATERIALS

60 patients with AF for LA and PV CTA before scheduled radiofrequency ablation underwent ECG-triggered, one beat CCTA on a 16cm wide-detector CT scanner under free breathing. Patients were prospectively and randomly divided into group A (n=30) with 80kVp, contrast dose of 0.4ml/kg mixed solution of 75% contrast and 25% normal saline and image reconstruction with 80%ASIR-V; and group B (n=30) with 120kVp, contrast dose of 0.9ml/kg and 50%ASiR-V. CT value (HU) of LA, PV and pulmonary artery (PA) were measured. CT value difference between LA and PA (ΔHU) was calculated: ΔHU=HULA-HUPA. The subjective score was assessed with a 5-point scale system. The effective radiation dose (ED) was evaluated and compared between two groups.

RESULTS

Patients of Group A and Group B showed no significant differences in gender, age, weight, and BMI (p>0.05). Group A reduced radiation dose (mSv) by 69.8% (1.10±0.21 vs. 3.64±1.01, p<0.001), contrast dose (g I) by 57.9% (9.47±1.34 vs. 22.48±3.15, p<0.001) and Iodine Delivery Rate (g I/s) by 36.2% (1.18±0.15 vs. 1.8, p<0.001). There were adequate enhancements in LA and PV of both groups. There were no differences of mean attenuation in LSPV, LIPV, RSPV and RIPV (p>0.05). CT value (HU) in LA of group A was higher than group B (568.98±129.57 vs. 501.07±62.15, p=0.02). ΔHU of group A was higher than group B (364.27±107.34 vs. 186.79±131.97, p<0.05) for better separation between LA and PA. There was no difference in the subjective score between group A and group B (4.33±0.55 vs. 4.21±0.77).

CONCLUSION

It is feasible to obtain excellent images for left atrium and pulmonary veins with ultra-low contrast dose and low radiation dose in CTA by using 80kV and ASIR-V on a wide-detector CT system.

CLINICAL RELEVANCE/APPLICATION

The use of low tube voltage and iterative reconstruction on a wide-detector CT makes it possible to obtain high image quality CTA of LA and PV at reduced radiation and contrast dose.

CA235-SD-MOB5

Role of Cardiac MRI in Identification of Myocardial Fibrosis in Patients of Non-Ischemic Dilated Cardiomyopathy

Monday, Dec. 2 12:45PM - 1:15PM Room: CA Community, Learning Center Station #5

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PURPOSE

To study the prevalence of myocardial scar and its quantification on Cardiac MRI (CMRI) and its utility in predicting clinical outcomes in patients of non-ischemic dilated cardiomyopathy (NIDCM)

METHOD AND MATERIALS

In this prospective observational study we enrolled 88 consecutive patients of clinically diagnosed NIDCM. Routine CMR sequences was done including black blood imaging T1W and T2W, Steady state free precession Cine images, first pass perfusion images at rest and post contrast (10-15 minutes) 2D segmented inversion recovery gradient recalled echo (GRE) imaging during diastole, inversion time set to null normal myocardium. Myocardial scar was defined as late gadolinium enhancement (LGE) and it's extent was quantified using visual scoring method. Patients were followed-up for major adverse cardiac events (MACE), including cardiovascular death, aborted sudden death and heart failure for a mean period of 12 months. ROC curve was generated to know the accuracy of LGE extent in predicting MACE.

RESULTS

Of 88 patients (median age: 42 years, 66% male), mainly presenting with congestive heart failure symptoms (79%) and palpitations (16%). On CMR 50% of patients showed LGE of variable pattern out of which mid myocardial enhancement was most frequent. The percentage of LGE in these patients ranged from 1.4% to 88%, with a median of 25%. With LGE cut off of 26%, MACE can be predicted with 70% sensitivity and 73.5% specificity (AUROC=0.75). During 12 months follow-up, 16 patients developed MACE,out of which 10 were LGE+ and 6 were LGE-ve.The higher event rate was observed in patients with LGE volume of >26% compared to LGE <26% (43.6% vs 10.7%).

CONCLUSION

In NIDCM, presenting with heart failure or ventricular arrhythmias, presence of myocardial scar and its extent gives additional prognostic information compared to left ventricular ejection fraction (LVEF) and other traditional risk factors. Even though the final diagnosis is uncertain in NIDCM, extensive amount of LGE should be considered as a sign of poor prognosis.

CLINICAL RELEVANCE/APPLICATION

Risk stratification depending solely on LVEF in NIDCM patients may be fallacious, as most patients who experience sudden cardiac death (SCD) did not have severely reduced LVEF. Identification and quantification of myocardial fibrosis could be used as an adjunct for more accurate risk stratification in these patients.

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CA236-SD-MOB6

Could a Very Short MRI Protocol Replace the CT in Assessment of Cavo-Pulmonary (Glenn) Shunts in the Future? Initial Results

Monday, Dec. 2 12:45PM - 1:15PM Room: CA Community, Learning Center Station #6

Participants
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PURPOSE

To assess the possibility of using a very short MRI protocol using TWIST and 3D Whole heart as an alternative to CT in the initial diagnosis and follow up of patients with CHDs managed by Glenn shunts. We aim to decrease multiple radiation exposures in such young patients and hence eliminating their hazardous effcets (especially carcinogenic effect on children). This short technique could be used even in young children only under sedation with no need for general anathesia.

METHOD AND MATERIALS

Six adult patients with different CHD (all have single ventricle physiology) managed by Glenn shunts were assessed by contrast enhanced MDCT and short MR (10-12 minutes) protocol including Contrast enhanced 3D whole heart and TWIST (Time-resolved Angiography With Stochastic Trajectories) sequences performed on a 1.5T machine. The points of assessment were the patency of the Glenn shunts, presence of collaterals, size and patency of pulmonary arteries and intra-cardiac anatomy. The assessment was done using 1-4 scale (4= optimal, 3= Good, 2= Fair, 1=Inconclusive). Anatomy was assessed only by CT and 3D whole heart. We considered the CT as the gold standard technique and compared the 2 MRI methods to it separately using Bland-Altman Plots.

RESULTS

Overall good agreement between the CT on one hand and each of TWIST and 3D whole heart separately on the other hand. Near total agreement is found between the CT and 3D whole heart in assessment of Glenn and collaterals. Apart from the agreement with CT, TWIST also has additional ability to detect the timing of blood flow as it showed preferential and earlier flow to the right lung in 2 cases (one of them only was apparent in CT). In another case, it showed the blood flow to the left lung started after the aorta suggesting systemic arterial source (2nd look at CT revealed partially thrombosed left modified Blalock- Taussig shunt). 3D whole heart shows very nice intra and extracardiac anatomy.

CONCLUSION

Very short MRI protocol using TWIST and 3D whole heart (with no need for additional sequence) could replace the CT effectively in initial assessment and follow up of Glenn shunts. These are the initial data however; larger number of patients will be enrolled in this study for better statistical analysis and more accurate results.

CLINICAL RELEVANCE/APPLICATION

Our suggested protocol can protect thousands of children and young adults from unnecessary radiation exposure with all its known hazards.

CH222-ED-MOB7

Pulmonary Hypertension on Chest Computed Tomography: Imaging Findings from Typical to Rare Cases and Quantitative Indices Including Updated Methods by Dual Energy Scanner

Monday, Dec. 2 12:45PM - 1:15PM Room: CH Community, Learning Center Station #7

Participants
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TEACHING POINTS

To review clinical course and classification of pulmonary hypertension (PH) To re-recognize typical imaging finding of PH To know specific imaging finding in each group of classification To review quantitative assessment indices To introduce new quantitative index by dual energy scanner

TABLE OF CONTENTS/OUTLINE

Clinical knowledge -Pathophysiological classification and clinical manifestation -Classification (5th WSPH Nice 2013) Typical CT imaging for 3 regions -Vascular remodeling -pulmonary parenchymal abnormality -cardiac configurational deformation Specific imaging finding to each sub-group including rare diseases -Group 1: Idiopathic, Heritable (Rendu-Osler disease), Scleroderma -Group 2: Patent Ductus Arteriosus -Group 3: Chronic obstructive pulmonary disease -Group 4: Chronic thromboembolic pulmonary hypertension -Group 5: Pulmonary tumor thrombotic microangiopathy, leukostasis, Beriberi Conventional quantitative indices -Diameter ratio of main pulmonary artery to ascending aorta -Diameter ratio of right to left ventricle -Pulmonary arterial distensiblity -%CSA<5 (cross sectional area) New potential quantitative methods by dual energy scanner -Iodine-concentration map imaging -Subtaction image between two different energies

CH223-ED-MOB8

Evaluation of Post-Thoracic Radiotherapy, CT Features of Thoracic Complications and Recurrence: What Every Radiologist Needs to Know

Monday, Dec. 2 12:45PM - 1:15PM Room: CH Community, Learning Center Station #8

FDA Discussions may include off-label uses.

Participants
Saly A. Abo Zahra, Toronto , ON (*Presenter*) Nothing to Disclose
Laura Jimenez-Juan, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Anastasia Oikonomou, MD,PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Lan C. Kha I, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Radiotherapy often plays a vital role in the treatment of thoracic malignancies. Familiarity with the imaging characteristics of post-radiotherapy complications and disease recurrence/progression by the radiologists is essential in guiding accurate clinical management. This exhibit will:1. Describe current radiotherapies utilized in thoracic malignancies.2. Illustrate imaging characteristics in early and late post-radiotherapy pulmonary complications. 3. Highlight imaging challenges in differentiating between post-radiation changes and local recurrent/progressive disease.4. Demonstrate extra-pulmonary post-radiation complications.

TABLE OF CONTENTS/OUTLINE

1. Describe current radiotherapies utilized in various thoracic malignancies.2. Illustrate early and late post-radiotherapy pulmonary complications and temporal sequence of post-radiation therapy pulmonary complications.3. Illustrate cases of post-radiotherapy positive therapeutic responses, recurrence and pitfalls.4. Provide various examples of extra-pulmonary complications (eg. heart, bones, esophagus).

CH224-ED-MOB6

Listen Up to the Windpipe: A Review of Tracheobronchial Pathologies

Monday, Dec. 2 12:45PM - 1:15PM Room: CH Community, Learning Center Station #6

Participants
Karma Z. Salem, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

At the completion of this exhibit, the viewer will have a better understanding of: Normal tracheobronchial anatomy and tools available to evaluate for pathology The spectrum of benign to neoplastic focal tracheobronchial diseases The wide range of diseases causing diffuse tracheal pathology and clues to differentiate them

TABLE OF CONTENTS/OUTLINE

Patients with tracheobronchial patholgies are often misdiagnosed with asthma or other obstructive lung diseases because of considerable overlap in their symptoms. The role of the radiologist is paramount in establishing an accurate diagnosis in order to prevent a delay in treatment.We will provide a pictorial review of the following pathologies: 1) Focal a.Benign Neoplasms: Papilloma Hamartoma Lipoma b. Malignant Neoplasm: Squamous cell carcinoma Adenoid cystic carcinoma Lymphoma Plasmacytoma Metastasis Carcinoid c. Non-Neoplastic Broncholith Post intubation stenosis Foreign body 2.Diffuse a.Non-Neoplastic Mounier-Kuhn Tracheobronchopathia Ostechondroplastic Amyloidosis Relapsing polychondritis Granulamtosis with polyangitis Sarcoidosis Williams-Campbell Saber Sheath trachea b.Neoplastic Lymphoma Papillomatosis

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CH251-SD-MOB1

Virtual Monochromatic Dual-Energy Pulmonary CT Angiography with Reduced Iodine Dose: Quantitative and Qualitative Assessment

Monday, Dec. 2 12:45PM - 1:15PM Room: CH Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Participants
Xiaohong Zhu, Hefei, China (*Presenter*) Nothing to Disclose
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Wendong Liu, Hefei, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The purpose of this study was to assess the feasibility of performing pulmonary angiography(CTPA) with 7.0g of iodine contrast medium acquired with low-energy(40 and 50kev) virtual monochromatic(VMC) images with rapid-kilovoltage-switching dual-energy CT.

METHOD AND MATERIALS

A tatal of 123 adults with suspected pulmonary embolism were enrolled in this study performed on GE Revolution CT.Subjects were randomly assigned to a contrast medium protocol for CTPA examinations:one group(n=41) received 14.0g iodine with an standard DE CTPA protocol,the other(n=41) received 7.0g iodine with a low CM injection DE CTPA protocol,another(n=41)received 17.5g iodine with a standard CTPA protocol. DE CTPA uses 50% ASIR-V and low mAs scanning to greatly reduce radiation dose.Two readers independently assessed the image quality of the CTPA and VMC DE CTPA datasets using the 5-point scale.CT attenuation,SNR ,CNR and subject image quality were compared between the three groups.

RESULTS

For the DE CTPA virtual monoenergetic spectral datasets(40-140kev)were reconstructed. The CT attenuation of the low CM DE CTPA at 50kev has no difference with the standard CTPA protocol group(low CM DE CTPA : 444.5±185.7;standard CTPA :455.1±126.3;p=0.603).Main and lobar pulmonary arteries at 40kev datasets provided the highest signal-to-noise-ratio(SNR) and contrast-to-noise-ratio(CNR)for both the standard DE CTPA protocol and the low CM injection protocol. the standard DE CTPA protocol had significantly higher CNR and SNR values than the standard CTPA protocol($p<0.05$),which the low CM DE CTPA was slightly lower than the standard CTPA,while its subjective score meets the diagnostic requirements.No pulmonary embolism was missed on the three protocols.

CONCLUSION

DE CTPA utilizing image reconstruction at 40-50kev are optimal when reducing the total iodine amount down to 7.0g(reduction of 60%) and the total radiation exposure(reduction of 78%)while maintaining adequate intravascular attenuation and diagnositic quality for pulmonary embolism evaluation.

CLINICAL RELEVANCE/APPLICATION

The DE CTPA protocol with ASIR-V performs equally to the standard protocol, and can be used to save contrast media when using VMS reconstructions of low energy datasets without a reduction in diagnostic accuracy,vessel opacification,CNR or perceived image quality.

CH252-SD-MOB2

CT-Identified Bronchiectasis in Never-Smokers: Association with Respiratory Symptoms, Lung Function, and Exercise Capacity

Monday, Dec. 2 12:45PM - 1:15PM Room: CH Community, Learning Center Station #2

Participants
Yuka Okajima, MD, Chuo-ku, MA (*Presenter*) Nothing to Disclose
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PURPOSE

While bronchiectasis can be identified on thoracic CT in normal subjects as an incidental finding, its clinical and functional relevance is not clearly understood. We aimed to examine the frequency of bronchiectasis and its association with respiratory symptoms, lung function, and exercise capacity in healthy never-smokers.

METHOD AND MATERIALS

We used baseline data of 105 never-smokers without known lung disease from the COPDGene Study (mean age 62 yr, female 69%). Bronchiectasis was identified on baseline and five-year follow-up thoracic CT, based on the presence of at least one of the following features: i) the ratio of the diameter of the airway lumen to that of the adjacent artery >1, ii) lack of airway tapering, and iii) visualization of an airway in the peripheral lung within 1 cm from the pleura. We examined the difference in clinical manifestations between those with and without bronchiectasis, using t-test and Fisher's exact test. A multivariable linear regression analysis was used to assess the association of bronchiectasis with clinical manifestations.

RESULTS

Bronchiectasis was identified in 25 (24%) subjects, most frequently in the right lower lobe (56%), followed by in the middle lobe (48%). Twelve subjects had bronchiectasis in two or more lobes. Airway wall thickening was present in eight subjects with bronchiectasis. Among those with bronchiectasis whose follow-up CT data was available, all persistently had bronchiectasis after five years. Those with bronchiectasis were older (mean 66 vs. 61 yr, p=0.003), and more likely to have dyspnea (12 vs. 1%, p=0.04), compared to those without it. Those with bronchiectasis tended to have a lesser six-minute walk test (6MWT) than those without bronchiectasis (mean 477 vs. 521 meters, p=0.05). There was no significant difference in cough, phlegm, and spirometric measurements between those with and without bronchiectasis. After adjusting for demographics and FEV1, subjects with bronchiectasis had significantly lower 6MWT than those without it (estimate [SE] -42.2 [19.6] meters, p=0.03).

CONCLUSION

Bronchiectasis was not an uncommon CT finding in never-smokers, and was associated with dyspnea and impaired exercise capacity.

CLINICAL RELEVANCE/APPLICATION

Radiographic bronchiectasis in otherwise normal subjects was associated with impaired exercise capacity, and may warrant clinical follow-up.

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CH253-SD-MOB3

A Novel Augmented Deep Learning Approach for Quantitative Assessment of Indeterminate Nodules

Monday, Dec. 2 12:45PM - 1:15PM Room: CH Community, Learning Center Station #3

Participants
Wei Zhao, Beijing , China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Although the use of low-dose computed tomography (LDCT) for lung cancer screening can significantly reduce mortality by 20%, indeterminate nodules were detected in 24% of the participants, of which 96% turned out to be false positives. The purpose of this study is to develop and validate a novel computerized approach for effective assessment of indeterminate nodules and classify them as benign or malignant.

METHOD AND MATERIALS

A dataset consisting of 1,706 LDCT scans was collected from several sources, including the National Biomedical Imaging Archive (NBIA), Kaggle database, and the PLA General Hospital. The nodules with verified benign / malignant status were located. For each nodule, we used an available computer system to segment the nodules and explicitly quantify its image features, including volume, density, solidness, calcification, and spiculation. In particular, the emphysema extent of the CT scans was quantified. We also extracted the 3D volumetric image patches that contain these nodules with a fixed dimension of 32×32×32 (mm3) for a deep convolutional neural network (CNN) to implicitly learn the rich image texture. We developed an augmented deep learning framework that integrates both the implicit CNN-based output and explicit image features. A separated dataset consisting of 300 chest CT scans (150/150: benign/malignant) were used for validation purpose. The performance metric was the area under the receiver operating characteristic (ROC) curves. A p-value of < 0.05 was considered statistically significant.

RESULTS

Our experimental results showed that the developed integrative model could achieve a performance with an AUC of 0.94 (95% CI: 0.86-1.0, $p < 0.001$), which is higher than the supported vector machine model (AUC: 0.84 (95% CI: 0.76-0.94)) and the deep learning model (AUC: 0.91 (95% CI: 0.81-0.99)).

CONCLUSION

This preliminary but encouraging study suggested that utilizing of deep learning augmented by objective quantification of image features may potentially lead to an improved diagnosis of indeterminate nodules.

CLINICAL RELEVANCE/APPLICATION

This study demonstrates a deep learning approach for quantitative assessment of indeterminate nodules and is recommended to aid in the early diagnosis and management of lung cancer.

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CH274-SD-MOB4

Based on CT Radiomics to Distinguish the Anterior Mediastinal Cyst from Type B1 and Type B2 Thymoma

Monday, Dec. 2 12:45PM - 1:15PM Room: CH Community, Learning Center Station #4

Participants
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PURPOSE

To explore the differential diagnosis between the anterior mediastinal cyst and type B1, type B2 thymoma based on CT-based radiomics model.

METHOD AND MATERIALS

94 patients pathologically confirmed the anterior mediastinal cyst and type B1, type B2 thymoma were retrospectively gathered from January 2010 to December 2018 included a primary cohort consisted of 65 patients and an independent validation cohort consisted of 29 patients. According to the pathological results of surgery,patients were divided into 53 cases of anterior mediastinal cyst and 41 cases of type B1, type B2 thymoma. 180 quantization radiomics features were extracted from unenhanced phase and enhanced phase computed tomography (CT) of the target lesion. ANOVA+KW test, Univariate logistic regression, Correlation analysis (remove redundancy r>0.9),Lasso regression model was used for data dimension reduction. Multiple logistic regression was used to develop the diagnostic model. The ability of the model was validated using the area under the curve (AUC) of receiver operating characteristic(ROC) analysis.

RESULTS

The radiomics features selected from the unenhanced phase and the enhanced phase were 4 and 3,respectively. The unenhanced model showed in primary dataset (AUC=0.823;sensitivity=75.7%,specificity=82.1%) and independent validation dataset (AUC=0.856,sensitivity=100.0% ,specificity=76.9%). The enhanced model showed in primary dataset (AUC=0.928;sensitivity=83.8%%,specificity=89.3%) and independent validation dataset (AUC=0.846,sensitivity=93.8% ,specificity=84.6%).

CONCLUSION

This study presents a radiomics model can be conveniently used to facilitate the differential diagnosis between the anterior mediastinal cyst and type B1, type B2 thymoma.

CLINICAL RELEVANCE/APPLICATION

This study presents a radiomics model can be conveniently used to facilitate the differential diagnosis between the anterior mediastinal cyst and type B1, type B2 thymoma.

ER163-ED-MOB7

Surgical Fixation of Rib Fractures: What the Radiologist Should Know

Monday, Dec. 2 12:45PM - 1:15PM Room: ER Community, Learning Center Station #7

Participants
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Ganesh Retnasingam, FRCR, MRCS, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Having experience of performing over 360 surgical rib fracture stabilisation procedures since 2014 at a single major trauma centre hospital, the purpose of this exhibits is:1. To review the indications and benefits for the surgical fixation of rib fractures2. Describe salient radiological features the surgeon needs to know prior to considering fixation3. Understand how the rib fractures are stabilised and the role of post operative imaging

TABLE OF CONTENTS/OUTLINE

Benefits of surgically stabilising rib fracturesIndications for surgical fixationRelevant preoperative imaging features, what the surgeon needs to know.Review of relevant pre and postoperative imaging including pre an post operative plain radiographs preoperative multiplanar CT preoperative 3D reconstructed images

ER164-ED-MOB6

Let's Be Blunt: Imaging and Management of Genitourinary Tract Trauma

Monday, Dec. 2 12:45PM - 1:15PM Room: ER Community, Learning Center Station #6

Participants
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TEACHING POINTS

1. Highlight mechanisms by which the genitourinary tract can be affected by trauma (e.g. blunt, penetrating, iatrogenic) 2. Describe relevant imaging strategies 3. Illustrate a spectrum of genitourinary traumatic injuries on multimodality imaging 4. Present a grading system for renal trauma with schematic diagrams and imaging correlation 5. Demonstrate the role of interventional radiology in the management of trauma of the genitourinary tract

TABLE OF CONTENTS/OUTLINE

1. Mechanisms of genitourinary tract trauma a. Commonly affected areas and protective mechanisms 2. Imaging strategies 3. Urinary tract trauma a . Renal i. Grading system b. Ureter c. Bladder d. Urethra 4. Male genital tract trauma 5. Female genital tract trauma 6. Management, including the role of interventional radiology a. Vascular b. Non-vascular

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ER207-SD-MOB1

Correlation between the Severity of Traumatic Aortic Injury and Clinical Outcomes at a Level 1 Trauma Center

Monday, Dec. 2 12:45PM - 1:15PM Room: ER Community, Learning Center Station #1

Participants
Ahmed M. Sobieh, PhD, Worcester, MA (*Presenter*) Nothing to Disclose
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PURPOSE

To determine if severity of traumatic aortic injury correlates with various clinical outcomes including: mortality, concomitant injuries, and length of hospital stay. To determine if severity of traumatic aortic injury can guide in clinical management.

METHOD AND MATERIALS

IRB-approved, HIPPA compliant retrospective study, informed consent requirement was waived. Data extracted from PACS & Trauma registry in a tertiary care university hospital from January 2005 to December 2018. Inclusion: Adult patients presenting with blunt trauma. Patients with CT scan showing acute aortic traumatic injury. Exclusion: None. Demographic data, trauma mechanism, injuries, calculated Injury severity score (ISS), hospital length of stay, operative management, clinical outcome (alive or dead) were obtained from the trauma registry. Two blinded emergency radiologists reviewed the CT images of all patients included in our cohort. We classified aortic injury into 4 types: Grade 1: intimal tear, Grade 2: focal dissection/intramural hematoma, Grade 3: pseudoaneurysm, Grade 4: rupture.

RESULTS

We identified 91 patients in our electronic medical records with various degrees of traumatic aortic injuries identified by CT. 46 blunt trauma patients had images available for review. 37 (80%) were male. The median age was 49 years old (range 18- 89). Median injury severity score (ISS) was 35. 38 patients survived to discharge, only 8 patients died (17%). Associated injuries include intra-abdominal (n=34, 74 %), traumatic brain injury (n =15 ,33%), extremity injury (n=37 ,80 %). spine fractures ((n=25 ,54 %) . Aortic injury grades were as follows 8 (17%) grade 1, 15 (33%) gade 2, 21 (46%) grade 3, and 2 (4%) grade 4. .Twenty four (52%) had operative intervention. 12.5%, 40%, 76% and 50% with increasing grade from 1 to 4 respectively. The overall mortality was 17%. Mortality was 25%, 13%, 14% and 50% by grade 1, 2, 3, and 4 respectively.

CONCLUSION

CT assessment of aortic injury severity can guide clinical management and predict outcome. Patients with a lower injury severity score, grades I and II, may not survive but it is their associated injuries which determine their mortality.

CLINICAL RELEVANCE/APPLICATION

CT angiography is highly sensitive in detecting significant actue aortic injuries and is recommended in the initial evaluation of suspected acute aortic injury. Different grades of aortic injury correlate to clinical outcome and length of hospital stay.

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ER208-SD-MOB2

A Comparative Study on the Detection Efficiency for Different Types of Fractures Based on Deep Learning (DL) Algorithm

Monday, Dec. 2 12:45PM - 1:15PM Room: ER Community, Learning Center Station #2

Participants
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Jie Ding, Ning Xia, China (*Abstract Co-Author*) Nothing to Disclose
Jun Gu Sr, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ruoshui Ha, BA, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To explore differences in the detection efficiency using deep learning (DL) based artificial intelligence (AI) diagnostic system for complete fracture, incomplete fracture and old rib fracture.

METHOD AND MATERIALS

In this retrospective study, a total of 76 patients with emergency chest trauma underwent chest CT examination were collected. All CT images were reconstructed using the lung algorithm and subsequently imported to a commercial AI diagnostic system (InferRead CT Bone research, Infervision, Beijing) to detect the presence of rib fractures. Rib fractures used as gold standard were labeled by two radiologists with more than 15 years of experience in chest diagnosis combined with results generated by DL-based system. Rib fractures were classified into three groups, including complete, incomplete and old fractures. The detection number of different types of fractures by the system was recorded and the sensitivity of different types of fractures compared using chi-square test.

RESULTS

A total of 329 rib fractures including 118 complete fractures, 103 incomplete fractures and 108 old fractures were established as the gold standard. Based on the results obtained using AI system, we detected a total of 331 rib fractures including 289 true positive (TP) fractures. Among all TP fracture, 113 were marked as complete fractures, along with 84 incomplete fractures and 92 old fractures. Therefore, the sensitivity of AI for rib fracture detection was 87.84%, and the false positive rate was 2.81%. The detection rate for complete fracture, incomplete fracture and old fracture was 95.76%, 81.55% and 85.19%, respectively. There was a statistically significant differences in sensitivity among three types of rib fracture detected by AI (P=0.003). Particularly, the diagnostic rate in the detection of complete fracture was found to be significantly greater than that of incomplete fracture and old fracture.

CONCLUSION

The diagnostic efficiency using AI in the detection of rib fracture was found to be correlated with the fracture type. Particularly, complete fracture was found to be best identified by the AI system compared to incomplete and old fracture.

CLINICAL RELEVANCE/APPLICATION

AI system demonstrated different performances in the detection of different types of fractures, and the effectiveness of complete fracture examination is found to be better than incomplete fractures and old fractures.

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ER209-SD-MOB3

Speed Balling: Identify Lab Values Which May Predict a Positive Imaging Finding on a CT to Help Triage Patients in an ED Setting

Monday, Dec. 2 12:45PM - 1:15PM Room: ER Community, Learning Center Station #3

Participants
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Ashwin Jain, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mustafa Qureshi, MBBS, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Bindu Setty, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patients frequently present to the emergency department acutely intoxicated on a combination of heroin and cocaine (speedball) with altered mental status. Consequently, many of these patients receive neuroimaging. The purpose of our study is to identify laboratory characteristics that predict for positive imaging findings, with the goal to help triage such patients who would require neuroimaging following speedball use.

METHOD AND MATERIALS

We obtained study data through a retrospective review of clinical, laboratory, and imaging data in the electronic medical records. Patients presenting with urine toxicology positive for opiates and cocaine who underwent neuroimaging were selected for analysis. Imaging data, including CT head from the associated hospitalization was collected. Clinical and laboratory data were also included for analysis. Crude and adjusted odds ratios were calculated using SAS software.

RESULTS

A total of 105 patients matching the study criteria were identified. The mean age was 42 years old (range: 22 to 63) and 72.4% of patients were male (n=76). On multivariate analysis (MVA) adjusting for age and gender, positive hepatitis C status (OR 3.33 [95% Confidence Interval (CI) 0.34-30.34], p=0.289), abnormal echocardiogram (OR 3.51 [95% CI 0.60-20.49], p=0.164), and head trauma (OR 1.46 [95% CI 0.44-4.85], p=0.539) were positively associated with abnormal neuroimaging. Laboratory findings including elevated white blood cell count (OR 1.02 [95% CI 0.35-3.03], p=0.968) and positive blood culture (OR 0.84 [95% CI 0.19-3.73], p=0.813) were not significantly associated with abnormal neuroimaging.

CONCLUSION

Though our results did not reach statistical significance, there was a trend toward an abnormal findings on neuroimaging in patients with positive hepatitis C status, abnormal echocardiogram, or head trauma. These criteria could help identify patients most appropriate to receive neuroimaging in the setting of speedball use.

CLINICAL RELEVANCE/APPLICATION

Our study could help identify subset of patients likely to have abnormal neuroimaging findings presenting to the ED under the influence of speedball.

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ER228-SD-MOB4

Intraosseous Contrast Administration for Emergency Computed Tomography: A Case-Control Study

Monday, Dec. 2 12:45PM - 1:15PM Room: ER Community, Learning Center Station #4

Participants
Philipp Schindler, MD, Muenster, Germany (*Presenter*) Nothing to Disclose
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PURPOSE

The aim of the study was to evaluate the feasibility of intraosseous (i.o.) contrast media injection (CMI) for emergency computed tomography (CT) of severe trauma and the associated image quality compared to intravenous (i.v.) CMI.

METHOD AND MATERIALS

The authors retrospectively analyzed objective (contrast-to-noise ratio (CNR)) and subjective (4-point Likert scale) image quality of CTs after i.o. (n=4) versus i.v. (n=20) CMI. All patients underwent a native head CT scan, a cerebral CT angiography (CTA) and CTA of the supra-aortic vasculature as well as a chest and abdominal CT scan in the venous phase; one patient with an i.o. access additionally received a CTA of the lower limbs. Electronic patient records have been reviewed to determine i.o. access related complications.

RESULTS

Both groups were consistent in age, heart rate, scan parameters including the flow rate of the contrast agent, resulting in comparable radiation dose levels. The image noise and CNR had no significant difference between the two groups. Scoring the delineation of the main vessels after i.o. CMI showed very good or good results (80% and 20% of patients) and no significant difference to the i.v. group. There were no CT or i.o. access related complications observed.

CONCLUSION

The i.o. access is a safe and suitable alternative for emergency CMI in CT. Using established protocols good to very good image quality can be achieved, comparable to i.v. CMI. We show for the first time, that i.o. CMI is also feasible for CTA imaging of the head and neck region as well as of pelvic and leg vessels.

CLINICAL RELEVANCE/APPLICATION

The intraosseous access is a safe and suitable alternative for emergency contrast media injection in CT while intraosseous contrast media injection is also feasible for CTA imaging of the head and lower limbs.

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ER229-SD-MOB5

Improved Detection of Acute Small Vessel Occlusions Using CT Perfusion in Acute Stroke

Monday, Dec. 2 12:45PM - 1:15PM Room: ER Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
Shobhit Mathur, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
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Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

PURPOSE

To evaluate the utility of CT perfusion in detection of acute small vessel occlusions.

METHOD AND MATERIALS

In this retrospective study, a total of 50 CT studies performed for acute stroke were included where CT perfusion study was performed. These included 20 consecutive CT studies with intracranial acute small vessel occlusions seen on CTA and 30 consecutive studies with negative CT and CTA at presentation and negative CT and/or MRI performed within 7 days of presentation. Initially, two radiologists reviewed the noncontrast CT and multiphase CTA studies. The observers noted the presence or absence of occlusion and name of the occluded vessel. The reader confidence on a scale from 1 to 5 and time taken for review was recorded. On a separate occasion, CT perfusion data was presented to the readers before the noncontrast CT and multiphase CTA and the same readings were made. On both occasions, the observers were blinded from each other, previous or follow up imaging and clinical data and the data was presented in a random fashion. Thereafter, consensus readings were made on the CTA studies, noncontrast CT and CT perfusion studies at presentation and the follow-up MRI or CT performed within 7 days.

RESULTS

No difference of age or sex was found in the study population positive and negative for small vessel occlusion. No significant difference in the sensitivity of small vessel intracranial occlusions was found between two sets of readings. The level of confidence and speed improved with addition of CT perfusion ($p<0.05$).

CONCLUSION

CT perfusion maps improve the speed and confidence of interpretation in the setting of acute stroke due to acute intracranial small vessel occlusions.

CLINICAL RELEVANCE/APPLICATION

Small vessel occlusions can be a diagnostic challenge on CT and MPCTA studies performed for acute stroke. Addition of CT perfusion maps could be beneficial in these cases.

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GI289-ED-MOB13

Guidelines for the Imaging of Patients with Clinically Suspected Chronic Pancreatitis or Patients at Risk of Chronic Pancreatitis

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #13

Participants
Milda Dedelaite, MD, Aalborg, Denmark (*Presenter*) Nothing to Disclose
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TEACHING POINTS

To discuss the role, indications and limitations of different cross-sectional imaging modalities (CT, MRI/MRCP and secretin-MRCP) used to diagnose chronic pancreatitis. To discuss the role of endoscopic ultrasound as an additional diagnostic tool for diagnosing chronic pancreatitis. To review the diagnostic imaging algorithm for evaluation of patients with clinically suspected chronic pancreatitis or patients at risk of chronic pancreatitis.

TABLE OF CONTENTS/OUTLINE

- Definition of the chronic pancreatitis.- Indications for the abdominal CT scan in the investigation of chronic pancreatitis.- CT scan as the potential best initial/baseline examination.- Limitations of the CT scan in the diagnosis of chronic pancreatitis.- Indications of the MRI/MRCP in the investigation of chronic pancreatitis.- The role of the secretin-stimulated MRCP in the investigation and diagnosis of chronic pancreatitis.- Limitations of the MRCP in the diagnosis of chronic pancreatitis.- The role of the endoscopic ultrasound as an additional diagnostic tool for diagnosing chronic pancreatitis.- Overview of the diagnostic imaging algorithm for patients with clinically suspected chronic pancreatitis or patients at risk of chronic pancreatitis.

Printed on: 10/29/20

GI290-ED-MOB15

Peritoneal Metastasis, Cytoreductive Surgery (CRS), and Hyperthermic Intraperitoneal Chemotherapy (HIPEC): What the Radiologist Should Know

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #15

Awards
Certificate of Merit

Participants
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TEACHING POINTS

Selected patients with disseminated peritoneal metastasis may be treated with cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC), which has significantly improved long-term patient survival. Post procedure complications associated with peritoneal CRC/HIPEC are unique and may be directly related to resection of peritoneal metastases, the type of chemotherapy agent used, or to the HIPEC procedure itself. Radiologists should be aware of the therapeutic approach of CRC/HIPEC, it's potential for unique complications and their imaging appearance to avoid misinterpretation.

TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Peritoneal metastasis and surgical procedures: CRS and HIPEC. 3. Normal imaging findings after CRS/HIPEC procedures: peritoneal effusion, organ inflammation. 4. Complications and their imaging features. 5. Vascular abnormalities and miscellaneous. 6. Visceral complications: hepatobiliary, bowel, pancreatic, urinary bladder, diaphragmatic. 7. Abdominal wall complications. 8. Unfavorable sites of involvement. 9. Conclusion

GI291-ED-MOB12

You Are at the Crossroads: Where Will You Go Next? - A Comprehensive Review of Currently Available Guidelines for Diagnosis and Management of Pancreatic Cystic Lesions

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #12

Awards
Cum Laude

Participants
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TEACHING POINTS

Compare and contrast the currently available guidelines regarding diagnosis & management of pancreatic cysts (American College of Gastroenterology, Fukuoka, ACR, European Study Group & American Gastroenterological Association) • Discuss characteristics of pancreatic cysts & their unique pathologic & imaging findings with special emphasis on role of imaging • Discuss our institutional working group guidelines for pancreatic cysts

TABLE OF CONTENTS/OUTLINE

Introduction What is the end point of pancreatic cyst follow-up? Early pancreatic cancer Characteristics of pancreatic cysts Pseudocysts, Serous cystadenomas, Mucinous cystic neoplasms, Intraductal papillary mucinous neoplasms (IPMNs): Side duct & Main duct, Solid-pseudopapillary neoplasms Cystic pancreatic neuroendocrine tumors Imaging Techniques: CT, MRI with MRCP & EUS Comparison of the available guidelines for pancreatic cysts Incidental pancreatic cyst on CT/US: What next? The role of imaging. Genetic testing for pancreatic cysts: Current Status Institutional Working Group on Management of Pancreatic Cystic lesions Conclusion Currently, there are five major society guidelines for the diagnosis and management of pancreatic cystic lesions. Although the goal of all these guidelines is early identification of pancreatic ductal adenocarcinoma, they vary significantly in their approach to problem.

GI292-ED-MOB14

CEUS for Vascular Assessment of the Immediate Posttransplant Liver: When Doppler Fails

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #14

Participants
Veronica Sue, MD, Portland, OR (*Presenter*) Nothing to Disclose
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TEACHING POINTS

When Doppler fails to show normal flow in the transplant hepatic artery, CEUS is a safe, non-invasive imaging technique which reliably excludes thrombosis. CEUS generally shows the hepatic artery well, though requires some technologist and radiologist experience. CEUS is easy to perform at the bedside in the immediate postop period and plays a critical role in the decision making process for transplant surgeons.

TABLE OF CONTENTS/OUTLINE

Brief overview of liver transplant vascular complications. a. Types and rates of immediate complications. b. Anatomy of common and uncommon arterial reconstructions that may be encountered. Options for vascular imaging of the transplant liver. a. Focus on ease, accuracy and contraindications of each. b. Current CEUS literature and our own institutional data in brief. CEUS technique. a. Brief overview of general CEUS technique. b. In-depth technique specific to vascular assessment of the transplant liver. Case series presentation. a. Various arterial reconstruction appearance on CEUS b. Challenges in imaging the artery. c. Venous imaging and challenges. Proposed algorithm for vascular imaging escalation incorporating CEUS.

GI293-ED-MOB16

Knowing and Recognizing the Complications of the Bile Duct After Liver Transplant: Normal Anatomy, Variants, and Complications

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #16

FDA Discussions may include off-label uses.

Participants
Teresa A. Garcia, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
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TEACHING POINTS

To recognize possible biliary complications after liver transplant and the value of the existing classifications. To Highlight the relevance of early diagnosis of biliary complications of liver transplant. To Review various imaging methods that we can use and explain how to choose them, with emphasis in the use of cholangiopancreatography (MRCP).

TABLE OF CONTENTS/OUTLINE

1.Brief review of the the bile duct anatomy and the most frequent anatomical variants. 2.Recognize the anatomical variant S4 and its relevance. 3.Description of the most common performed anastomosis for liver transplant. 4.Current classification of biliary complications according to: -Time -Etiology -Location 5.Exhibit examples of our institution, considering that it is one of the largest liver transplant centers in Argentina

GI294-ED-MOB11

The ABC of Birt-Hogg-Dube: A Brief Overview

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #11

Participants
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TEACHING POINTS

Clinical Findings Skin findings Spontaneous pneumothoraces Renal tumors Genetic analysis Similarities to and difference from tuberous sclerosis complex Renal Tumors Hybrid histological tumor types Conventional tumor types MRI/CT findings Management Standard current therapies Investigational therapies

TABLE OF CONTENTS/OUTLINE

Background Birt Hogg Dube (BHD) syndrome is a multi-system, autosomal dominant disease process that manifests with multiple clinical and radiographic findings including; cutaneous skin findings, renal lesions, pulmonary cysts, and spontaneous pneumothorax. In addition to renal cysts, BHD patients presents with renal masses including oncocytoma, chromophobe renal cell carcinoma, clear cell renal cell carcinoma and hybrid renal lesions. Numerous pulmonary cysts are important diagnostic criteria. Patient may present with spontaneous pneumothoraces. , and may be found incidentally in individuals undergoing screening for renal masses. Purpose The purpose of this educational exhibit is to discuss what radiologist needs to know about BHD syndrome, including the radiological findings that may help making the diagnosis. We also aim to discuss the critical management of renal masses among patients with BHD syndrome.

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GI341-SD-MOB1

Radiographic Follow-Up of Pancreatic Cystic Lesions: Are Follow-Up Recommendations Excessive?

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #1

Participants
N. Masoom, MD, Burlington, MA (*Presenter*) Nothing to Disclose
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PURPOSE

Evaluate the validity of recommended follow-up for incidental pancreatic cystic lesions on MRI.

METHOD AND MATERIALS

A five-year retrospective review of pancreatic cystic lesions on MR cholangiopancreatography (MRCP) was undertaken for 285 patients over a 5 year period. Cyst size, location and concerning features such as main duct dilatation, intralesional solid component and enhancement were reviewed over time and any changes documented. Clinical notes were reviewed for EUS and FNA results.

RESULTS

169 female and 116 male patients (mean age 65 years) were evaluated with median and mean follow up of 22 and 31 months. Average largest initial cyst size was 12.3 mm. 23 cases (8%) underwent endoscopic ultrasound (EUS) with fine-needle aspiration (FNA), for concerning features, including contrast enhancement (7 cases) and pancreatic ductal dilatation either focal (19 cases) or diffuse (24 cases), 2 cases had both features. The average size of the cysts that developed worrisome features requiring further workup was 26.1mm. Only one case was less than 10mm. 6 EUS cases were non-diagnostic (unsuccessful cyst aspiration, or insufficient tissue for diagnosis). Of the remaining cases, 11 (65%) had malignant or potentially malignant pathology; ductal adenocarcinoma (3 cases), mucinous cystadenoma (6 cases) and IPMN (2 cases). Additionally serous cystadenoma (3 cases) and non-malignant ductal cells with negative mucin stain (3 cases). 139 cases (49%) showed a change in size; 85 increased (mean, 5 mm); and 54 decreased (mean, 8.1 mm). Of 155 patients with cysts <=10 mm, 138 (90%) had no change or decreased in size over 5 years. The remaining 10% exhibited a mean change of 1mm.

CONCLUSION

In this retrospective, longitudinal review of incidental pancreatic cystic lesions on MRI, the development of suspicious features in a sub centimeter lesion is rare. A follow-up MRI at 2 years, and at 5 years is likely sufficient, if there has been no change in size or appearance. For lesions greater than 2 cm, or those lesions with suspicious features, earlier intervention with EUS and aspiration is proposed to more accurately define the lesion and management plan.

CLINICAL RELEVANCE/APPLICATION

Improve recommendations for follow-up and management of incidental pancreatic cystic lesions, to enhance patient care and minimize unnecessary imaging.

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GI342-SD-MOB2

Predictive and Prognostic Value of CT-Based Radiomics Model for Lymph Node Metastasis in Esophageal Squamous Cell Cancer

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #2

Participants
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PURPOSE

To develop and validate a radiomics nomogram for preoperative prediction and prognosis of lymph node metastasis (LNM) in patients with esophageal squamous cell cancer (ESSC).

METHOD AND MATERIALS

Three hundred and seven patients with clinicopathologically confirmed ESSC were divided randomly into a training set (n=200) and a validation set (n=107). Data was gathered from March 2009 to September 2013. Clinical characteristics, including age, sex, clinical stage and histologic grade, were constructed a clinical data model by Cox proportional hazard model. Radiomic features of lymph nodes, pathologically diagnosed positive or negative, were extracted from portal venous-phase computed tomography (CT) of ESSC for survival analysis. Radiomics signature was built using LASSO Cox regression. Two radiomics nomograms were developed incorporating the radiomics signature and selected clinical predictors based on Cox proportional hazard model. Nomogram discrimination, calibration and clinical usefulness were evaluated. Associations between radiomics features and clinical data were investigated using heatmaps. Internal validation was assessed.

RESULTS

The radiomics signatures, which consisted of 13 selected features, were significantly associated with OS, with a C-index of 0.709. N-staging showed highest prognostic value among the clinical factors. One radiomics nomogram was incorporated radiomics signature with the TNM staging system. This nomogram showed a significant improvement for prognosis of LNM over the TNM staging system only in terms of evaluating OS in the training cohort (C-index, 0.844 vs. 0.830; P <0.05). Another radiomics nomogram combined the radiomics signature with all clinical data showed good discrimination, with a C-index of 0.866 (95% CI: 0.836-0.897). Application of the nomogram in the validation cohort still gave good discrimination (C-index, 0.781; 95% CI: 0.717-0.845) and good calibration. Heatmaps revealed associations between radiomics features and tumor stages.

CONCLUSION

CT-based radiomics nomograms provided improved prognostic ability for LNM in ESSC, which may provide evidence for precision medicine and affect treatment strategies.

CLINICAL RELEVANCE/APPLICATION

Esophageal cancer is the sixth most fatal cancer globally and new approaches, radiomics, are urgently needed to identify patients who are at risk of poor prognosis.

GI343-SD-MOB3

Comparison and Correlation of Attenuation Values on Virtual and True Non-Contrast Images Obtained by Triphasic Dynamic Series with Third-Generation Dual-Source Dual-Energy CT

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate the agreement and correlation between the true non-contrast attenuation values of intra-abdominal structures and attenuation values obtained on virtual non-contrast images based on 3rd generation dual source dual-energy CT.

METHOD AND MATERIALS

Seventy seven patients who underwent triphasic abdominal CT (liver dynamic protocol) between November 2018 and January 2019 were retrospectively reviewed. Unenhanced series was performed using conventional single-energy mode at 120 kVp. Arterial, venous phase and 5 minutes delayed phase post-contrast series were obtained utilizing dual source dual-energy CT technique (tube potential, 100 kVp and Sn 150 kVp). Virtual non-contrast images were processed off of arterial (VNC-art), venous phase (VNC-por) and 5 minutes delayed (VNC-del) series. Attenuation values of liver, pancreas, kidneys, muscle, subcutaneous fat intraabdominal fat, vertebra, aorta, IVC, main portal vein, intrahepatic portal vein were recorded on true non-contrast study and virtual non-contrast study sets of images. Attenuation values were compared using paired t test. The correlations of attenuation values were also evaluated via the Pearson's correlation coefficient.

RESULTS

Paired t test showed significant difference between TNC, VNC-art, VNC-por and VNC-del attenuation across all organs ($p < 0.0001$). But there were excellent correlations between TNC and VNC-art attenuation values of liver ($r = 0.907$- 0.924), pancreas ($r = 0.718$), spleen ($r = 0.728$) and subcutaneous fat ($r = 0.953$). There were excellent correlations between TNC and VNC-por attenuation values of liver ($r = 0.880$ - 0.926), pancreas ($r = 0.846$), vertebra ($r = 0.919$) and subcutaneous fat($r = 0.939$). There were also excellent correlations between TNC and VNC-del attenuation values of liver, ($r = 0.885$ - 0.919), pancreas ($r = 0.777$) vertebra ($r = 0.914$) and subcutaneous fat($r = 0.957$).

CONCLUSION

Although the attenuation values of all tissues were significantly different between virtual non-contrast and true non-contrast images, the correlation values were excellent. The true non-contrast attenuation values of liver, spleen, pancreas, vertebra and subcutaneous fat can be obtained by regression analysis. Further optimization of post-processing algorithms might be necessary before complete replacement of TNC with VNC images.

CLINICAL RELEVANCE/APPLICATION

This will be helpful for diagnosis and evaluation of fatty liver on vertual non-contrast study.

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GI371-SD-MOB4

Preoperative MR Enterography in Predicting Early Anastomotic Recurrence after Primary Intestinal Resection in Crohn's Disease

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #4

Participants
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PURPOSE

Up to 70% of patients with Crohn's disease (CD) who had underwent primary bowel resection will develop postoperative recurrence. Stratifying CD patients according to the risk of recurrence and tailoring therapy are the ideal and most cost-effective ways to manage these patients. The aim of this preliminary study was to explore whether preoperative MR enterography (MRE) can predict early anastomotic recurrence after primary bowel resection in CD patients.

METHOD AND MATERIALS

32 CD patients who underwent preoperative MRE and primary bowel resection were enrolled. We defined early anastomotic recurrence as postoperative endoscopic Rutgeerts score>=i2 or bowel wall thickening/high enhancement on CT/MRE within 6 months. MRE including resected bowel (wall thickness, bowel obstruction, bowel edema, enhanced pattern, DWI hyperintensity and ADC) and perienteric mesentery (mesenteric edema, perienteric effusion, comb sign, creeping fat, fistula/abscess, DWI hyperintensity) was retrospectively analyzed. Logistic regression analysis was used to develop a predictive model for recurrence.

RESULTS

Of 32 CD patients, 20 (62.5%) had early anastomotic recurrence and were defined as R+ group, the other 12 patients were defined as R- group. Significant differences in creeping fat (P=0.024), mesenteric abscess/fistula (P=0.036), bowel obstruction (P=0.036) and mesenteric hyperintensity on DWI (P=0.044) were found between R+ and R- group. Early anastomotic recurrence correlated positively with creeping fat (r=0.469, P=0.007), mesenteric abscess/fistula (r=0.437, P=0.012), bowel obstruction (r=0.423, P=0.016) and mesenteric hyperintensity on DWI (r=0.437, P=0.012). The results from the MRE-based predictive model (=2.597×creeping fat+2.256×mesenteric abscess/fistula+2.493×bowel obstruction-4.675) strongly correlated with the recurrence outcome (r=0.683,P<0.001) in these 32 patients with an area under ROC curve of 0.902 (95% CI, 0.793-1.000; P<0.001).

CONCLUSION

Preoperative MRE can predict early anastomotic recurrence after primary bowel resection in CD patients. Mesenteric abnormality seems to be a more important risk factor for early anastomotic recurrence.

CLINICAL RELEVANCE/APPLICATION

Preoperative MRE can predict early anastomotic recurrence after primary bowel resection in CD patients and stratifies them according to the risk of recurrence for tailoring therapy

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GI372-SD-MOB5

Computed Tomography (CT) Determined Pancreatic Volume and Steatosis as a Discriminant Marker for Diagnosis of Type II Diabetics versus Non-Diabetic Controls

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #5

Participants
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PURPOSE

To study the computed tomographic (CT) indices of pancreatic volume and fat content in patients with type II diabetes mellitus and compare it with age and body mass index (BMI) matched non-diabetic patients

METHOD AND MATERIALS

We prospectively evaluated 66 diabetic patients (42 females, 24 males, mean age 53.2 ± 7.9 years) and 47 non-diabetic patients (20 females, 27 males, mean age 50 ± 8.2 years) between the age group of 40-65 years who underwent unenhanced CT scan of the abdomen using a 64-slice Multi Detector CT (MDCT) machine (Ingenuity CT, Philips) for unrelated pathologies. The cases had adequately controlled blood sugar levels, while none of the cases or controls had any kind of systemic co-morbidities. The following parameters were noted: Pancreatic volume (using an inbuilt volume application in CT) Pancreatic fat indirectly as: Difference between pancreatic attenuation and splenic attenuation (HU P-S) and Ratio of pancreatic attenuation to splenic attenuation (HU P/S) After age, gender and BMI matching, T test was applied for calculating p-value of pancreatic volume and Mann-Whitney test for calculating the p values of HU P-S and HU P/S. Spearman's rho coefficient was calculated to see the relationship of pancreatic volume with HU P-S and HU P/S. Receiver Operating Curve (ROC) was made for finding the cut-off value of pancreatic volume with optimal sensitivity and specificity.

RESULTS

CT showed that pancreatic volume was significantly low ($p<0.001$) in patients with type 2 diabetes mellitus (48±13.7) as compared to non-diabetic patients (63.6±17.3). Further, fat content was also significantly high ($p<0.001$) in diabetic patients (HU P-S of -13.2±7.9 and HU P/S of 0.73±0.15) as compared to non-diabetic patients (HU P-S of -6.7±5.9 and HU P/S of 0.86±0.12). Thus, changes in pancreatic volume and fat act as a surrogate marker for type 2 diabetes mellitus.

CONCLUSION

Low pancreatic volume and a high fat content quantified by using CT are significantly associated with existence of type II diabetes mellitus

CLINICAL RELEVANCE/APPLICATION

These changes if found in a high-risk individual incidentally who undergoes CT scan of abdomen for an unrelated pathology, would help in early diagnosis of diabetes mellitus as it would prompt a complete biochemical work up. Thus, disabilities and complications related to long standing diabetes can be prevented efficiently in a significant chunk of population.

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GI373-SD-MOB6

Structured Reporting of CT or MRI for Perihilar Cholangiocarcinoma: Usefulness for Clinical Planning and Interdisciplinary Communication

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #6

FDA Discussions may include off-label uses.

Participants
Seungbaek Hong, MD, Pusan, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate the effect of the structured reports compared with the narrative reports for reporting CT or MRI in patients with perihilar cholangiocarcinoma.

METHOD AND MATERIALS

This retrospective study included 54 patients (37 men, 17 women; mean age, 75.6 years) with perihilar cholangiocarcinoma. All patients performed CT or MRI before endoscopic retrograde cholangiopancreaticography (ERCP) or surgery. For all patients, we generated the narrative reports and structured reports for perihilar cholangiocarcinoma. We compared the number of key features between the two types of reports. In addition, one experienced abdominal surgeons and two physicians experienced in ERCP reviewed a questionnaire with 3 questions including sufficiency of information regarding surgical or procedural planning, the effort for the information extraction, and report quality rated on Likert scale (1, insufficient; 6, excellent).

RESULTS

Structured reports (mean±SD, 6.89±0.31) included significantly more predefined key features compared with the narrative reports (mean±SD, 5.87±0.70)($p<0.001$). The structured reports was considered to provide the sufficient information for ERCP or surgery in 89.9% of cases (versus only 18.5% of cases in narrative reports) ($p<0.001$). Regarding the effort for the information extraction, 94.4 % of structured reports was considered to be easy, but only 9.3% of narrative reports were considered to be easy ($p<0.001$). In addition, structured reports (mean±SD, 5.96±0.19) received the higher overall report quality rate compared with narrative reports (mea±SD, 4.31±0.77) ($p<0.001$).

CONCLUSION

Structured reporting of CT or MRI for hilar cholangiocarcinoma can provide more predefined key features, more sufficient information, and higher satisfaction level to referring clinician, compared to the narrative report.

CLINICAL RELEVANCE/APPLICATION

In patient with hilar cholangiocarcinoma, structured reporting of CT or MRI can provide improved report quality. Therefore, referring clinicians are more confident about further clinical decision making.

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GI374-SD-MOB7

Deep Learning-Assisted Diagnosis of Atypical Hepatocellular Carcinoma (HCC) on Contrast-Enhanced MR Imaging: Differentiating Pathologically Proven HCC from Non-HCC Liver Lesions

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #7

Participants
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PURPOSE

To train a deep learning model to differentiate between hepatocellular carcinoma (HCC) and non-HCC lesions on multi-phasic contrast-enhanced magnetic resonance imaging (MRI), using pathologically proven liver lesions as the "ground truth".

METHOD AND MATERIALS

This IRB-approved retrospective study included 118 patients with 93 (62%) HCC and 57 (38%) non-HCC lesions, all of which were pathologically confirmed and clearly localizable on MRI. Histopathological data was obtained from biopsies (n=72), resections (n=29), liver transplants (n=46), and autopsies (n=3). The non-HCC class included intrahepatic cholangiocarcinoma (n=19), regenerative nodules (n=2), dysplastic nodules (n=2), hemangioma (n=16), cysts (n=15), focal nodular hyperplasia (n=2) and bile duct adenoma (n=1). 47% of HCC lesions showed atypical imaging features (not meeting Liver Imaging Reporting and Data System [LI-RADS] criteria for definitive HCC or LR5). A 3D convolutional neural network (CNN) was trained on 140 lesions and tested for its ability to classify 10 remaining unseen lesions (5 HCC and 5 non-HCC). The CNN consisted of 3 convolutional layers, 2 maximum pooling layers, and 2 fully connected layers. An Adam optimizer was used for model training. The performance of the model was averaged over 150 runs with random sub-sampling to provide class-balanced test sets.

RESULTS

The CNN demonstrated an overall accuracy of 87.3%. The sensitivities for HCC and non-HCC lesions were 92.7% and 82.0%, respectively. Correspondingly, specificities of HCC and non-HCC lesions were 82.0% and 92.7%, respectively. The area under the receiver operating curve was 0.912. The training time of the CNN was 3.2 minutes ± 0.9, and the time to classify each lesion in the test data set was 2.9 ms ± 1.7.

CONCLUSION

This study provides proof-of-concept for CNN-based classification of both typical and atypical-appearing HCC lesions on multi-phasic MRI, utilizing pathologically confirmed lesions as "ground truth".

CLINICAL RELEVANCE/APPLICATION

A CNN trained with pathological "ground truth" can correctly classify HCC lesions that do not meet established imaging diagnostic criteria, potentially expanding the role of image-based diagnosis.

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GI375-SD-MOB8

CT Radiomics Features Enhance Preoperative Survival Prediction in Patients with Pancreatic Ductal Adenocarcinoma

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #8

Participants
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PURPOSE

Pancreatic ductal adenocarcinoma (PDAC) is a highly lethal malignancy with limited preoperative predictors of long-term survival. Existing nomograms incorporate post-resection data and are of limited utility in guiding surgical decision making. The purpose of this study is to evaluate the prognostic utility of preoperative CT radiomics features in predicting postoperative survival of PDAC patients.

METHOD AND MATERIALS

125 patients with surgically resected pancreatic ductal adenocarcinoma (PDAC) and preoperative dual-phase CT between 2010 and 2014 were retrospectively identified. Demographic, clinical parameters, baseline CA 19-9, tumor size, and patient survival were collected from the medical records. Patients were risk stratified based on survival time after surgery into low-risk group (survival time > 900 days) and high-risk group (survival time < 350 days). The whole 3D volume of pancreatic tumor and background pancreas were manually segmented (Velocity, Varian Medical Systems). 489 radiomics features were extracted from the whole pancreas boundary. Feature reduction was performed by minimum-redundancy maximum-relevance selection and random forest method, and the 10 most relevant radiomics features were selected. Survival analysis was performed based on clinical parameters with and without the addition of the 10 radiomics features. Survival status and time were computed by 4-fold cross validation. Concordance index (C-index) was used to evaluate performance of the survival prediction.

RESULTS

Mean age of PDAC patients was 67 ± 11 years. Mean tumor size was 3.3 ± 1.5 cm. The 10 radiomics features showed 82% accuracy in classification of high-risk vs. low-risk groups. C-index of survival prediction with only clinical parameters was 0.71. Addition of CT radiomics features improved C-index to 0.75.

CONCLUSION

Addition of CT radiomics features to standard clinical factors improves survival prediction in PDAC patients.

CLINICAL RELEVANCE/APPLICATION

Radiomics features from preoperative CTs of pancreatic ductal adenocarcinoma patients may be useful in risk stratification prior to planned resection for pancreatic cancer.

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GI376-SD-MOB9

CT Texture Analysis May Predict Therapeutic Response of HCCs to Transcatheter Arterial Chemoembolization

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #9

Participants
Jan Vosshenrich, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate the value of CT texture analysis of pretherapeutic dynamic CT for prediction of therapeutic response of hepatocellular carcinoma (HCC) to transcatheter arterial chemoembolization (TACE) according to mRECIST.

METHOD AND MATERIALS

Pre- and posttherapeutic dynamic (4-phase) CT scans of 91 biopsy proven HCCs in 37 patients treated with TACE were retrospectively analyzed. Patients with and without liver cirrhosis were included. Pretherapeutic CT was performed directly prior to TACE, first posttherapeutic imaging four weeks after TACE. Subsequent monitoring occurred at 3-month intervals. Each HCC was manually segmented on arterial phase images according to mRECIST criteria. Measurements and quantitative texture features were extracted and included: long axis (LA), Mean of positive Pixels (MPP) and Uniformity of positive Pixel Distribution (UPP). Predictive factors for Complete Response (CR) were assessed.

RESULTS

For initial posttherapeutic imaging (< 6 months), smaller tumor size, higher arterial enhancement and higher homogeneity at baseline were significantly associated with and predictive for CR of HCCs in cirrhotic livers: 1st exam post TACE - LA (19.4 vs 48.3 mm), MPP (192.1 vs 101.6), UPP (0.021 vs 0.017); 2nd exam post TACE - LA (21.7 vs 39.4 mm), MPP (262.1 vs 101.1), UPP (0.023 vs 0.017). On all imaging later than 6-months post TACE, CR was independent of baseline tumor size and homogeneity. However, the higher the mean pretherapeutic MPP, the longer a complete response of HCC lesions to TACE therapy could be observed (Follow Up 3: 290.3; FU 4: 357.4; FU 5: 389.3; FU 6: 463.4; FU 7: 459.4; FU 8: 545.5). Results of texture analysis of HCCs in non-cirrhotic livers were discordant as lesions were generally bigger at baseline and only a subtle, nonsignificant tendency to achieve CR with higher baseline MPP could be observed emphasizing different tumor biology, depending on underlying global liver disease.

CONCLUSION

Pretherapeutic texture analysis of multiphase CT-imaging may be helpful to predict Complete Response of HCC to TACE in cirrhotic livers. Long term CR of a treated lesion seems to significantly depend on high arterial enhancement at baseline and may also be associated with smaller tumor size.

CLINICAL RELEVANCE/APPLICATION

Pretherapeutic CT texture analysis in HCC patients could be a valuable tool for radiologists and clinicians in multidisciplinary conferences when triaging patients to TACE.

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GI377-SD-MOB10

Liver, Spleen Stiffness Measurements, and Their Derivatives as Noninvasive Predictors of Esophageal and High-Risk Esophageal Varices Using 2D-Shear Wave Elastography in B-Viral Cirrhotic Patients

Monday, Dec. 2 12:45PM - 1:15PM Room: GI Community, Learning Center Station #10

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To evaluate the prognostic value as noninvasive predictors of esophageal varices (EVs) and high risk EVs among liver stiffness (LS), spleen stiffness (SS) measurements and their derivatives including liver stiffness-spleen size-to-platelet ratio risk score (LSPS) and spleen stiffness-spleen size-to-platelet ratio risk score (SSPS) using 2D-shear wave elastography in B-viral cirrhotic pateints.

METHOD AND MATERIALS

In this retrospective study, from April 2017 to October 2018, a total of 65 B-viral cirrhotic patients who underwent the liver, spleen stiffness measurement by 2D-SWE and endoscopic evaluation for EVs were enrolled. LSPS and SSPS were calculated using following fomulas: LS value × spleen diameter (cm)/platelet count (109/L) and SS value × spleen diameter (cm)/platelet count (109/L), respectively. Cutoff values of predicting presence of EVs and high risk EVs were identified by the Youden index and prognostic values were assessed by the area under the receiver operating characteristic curve (AUC).

RESULTS

Twenty six patients had no EV on endoscopy. Among 39 patients who had EVs, 12 patients had high risk EVs. The optimal cutoff values of LS value, SS value, LSPS and SSPS for predicting EVs were 9.9 (kPa), 29.9 (kPa), 0.8 and 3.7, respectively, at which AUC, 0.72, 0.77, 0.80 and 0.85, respectively. The optimal cutoff values of LS value, SS value, LSPS and SSPS for predicting high risk EVs were 15.4 (kPa), 34.9 (kPa), 1.3 and 4.4, respectively, at which AUC, 0.55, 0.78, 0.67 and 0.80, respectively.

CONCLUSION

LS, SS values and their derivatives including LSPS and SSPS were defined as noninvasive and useful methods to predict EVs and high risk EVs in B-viral cirrhotic patients.

CLINICAL RELEVANCE/APPLICATION

There had been many efforts to define a noninvasive and accurate method to predict esophageal varices and high risk esophageal varices surrogate invasive procedure including endoscopy. Authors of the present study found LS, SS values, LSPS and SSPS can be used as a good predictor for EVs as well as high risk EVs.

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GU209-SD-MOB1

Usefulness of Macroscopic Classification in pT3a Renal Cell Carcinoma

Monday, Dec. 2 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #1

Participants
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PURPOSE

The TNM classification of renal cell carcinoma (RCC) was updated in 2017. In this new classification, T3a consists of tumors with renal and peri-renal vein involvement and tumors with fat invasion. Especially, detection of sinus fat or renal vein invasion is important before partial nephrectomy for preventing pathological upstaging of clinical T1 to pathological T3. The purposed of this study is to evaluate the correlation between simple macroscopic classification of RCC and the pathological T stage (sinus fat or renal vein invasion).

METHOD AND MATERIALS

Materials were consecutive 308 RCC cases histologically proven less than pT3a which underwent surgical resection from January 2007 to October 2017. By using CT and/or MR images, all cases were simply macroscopically classified into 3 groups, mono-nodular, multi-nodular or teardrop shape by two radiologists. The correlation between macroscopic and pathological findings was retrospectively evaluated.

RESULTS

Of the all RCC cases, 83 cases were histologically proven as pT3a including invasion of renal vein or sinus fat. 96% (80 cases) of all pT3a cases were classified as either multi-nodular (72 cases) or teardrop shaped (8 cases). 99%(166/168cases) of mono-nodular carcinomas showed no invasion of sinus fat or renal vein. Macroscopic classification is strongly correlated with tumor size (Pearson coefficient $r=0.56$, $p<0.01$). Of RCC smaller than 4cm diameter case, teardrop shape or multi-nodular tumor were more commonly associated with sinus fat invasion than mono-nodular tumor (odds ratio, 55.14; 95% confidence interval, 7.07 to 430.10; $p<0.001$).

CONCLUSION

Simple macroscopic classification of renal cell carcinoma may be useful for detection of sinus fat or renal vein invasion. 96% (80 cases) of all pT3a cases were classified as either multi-nodular (72 cases) or teardrop shaped (8 cases). 99%(166/168cases) of mono-nodular carcinomas showed no invasion of sinus fat or renal vein.

CLINICAL RELEVANCE/APPLICATION

Before partial nephrectomy, the findings of macroscopic classification of RCC may be added in nephrectomy scoring system.

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GU210-SD-MOB2

Contrast-Induced Nephropathy May Be Associated with HMGB1 which is Related to Sterile Inflammation

Monday, Dec. 2 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #2

Participants
Hyewon Oh, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Yong Eun Chung, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A nucleosome protein, HMGB1 (High mobility Group Box1) is the primary mediators of sterile immune response. Reactive oxygen species (ROS) which induce cytoplasmic translocation and extracellular release of HMGB1, is one of the major causes of contrast induced nephropathy (CIN). So the purpose of this study was to investigate the association between CIN and HMGB1

METHOD AND MATERIALS

The NRK-52E cell line (rat proximal tubular cells) were treated with iopamidol 50mgI, 100mgI, and 200mgI for 2h and harvested. Cell viability and oxidative stress were compared between control and iopamidol treated cell groups. Translocation of HMGB1 from nucleus to cytoplasm was assessed by immunohistochemistry and compared between groups. In animal experiment, CIN model was made by administering indomethacin (10mg/kg), L-NAME (15mg/kg), and iopamidol (1ml/kg) in Spargue-Dawley male rats. After 24 hours, blood was collected and blood urea nitrogen (BUN) and creatinine (Cr) were measured to confirm the development of CIN. Oxidative stress measured by TBARS assay and HMGB1 expression was measured by ELISA. Mann-Whitney test and Kruskal-Wallis test were used for the statistical analysis and $P<0.05$ was considered as statistically significant.

RESULTS

In vitro experiment, cell viability decreased (50mgI: 100mgI: 200mgI, 55.6±10.4%: 29.6±2.7%: 15.5±1.5%, compared to control: 100%) and oxidative stress (50mgI: 100mgI: 200mgI, 1.5±0.1: 1.6±0.1: 1.6±0.1, compared to control: 1) increased after iopamidol exposure according to iodine concentration. As the iodine concentration increased, cytoplasmic translocation of HMGB1 was noted in immunohistochemical staining. In vivo experiment, there was significant difference in BUN and Cr between control (BUN:Cr, 13±2.4:0.4±0) and CIN model (191±40.8:1.9±0.5, $P<0.05$). Oxidative stress (CIN/control, 1.4±0.2) and serum HMGB1 level (CIN/control, 2.0±0.7) was significantly increased in CIN model compared to control group ($P<0.05$).

CONCLUSION

Iodinated contrast media induces cytoplasmic translocation of HMGB1 related to sterile inflammation.

CLINICAL RELEVANCE/APPLICATION

HMGB1 may play a role in the development of CIN through sterile inflammation, so HMGB1 may be a new target for the prevention and treatment of contrast induced nephropathy.

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GU211-SD-MOB3

Detection of Cervical Cancer Using Diffusion MRI with a Continuous-Time Random Walk Model

Monday, Dec. 2 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate the feasibility of using a novel diffusion model based on continuous-time random walk (CTRW) for detecting cervical cancer, and to investigate its possible advantage over the apparent diffusion coefficient (ADC).

METHOD AND MATERIALS

In this retrospective study, forty-five patients with biopsy-proven cervical cancer (13 stage I, 15 stage II, 12 stage III, and 5 stage IV) underwent pre-treatment MRI at 3T. Diffusion-weighted images (DWI), acquired with multiple b-values (0, 50, 80, 100, 150, 200, 500, 800, 1300,1700, 1800 or 2000, 2400, 3000, 3600, 4000, and 4500 sec/mm2), were analyzed using a CTRW diffusion model. For each subject, a region of interest (ROI) was manually selected along the tumor boundary on the slice with maximal area on DWI (b =1000 sec/m2). Three CTRW parameters (anomalous diffusion coefficient Dm, temporal diffusion heterogeneity a, and spatial diffusion heterogeneity ß) as well as conventional ADC were compared between the cervical cancer and normal cervix tissue, followed by a non-parametric Wilcoxon signed-rank test. The diagnostic performances of using the individual CTRW parameters and ADC for detecting cervical cancer were evaluated using receiver operating characteristic (ROC) analyses. Different combinations of the CTRW parameters, (Dm, a), (Dm, ß), (a, ß), and (Dm, a, ß), were also evaluated using a binary logistic regression.

RESULTS

Significant differences were detected in Dm (0.81 ± 0.26 μm2/ms vs. 1.14 ± 0.52 μm2/ms, $p < 0.001$), a (0.95 ± 0.04 vs. 0.92 ± 0.09, $p = 0.034$), and ß (0.79 ± 0.07 vs. 0.70 ± 0.16, $p < 0.001$), and ADC (0.86 ± 0.22 μm2/ms vs. 1.08 ± 0.30 μm2/ms, $p < 0.001$) between the cancerous and normal cervix tissues. The ROC analysis showed that the combination of CTRW parameters (Dm, a, ß) yielded better sensitivity (88.9% vs. 68.9%), specificity (91.1% vs. 88.2%), and area under the curve (0.948 vs.0.777) for detecting cervical cancers as compared to ADC.

CONCLUSION

The CTRW model parameters computed from high-b-value diffusion images outperformed conventional ADC for differentiating cancerous tissue from normal cervix tissue.

CLINICAL RELEVANCE/APPLICATION

With its ability to probe tissue microstructural changes, the CTRW diffusion model can be used for detecting and charactering an increasingly number of cancerous tissues.

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GU233-SD-MOB4

Radiomics Features on Diffusion-Weighted Imaging for Differentiating Muscle-Invasive Bladder Cancer from Non-Muscle-Invasive Bladder Cancer

Monday, Dec. 2 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #4

Participants
Jianjian Zhang, Shanghai, China (*Presenter*) Nothing to Disclose
Guangyu Wu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yongming Dai, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of radiomics features from diffusion-weighted imaging (DWI) in differentiating muscle-invasive bladder cancer (MIBC) from non-muscle-invasive bladder cancer (NMIBC).

METHOD AND MATERIALS

This study included 218 pathologically-confirmed bladder cancer patients (training set: 131 patients, 86 MIBC; validation set: 87 patients, 55 MIBC) who underwent DWI before biopsy through transurethral resection (TUR). Radiomics models based on DWI for discriminating state of muscle-invasive were built using random forest (RF) and all-relevant (AR) methods on the training set and were tested on validation set. Combination models based on TUR data were also built. Discrimination performances were evaluated with the area under the receiver operating characteristic (ROC) curve (AUC), accuracy, sensitivity, specificity, F1 and F2 scores. Qualitative MRI evaluation based on morphology was performed for comparison.

RESULTS

No significant difference was found between RF and AR models. RF model was more sensitive than TUR (0.873 vs 0.655, p=0.019) for discriminating muscle-invasive bladder cancer. When combining RF with TUR, the sensitivity increased to 0.964, significantly higher than TUR model (0.655, p<0.001), MRI evaluation (0.764, p=0.006), and the combination of TUR and MRI (0.836, p=0.046). Combing RF and TUR achieved the highest accuracy of 0.897 and F2 score of 0.946.

CONCLUSION

Combining DWI radiomics feature with TUR could improve the sensitivity and accuracy in discriminating the state of muscle-invasive in bladder cancer for clinical practice.

CLINICAL RELEVANCE/APPLICATION

This study may develop and validate a more sensitive radiomics model from diffusion-weighted (DW) magnetic resonance (MR) imaging for discriminating muscle-invasive bladder cancer.

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GU234-SD-MOB5

How Often Do Non-Index Target PI-RADSv2 Lesions Yield Higher Grade Clinically Significant Prostate Cancer than the Index PI-RADSv2 Lesion?

Monday, Dec. 2 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #5

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PURPOSE

mpMRI of the prostate is often used to identify suspicious target lesions prior to prostate biopsy, allowing for image-guided biopsy of target lesions. It is not known if sampling of additional target lesions beyond the index target lesion results in a higher rate of clinically significant prostate cancer detection. The purpose of this study was to estimate the fraction of cases with more than one PI-RADS target lesion where higher grade clinically significant prostate cancer was detected in the non-index target lesion as compared to the index target lesion.

METHOD AND MATERIALS

This retrospective study received approval in the form of an IRB-waiver. Reports of 1605 sequential mp-MRI examinations of the prostate obtained at a single institution between 6/5/15 and 1/26/19. We identified patients with mp-MRI reports describing more than 1 PI-RADSv2 target lesion and then determined which of these patients went on to MRI/US fusion guided prostate biopsy. Results of the targeted and concurrently obtained standard 12 core non-targeted systematic biopsies were obtained from the electronic medical record. Clinically significant prostate cancer was defined as Gleason score >= 7.

RESULTS

225 of the 1605 patients had mp-MRI exam reports describing more than 1 PI-RADSv2 target lesion. Of these, 96 patients with a total of 220 target lesions went on to MRI-US fusion guided transrectal prostate biopsy that included sampling of all PI-RADSv2 target lesions and standard 12 core non-targeted systematic biopsies. 3 of the 96 (3.1 %) patients had higher grade clinically significant prostate cancer in non-index target lesions as compared with their index target lesion. In each of these 3 cases, the concurrently obtained non-targeted 12 core systematic biopsy also found clinically significant cancer of equal or greater Gleason score than the non-index target lesion.

CONCLUSION

Sampling of non-index PI-RADSv2 target lesions in addition to the index target lesion results in diagnosis of higher grade clinically significant prostate cancer in only a very small fraction (3.1%) of patients. In the setting of targeted biopsy plus standard systematic biopsy, sampling of non-index target lesions failed to yield higher grade clinically significant prostate cancer.

CLINICAL RELEVANCE/APPLICATION

It may be safe to forego sampling of non-index PI-RADSv2 target lesions, which may mitigate undesirable biopsy related side effects such as bleeding and infection.

Printed on: 10/29/20

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GU235-SD-MOB6

Comparative Role of Retro Grade Urethrography (RGU) and Sonourethrography (SUG) in Anterior Urethral Strictures

Monday, Dec. 2 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #6

Participants
Neha Jain, MD, New Delhi, India (*Presenter*) Nothing to Disclose
Rajul Rastogi, MD, Greater Noida, India (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Sonourethrography (SUG) has starting earning clinical acceptance over Retrograde Urethrography (RGU) recently for evaluation of anterior urethral strictures. Conspicuous delineation of stricture as well as periurethral region is possible with SUG obviating radiation exposure. Urethral management primarily depends upon site & length of stricture, presence or absence of spongiofibrosis and distraction of urethral segments. Hence, this prospective pilot study aims for determining: • Comparative role of RGU & SUG in evaluation of anterior urethral strictures. • Comparative role of RGU & SUG in predicting management of anterior urethral strictures

METHOD AND MATERIALS

Fifteen patients with suspected anterior urethral strictures referred to our department were evaluated by RGU after instilling optimal amounts of non-ionic contrast agent per urethram followed by filming at 45 degrees oblique position with the ipsilateral lower limb flexed at hip & knee joints and penis stretched parallel to leg. SUG was performed with a high-resolution, linear-array transducer through penile & transperineal technique after instillation of sterile gel per urethram followed by soft, penile tip clamp. Data related to site & length of stricture, presence or absence of spongiofibrosis and any other associated abnormality will be recorded in both RGU & SUG.

RESULTS

SUG detected spongiofibrosis in addition to the accurate length of stricture required for management in 5 patients out of fifteen affecting the mode of management

CONCLUSION

SUG is an accurate imaging tool in anterior urethral strictures that not only complements RGU but also affect the mode of management thus affecting the prognosis of the patient, hence should be a routine procedure in all patients with positive findings on RGU

CLINICAL RELEVANCE/APPLICATION

Since SUG is an effective tool for evaluating anterior urethral strictures in males, it should be performed routinely prior to decision making for the mode of managment thus reducing the morbidity associated with the disease

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HP001-EB-MOB

Optimization of Eye Lens Doses for Interventional Radiology and Cardiology Staff: Monitoring and Protection Methods of Eye Lens

Monday, Dec. 2 12:45PM - 1:15PM Room: HP Community, Learning Center Hardcopy Backboard

Participants
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TEACHING POINTS

To understand the importance of correct evaluation of occupational radiation doses to the eye lens. To understand the methods used to evaluate the eye doses received by interventional radiology (IR) and cardiology (IC) staff. To understand the need for education on radiation monitoring/protection of eye lens.

TABLE OF CONTENTS/OUTLINE

Clinical monitoring of occupational eye doses during IR and IC procedures The eye lens doses received by clinical staff during IR and IC procedures were measured using radiophotoluminescence (neck badge) and thermoluminescence dosimeters (eye dosimeter). *Reducing the radiation of eye lens* Understand protective effects of using some commercial lead glasses. OUTLINE: ICRP recommended reducing thresholds and dose limits of eye lens in 2011. Occupational doses management in the IR/IC is urgently required because the eye lens may receive high radiation doses. In this study, several physicians were exceeded the equivalent dose limit for the lens. In particular, the left eye lens dose is high (left eye lens > right eye lens). Eye lens doses of IR/IC staff were reduced with the routine use of lead glasses. However, lead eye glasses without side shields were not effective.

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HP210-SD-MOB2

National Trends in Diagnostic Imaging Use in Spain (2010-2016)

Monday, Dec. 2 12:45PM - 1:15PM Room: HP Community, Learning Center Station #2

Participants
Alexandre Perez, MD, Valencia, Spain (*Presenter*) Nothing to Disclose
Asuncion Torregrosa, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Luis Marti-Bonmati, MD, PhD, Godella, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe national trends in diagnostic imaging use in Spain during period 2010 to 2016 in public and private healthcare.

METHOD AND MATERIALS

Required data was obtained from National Hospitals Statistics published online by Spanish Health Ministry (https://www.msssi.gob.es/estadEstudios/portada/home.htm). Collected variables were: annual examinations rate per 1.000 inhabitants, annual scanners/rooms per 1.000.000 inhabitants and a ratio between the number of examinations per scanner/room. Included modalities are: CT, MR, PET/CT, SPECT, digital angiography, mammography, conventional radiography and scintigraphy.

RESULTS

For cross-sectional imaging, annual national examinations rate per 1.000 inhabitants increased 83% for PET/CT (1.62 to 2.98), 42.8% for MR (47.58 to 67.90), 37.5% for SPECT (2.40 to 3.30) and 27.4% for CT (83.13 to 105.94). In 2016, public healthcare accounted for 79% of PET/CT examinations, 61% of MR studies, 87% of SPECT examinations and 83% of CTs. Conventional radiography and mammography also increased their examinations rate in 11.0%, 25.2%, respectively. Conversely, digital angiography and scintigraphy decreased 4.0% and 13.6%. All modalities except conventional radiography and scintigraphy increased the number of scanners/rooms per 1.000.000 inhabitants. In the same way, all modalities increased the number of examinations per scanner/room, except digital angiography and scintigraphy.

CONCLUSION

All diagnostic imaging modalities significantly increased the number of examinations per 1.000 inhabitants in Spain between 2010 and 2016, except digital angiography and scintigraphy.

CLINICAL RELEVANCE/APPLICATION

National trends in diagnostic imaging use should be considered to accurately offer future radiology training positions and for national strategic healthcare planning.

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HP211-SD-MOB3

Cost-Effectiveness Analysis of Including Contrast-Enhanced Ultrasound (CEUS) in the Management of Asymptomatic Pancreatic Cystic Lesions

Monday, Dec. 2 12:45PM - 1:15PM Room: HP Community, Learning Center Station #3

Participants
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Riccardo Valletta, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Mirko D'Onofrio, MD, Verona, Italy (*Abstract Co-Author*) Speaker, Bracco Group Speaker, Siemens AG Consultant, Siemens AG Speaker, Hitachi, Ltd

PURPOSE

To determine the cost-effectiveness of including contrast-enhanced ultrasound (CEUS) in the management of asymptomatic pancreatic cystic lesion (PCL) without risk features.

METHOD AND MATERIALS

By using a Markov decision model, in a hypothetical cohort of patients with PCL, we compared our management strategy including CEUS with latest consensus, European and Italian guidelines. Our strategy for BD-IPMN/MCN <1 cm includes the following: CEUS every 4 months for the first year, then twice a year for 4 years and then annually. For those between 1-2 cm, it includes a CEUS every 3 months for the first year, then every 4 months for 4 years and then annually. For those between 2-3 cm it comprises MRI every 3-6 months for the first year, then close surveillance alternating 2 CEUS and 1 MRI every year for 9 years. Strategy for SCN is based on CEUS every 6 months for the first year, then surveillance alternating CEUS and MRI every year for 3 years.

RESULTS

Primary outcomes are quality-adjusted life years (QALYs), incremental cost-effectiveness ratio (ICER) and NMB (net monetary benefit). CEUS surveillance is the dominant strategy for SCN, BD-IPMN and MCN with diameter less than 3 cm without risk of malignant progression. European surveillance average cost calculated for all the cystic categories is 3,854.19 €; mean QALY is 8.9 and mean ICER is 431.98 €. CEUS surveillance average cost is 3,520.83 €, mean QALY 8.6 and mean ICER is 405.64 €. In a sensitivity analysis, if willingness to pay is 30,000 € per QALY gained, 59% of patients using CEUS strategy would be within budget.

CONCLUSION

Guidelines strategy is the most effective: although this may result in more QALYs, costs are relatively high from a policy perspective. CEUS surveillance may be a cost-effective strategy yielding a nearly high QALYs, an acceptable ICER and a lower cost.

CLINICAL RELEVANCE/APPLICATION

This study provides new data relating asymptomatic PCL's management strategies, suggesting new models of follow up, possibly with lowest cost, highest effectiveness and better survival.

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HP231-SD-MOB4

Imaging Trends and Costs from a Large Pediatric Accountable Care Organization

Monday, Dec. 2 12:45PM - 1:15PM Room: HP Community, Learning Center Station #4

Participants
Ramkumar Krishnamurthy, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
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Ling Wang, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To detail advanced imaging patterns in one of the largest pediatric Accountable Care Organizations (ACO) in United States, which covers over 300,000 children. An ACO is an organization of healthcare providers that provides high quality, efficient care and improved coordination of care. Payments of services are tied to quality of service and cost of care.

METHOD AND MATERIALS

Advanced imaging claims data from 2016 and 2017 from the ACO were reviewed. MRI, CT, NM and US utilization trends from emergency department (ED) and outpatient (OP) encounters and associated costs were tabulated. CPT codes of the procedures were analyzed, and similar procedures were grouped together by anatomic location.

RESULTS

The total number of encounters and total paid amount for the ten most commonly performed procedure groups are presented in Table 1. Over the 2-year study period, US of abdomen was the most commonly performed (# procedures: 23903), followed by CT of head (19999) and CT of abdomen and pelvis (15401). The procedure groups performed most frequently differed in the ED and OP settings. In the ED, CT of head (16235), followed by CT of abdomen and pelvis (12477) and US of abdomen (10932) were the top procedures, while US of abdomen (12971), US of kidney (8938) and MRI of head (8776) were the top 3 OP encounters. Total imaging-associated cost for the 10 most common procedure groups in the ACO over 2 years in the ER an OP setting was $5.13 million (M) and $6.78M, respectively for a total of $11.88M. CT of head had the highest total costs ($2.34M), followed by MRI of head ($2.23M) and CT of abdomen and pelvis ($2.09M). For procedures performed in the ED, CT of head ($1.95M), CT of abdomen and pelvis ($1.74M) and US of abdomen ($0.7M) were responsible for the highest total costs. MRI of the head ($2.14M) followed by MRI spine ($0.87M) and US of abdomen ($0.81M) had the highest OP costs.

CONCLUSION

This is the first examination of imaging trends and associated costs from a large pediatric ACO. It improves the global understanding of the imaging and financial resources needed to cover a diverse pediatric population. It also paves the way for targeting and improving efficiencies and quality in imaging-related disease pathways from a systemic perspective.

CLINICAL RELEVANCE/APPLICATION

Imaging utilization trends in a large pediatric Accountable Care Organization provide pathways to improve efficiency and quality in value based care.

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HP232-SD-MOB5

The Potential Impact of Opportunistic CT Evaluation for Osteoporosis: A COARDRI Network Study of 24,803 Patients in Three Health Systems

Monday, Dec. 2 12:45PM - 1:15PM Room: HP Community, Learning Center Station #5

Participants
Anne-Olivia Raulli, MD, Boston, MA (*Presenter*) Nothing to Disclose
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PURPOSE

The purpose was to determine the level of dual x-ray absorptiometry (DXA) utilization in three health systems and the potential impact of routine osteoporosis evaluation on CT for older women.

METHOD AND MATERIALS

Electronic medical record review was performed via the mPower (Nuance) database at three independent academic medical centers in three different geographic regions of the United States by the Clinically Oriented Academic Radiology Initiative (COARDRI). Female patients, age 65 and over, who had CT studies of the chest or abdomen were identified over a three-year period (2015-2018). A sequential search then evaluated how many of these patients had also undergone a DXA scan over the same time period.

RESULTS

1389 of 24,803 (5.6%) of women with CT scans also had DXA scans (range: 4.4-14.1%). Specific site data was as follows: Site 1: women with CTs: 2482, women with CTs + DXA: 349 (14.1%); Site 2: women with CTs: 15429, women with CTs + DXA: 738 (4.8%); Site 3: women with CTs: 6892, women with CTs + DXA: 302 (4.4%).

CONCLUSION

Despite widely disseminated practice guidelines by the ACR, ISCD, and NOF that suggest DXA is indicated for women age 65 and older, we found DXA utilization was very low across all three health systems in older women undergoing chest and abdomen CTs. A concerted effort should be undertaken to optimize opportunistic CT assessment in order to improve detection of osteoporosis, which may be performed without any additional exam cost or radiation burden.

CLINICAL RELEVANCE/APPLICATION

DXA is underutilized in older women undergoing chest and abdominal CT. Routine osteoporosis evaluation on CT represents a potential solution to improve the evaluation of patients at increased risk for osteoporosis.

IN027-EC-MOB

Development of a Tracking System for PET/CT Exams That Integrates PET Image Quality Metrics and Radiation Dose Information from Both Modalities

Monday, Dec. 2 12:45PM - 1:15PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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Manabu Yamada, Shinagawa, Japan (*Abstract Co-Author*) Sumitomo Heavy Industries, Ltd
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG
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Conclusion

We have successfully developed new database software that provides an environment that can seamlessly integrate information about injected radioactivity, CT dose indices and IQ index.

Background

The comprehensive management of information about radioactivity, CT dose and image quality (IQ) is important for the optimization of PET/CT exams. The purpose of this effort was to develop application software that automatically builds a database for PET/CT exams that includes information about the injected radioactivity, CT dose and IQ.

Evaluation

The injected radioactivity can be reported using a new automatic injector with functions based on MWM, REM-NM, and Radiopharmaceutical-RDSR. This information is sent from the injector through the R-RDSR. CT dose parameters (CTDIvol, DLP) are transmitted through a CT-RDSR from the PET/CT scanner as well as PET image data. The software (Code name: onti) integrates these pieces of information and calculates Noise Equivalent Counts (NEC) from the PET image. The scanners used for this evaluation were Discovery iQ (GE Healthcare) and the automatic injector was the AI 300 (Sumitomo Heavy Industries). A demonstration study was conducted using data from 61 test patients with all values known. The onti system accurately received information about the injected radioactivity, CT dose indices, and PET image from the injector and PET/CT scanner. The onti system semi-automatically calculated NECpatient and NECdensity using the extracted factors by deleting the images containing brain and bladder. Radioactivity per body weight was correlated with NECpatient ($R^2=0.53$, $P<0.001$) and NECdensity ($R^2=0.73$, $P<0.001$).

Discussion

The radiation dose of PET/CT exams can be higher than other radiologic examinations, and PET images differ greatly in IQ depending on the physical situation of the patient. The system developed based on the international standard has successfully integrated information on injected radioactivity, CT dose indices and IQ index. NEC calculation requires more than 30 minutes per patient in manual calculation, the software could calculate in just a few seconds. Databases created by this software will support optimization of PET/CT exams.

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IN028-EC-MOB

MRQuantif: A Software Program for Quantifying Liver Fat and Iron

Monday, Dec. 2 12:45PM - 1:15PM Room: IN Community, Learning Center Custom Application Computer Demonstration

FDA Discussions may include off-label uses.

Participants
Yves Gandon, MD, Rennes, France (*Presenter*) Nothing to Disclose
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Dihia Belabbas, MD, Rennes, France (*Abstract Co-Author*) Nothing to Disclose
Thibaut Lapotre, MD, Rennes, France (*Abstract Co-Author*) Nothing to Disclose
Herve Saint-Jalmes, PhD, Rennes, France (*Abstract Co-Author*) Nothing to Disclose

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Conclusion

With the ready-for-download MRQuantif software program, it is possible to quantify hepatic iron concentration and PDFF at 1.5T and 3T using a standardized sequence available on all MRI scanners.

Background

To simplify and standardize the quantification of fat fraction (PDFF) and hepatic iron concentration (MR-LIC) by MRI, we developed a DICOM program in Java (Oracle; Redmond, WA, USA) using the ImageJ library (NIH; Bethesda, MD, USA).

Evaluation

The program can receive and read compressed or uncompressed DICOM images. It analyzes the parameters of MRI images to select sequences for processing and suggests changing the MRI protocol when necessary. After ROI placement, it determines optimal results by comparing the results of different methods. It incorporates a calculation of R2* with extrapolation to reduce the risk of underestimation in situations of high overload. It also provides alerts about potential limitations and issues a report. The validation of results is based on 217 patients investigated at 1.5T and 3T who had a biopsy with biochemical determination of LIC (bLIC) and histomorphometric fat fraction (bFF). The r^2 correlation between MR-LIC and bLIC, and between PDFF and bFF, was 0.85 and 0.94, respectively. For 40 patients simultaneously investigated at both magnetic field strengths, the r^2 correlation between the two calculated MR-LICs was 0.99.

Discussion

The program can handle various sequences, but for greater precision and robustness we recommend using a standardized multi-echo GRE sequence that can be performed in a single breathhold, at 1.5T or 3T, and in less than a minute yields MR-LIC and PDFF values that have been validated against gold-standard biopsy. FDA approval will be required for routine use.

IN142-ED-MOB6

Deep Learning Image Reconstruction Artifacts: What the Radiologist Needs to Know

Monday, Dec. 2 12:45PM - 1:15PM Room: IN Community, Learning Center Station #6

Participants
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TEACHING POINTS

1. Describe basic concepts of how deep learning can be used to reconstruct medical images, including MRI, CT and PET 2. Review the benefits of using deep learning-based image reconstruction 3. Discuss the pitfalls of deep learning-based image reconstruction and show representative imaging artifacts.

TABLE OF CONTENTS/OUTLINE

1. Definitions and basic concepts of artificial intelligence, machine learning, and deep learning. 2. Review techniques for deep-learning based image reconstruction and include illustrations of commonly-used neural network architectures (e.g. U-Net, GAN, AUTOMAP) 3. Review benefits of deep learning (e.g. decreased scan time, decreased radiation dose, increased spatial resolution) 4. Review pitfalls of deep-learning based reconstruction a. Data set-related (e.g. bias, noise) b. Network architecture-related (e.g. GANs may cause 'fake structures' to appear in final result) c. Training-related (e.g. overfitting) d. Regularization-related (e.g. smoothing) 5. Show images with deep learning artifacts. 6. Discuss how to mitigate artifacts or at least prevent them from negatively impacting our diagnostic abilities 7. Thoughts on the future of deep-learning based reconstruction algorithms.

IN143-ED-MOB5

How to Create a Great Radiology Report

Monday, Dec. 2 12:45PM - 1:15PM Room: IN Community, Learning Center Station #5

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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Ian C. Bickle, MBBCh, Kampong Maraburong, Brunei Darussalam (*Abstract Co-Author*) Nothing to Disclose
Jeffrey P. Kanne, MD, Madison, WI (*Abstract Co-Author*) Research Consultant, PAREXEL International Corporation;
Frank Gaillard, MBBS, Toronto, ON (*Abstract Co-Author*) Founder, Radiopaedia Australia Pty Ltd Editor, Radiopaedia Australia Pty Ltd Support, Toshiba Corporation Consultant, Medtronic plc Speaker, Medtronic plc

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TEACHING POINTS

(1) The radiology report represents our highest level of insight into our patients. Stylistic variability in reporting is inherently personal and carefully crafted over many years of experience. However, there are guiding principles for reporting that serve as a framework as style develops.(2) Radiologists should expect to continuously improve their reporting as they learn from patient care experiences. Following patients' hospital courses, surgery, and pathology is the optimal way to accomplish this.(3) The "Findings" section should emphasize factual observations about the study with short, informative phrases. Avoid overuse of terms of perception, redundancy, and repeating impression statements.(4) The "Impression" or "Conclusion" is a thoughtful synthesis of the findings in the context of the clinical presentation, and should include a single or differential diagnosis with recommendations for further action when appropriate.

TABLE OF CONTENTS/OUTLINE

1. Big picture a. Principles, not rules2. Findings: a. Short, informative phrases b. No "impression" statements c. Avoid terms of perception d. Avoid redundancy e. Lists3. Impression: a. Clear, readable, repeatable b. Diagnosis first c. Avoid unnecessary doubt d. Avoid redundancy4. Special topics a. Missed findings on older exams b. Patient access to reports 5. Summary

IN229-SD-MOB3

Implementation of An Onsite Medical Display Device Quality Control Program

Monday, Dec. 2 12:45PM - 1:15PM Room: IN Community, Learning Center Station #3

Participants
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CONCLUSION

Onsite based surveys of medical display devices is paramount to ensuring monitors are meeting established performance criteria. After time monitors begin to age and relying on the internal sensor to perform monitor routine quality control activities leads to failure to detect suboptimal performance.

Background

It is recommended that display devices used in diagnostic radiology are evaluated periodically to monitor elements of performance criteria. Monitors are typically accessed using a built-in light sensor along with a software program to perform routine checks and self-calibrations with the results monitored remotely. In this study we performed a physical evaluation on all of the monitors in our institution to evaluate the efficacy of a remote-based monitor quality control program.

Evaluation

Physical evaluations were performed on over 70 monitors within our institution. Each monitor was previously evaluated remotely through the QA software and sensor. Using a calibrated light meter each monitor was surveyed onsite and evaluated for: maximum luminance, luminance uniformity, DICOM GSDF conformance, and artifacts using preinstalled test patterns. Performance criteria for maximum luminance at our site adopted the American College of Radiology technical standard of 350 cd/m^2. The DICOM GSDF conformance limit was set to less than 10%, set by the manufacture. Luminance uniformity limits of 15% were used, as required by the American Association of Medical Physics for diagnostic acquisition workstations. Artifacts were evaluated using various test patterns to evaluate image retention and presentation defects.

Discussion

The physical checks demonstrated that 57% of all monitors surveyed failed to meet at least one of the performance elements. Half of the 40 monitors that failed could not produce a maximum luminance greater than 350 cd/m^2. Sixteen monitors produced artifacts related to aging defects. Monitors that failed maximum luminance and demonstrated artifacts had mostly been in service for over 10 years and exceeded 15,000 hours of backlighting. As a result of this evaluation monitors were replaced and recalibrated to achieve compliance with our facilities standards.

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IN264-SD-MOB2

Craniomaxillofacial Landmarks Detection on CBCT Images Using 3D Mask-RCNN For Craniomaxillofacial Surgery

Monday, Dec. 2 12:45PM - 1:15PM Room: IN Community, Learning Center Station #2

Participants
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PURPOSE

Craniomaxillofacial (CMF) surgery aims to correct congenital or acquired deformities of the head and face, where CMF landmark localization is an important step for analyzing jaw deformities and developing surgical plans. In this study, we propose a three-stage coarse-to-fine deep learning method for digitizing 105 anatomical CMF landmarks simultaneously on CBCT images and present results evaluated on 49 CBCT scans of CMF patients.

METHOD AND MATERIALS

Forty-nine sets of CBCT images (0.4×0.4×0.4 mm3 or 0.3×0.3×0.3 mm3) of patients with non-syndromic jaw deformities were used in this study. Ten sets of CBCT images were used for testing, 34 sets were used for training, and 5 sets were used for validation. All the landmarks were grouped into 9 pre-defined anatomical regions. In the first stage, a simple network is trained using down-sampled 3D images, to output a coarse location for each landmark. Then, in the second and third stages, we refine landmark locations by training our network using patches sampled from medium- and high-resolution 3D images, respectively, around the landmark locations that are estimated in the previous stage. In all stages, each landmark is predicted by a modified Mask R-CNN, which can also learn the geometrical relationship among landmarks in the same region. A 5-fold cross-validation was performed to evaluate the accuracy by mean square error (MSE).

RESULTS

Our approach achieved an accuracy with an average MSE of 1.75mm±0.91mm on 0.4×0.4×0.4 mm^3 CBCT images , which overperforms the related methods (U-net and the original Mask R-CNN) in the term of accuracy. Details of the MSE in the 9 pre-defined regions are: 1.33mm±0.46mm for left midface, 1.58mm±0.98mm for upper midface, 1.31mm±0.56mm for right midface, 1.57mm±0.79mm for mid-midface, 2.05mm±1.12mm for tooth-midface, 1.71mm±1.11mm for left mandible, 1.67mm±1.16mm for right mandible, 1.65mm±1.26mm for mid-mandible and 1.76mm±0.76mm for tooth-mandible.

CONCLUSION

We achieved an accuracy with an average MSE of 1.75mm±0.91mm for localizing 105 landmarks from 49 CBCT images of CMF deformity patients using a modified Mask R-CNN trained by a three-stage coarse-to-fine training strategy.

CLINICAL RELEVANCE/APPLICATION

Our approach can localize a large scale of CMF landmarks, which can be used for generating 3D CMF models composed of midface and mandible to develop a de-tailed CMF surgical plan.

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IN275-SD-MOB1

Application of Model-Based Iterative Reconstruction in Reducing Radiation Dose and Improving Low-Dose Abdominal CT Image Quality

Monday, Dec. 2 12:45PM - 1:15PM Room: IN Community, Learning Center Station #1

Participants
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PURPOSE

To explore the application of a model-based iterative reconstruction (MBIR) in improving image quality in low-dose abdominal CT by comparing with the routine-dose and low-dose adaptive statistical iterative reconstruction (ASIR) images.

METHOD AND MATERIALS

100 patients with abdominal CT scanning were randomly divided into Group A (n=50) and Group B (n=50). Group A was scanned with routine-dose (noise index, NI=10HU) and reconstructed with 40% ASIR; while Group B was scanned with low-dose (NI=20HU) and reconstructed with 40%ASIR (subgroup B1) and MBIR (subgroup B2). The volumetric CT dose index (CTDIVOL) values of Group A and Group B were recorded. The CT value and standard deviation (SD) of the liver, spleen, pancreas, kidneys and subcutaneous fat were measured to calculate signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). Two reviewers scored image quality blindly with 5-point scoring system. Data were statistically compared.

RESULTS

There was no difference in general data between two groups ($P>0.05$). Group B (1.43±0.66mSv)used significantly lower radiation dose (75% reduction) than Group A (5.71±2.37mSv)($p<0.001$). The low-dose MBIR group (Group B2) had significantly lower image noise and significantly higher SNR and CNR than those in groups A and B1, and there were statistically significant differences among the three groups ($p<0.001$)(Table 1 and Table 2). The subjective scores of groups B1, A and B2 were sequentially increased, and there was statistically significant difference among them ($p<0.000$)(Table 3).

CONCLUSION

Compared with the conventional ASIR images in routine-dose abdominal CT, MBIR further reduces the image noise and improves image quality with 75% lower radiation dose, and provides basis for ultra-low radiation dose abdominal CT.

CLINICAL RELEVANCE/APPLICATION

Compared with the conventional ASIR images in routine-dose abdominal CT, MBIR further reduces the radiation dose and image noise,and improves image quality, which provides basis for ultra-low radiation dose abdominal CT.

MI113-ED-MOB3

A Beginner's Guide to [177Lu]DOTATATE Peptide Receptor Radionuclide Therapy

Monday, Dec. 2 12:45PM - 1:15PM Room: MI Community, Learning Center Station #3

Participants
Samuel J. Galgano, MD, Birmingham, AL (*Presenter*) Research support, Blue Earth Diagnostics Ltd; Research support, Advanced Accelerator Applications SA
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TEACHING POINTS

• [177Lu]DOTATATE therapy is FDA-approved for treatment of gastroenteropancreatic neuroendocrine tumors (GEP-NETs) • A comprehensive patient work-up prior to therapy is essential, including history and physical, assessment of renal, hepatic, and hematopoietic function, and pretreatment [68Ga]DOTATATE PET scan • Close collaboration with medical and surgical oncologists is necessary to manage patients who are eligible and/or undergoing evaluation for [177Lu]DOTATATE therapy • Following initiation of [177Lu]DOTATATE therapy, intermittent assessment of renal, hepatic, and hematopoietic function is needed to assess for toxicities

TABLE OF CONTENTS/OUTLINE

• Introduction and Background • Considerations in Pretreatment Patient Assessment o Imaging with [68Ga]DOTATATE: Who to Image? o Pretreatment History and Physical o Pretreatment Laboratory Assessments • Developing a Multidisciplinary Neuroendocrine Tumor Service • Administration of [177Lu]DOTATATE: Potential Pitfalls and Adverse Events • Treatment Schedule and Follow-up of Patients After [177Lu]DOTATATE

Printed on: 10/29/20

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MI206-SD-MOB1

Simultaneous Measurement of Split Renal Glomerular Filtration Rate, Effective Renal Plasma Flow and Regional Quantitative Imaging Using Model Analysis of Dynamic Area Detector CT Images

Monday, Dec. 2 12:45PM - 1:15PM Room: MI Community, Learning Center Station #1

Participants
Takashi Ichihara, PhD, Toyoake, Japan (*Presenter*) Research Grant, 12Sigma Technologies
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PURPOSE

The purpose of this study was to simultaneously measure split renal glomerular filtration rate (GFR) and effective renal plasma flow (ERPF) and generate their distribution images based on compartment model analysis using dynamic area detector CT (ADCT).

METHOD AND MATERIALS

Seventeen living-related renal transplant donors underwent the inulin clearance test and standard renal dynamic CT scan for 3D-CT angiography with addition of low radiation dose dynamic scan using 320-row ADCT (Aquilion ONE; Canon Medical Systems). As the input function, time-density curves (TDCs) were obtained from the left and right renal arteries. The output functions were obtained from a pixel in the renal cortex and medulla of the left and right kidney. These TDCs were employed for calculation of the regional GFR and ERPF on a pixel-by-pixel basis on compartment analysis. In our proposed compartment analysis, arterial blood (plasma), extravascular space of kidney and glomerulus were defined as an individual compartment. K1 and k2 represent the first-order transfer constants from plasma to extravascular space and from extravascular to plasma, respectively. The elimination of the marker from the body is from plasma. K3(=GFR) represents transfer constants of this elimination. The total GFR and ERPF were calculated from integration of the regional GFR and ERPF over the whole kidney. Total GFR was compared with the results of inulin clearance test.

RESULTS

Regional and total GFR and ERPF were obtained in all subjects. The results of a linear regression analysis between the CT based GFR and inulin clearance showed a good correlation ($y = 0.969x + 2.73$, $r = 0.761$, $p = 0.00039$).

CONCLUSION

We have developed a new functional imaging to simultaneously measure GFR and ERPF and generate their distribution images based on compartment model analysis by using dynamic ADCT.

CLINICAL RELEVANCE/APPLICATION

This approach would contribute substantially to understanding of a variety of renal disease mechanisms, as well as potentially increasing the accuracy of diagnosis and directing appropriate therapy.

MK309-ED-MOB9

Interventional Musculoskeletal Ultrasound Techniques: A Review

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #9

Awards
Magna Cum Laude
Identified for RadioGraphics

Participants
Junzi Shi, MD, Boston, MA (*Presenter*) Nothing to Disclose
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Christopher J. Burke, MBChB, FRCR, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ronald S. Adler, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Luis S. Beltran, MD, Chestnut Hill, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Ultrasound-guided interventions for musculoskeletal applications are minimally invasive procedures with low risk and good outcome for a variety of indications. 2. To review the indications, interventional methods, contraindications, and potential complications of various interventional MSK ultrasound procedures.

TABLE OF CONTENTS/OUTLINE

1. Review normal musculoskeletal ultrasound anatomy 2. Clinical signs/symptoms, pathophysiology of injury and abnormal findings as seen on diagnostic ultrasound imaging 3. Interventional musculoskeletal ultrasound techniques in various joints, including the shoulder, elbow, wrist/hand, hip, knee, and ankle/feet 4. Follow-up management 5. Outcomes and potential complications 6. Future directions, a brief discussion of advance techniques for example 3D ultrasound imaging and ultrasound-magnetic resonance imaging fusion

MK310-ED-MOB8

Ultrasound MSK Guided Intervention: Tips and Tricks

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #8

Participants
Ines Abreu, MD, Maia, Portugal (*Presenter*) Nothing to Disclose
Luis Amaral Ferreira, MD,MSc, Coimbra, Portugal (*Abstract Co-Author*) Nothing to Disclose
Nuno A. Pereira da Silva, MD, Coimbra, Portugal (*Abstract Co-Author*) Nothing to Disclose
Paulo Donato, MD, Coimbra, Portugal (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1 - Describe typical ultrasound abnormalities observed on most common MSK pathologies treatable by percutaneous US-guided procedures 2 - A step-by-step demonstration of the most frequently performed MSK percutaneous US-guided procedures with videos and US images

TABLE OF CONTENTS/OUTLINE

1 - Basic principles of US-guided MSK intervention 2 - Infiltration of subacromio-subdeltoid bursitis 3 - Barbotage of the shoulder rotator cuff HADD disease 4 - Dry needling of tendinopathies 5 - Hydrostatic dissection of the Achilles tendon 6 - US-guided treatment of plantar fasciitis 7 - US-guided treatment of Morton's Neuroma 8 - Summary 9 - Conclusions

Printed on: 10/29/20

MK311-ED-MOB10

Ultrasound Guided Perineural Injections for the Diagnosis and Treatment of Chronic Pelvic Pain

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #10

Participants
Leah E. Waldman, MD, New York, NY (*Presenter*) Nothing to Disclose
Miriam Defilipp, MD, New York , NY (*Abstract Co-Author*) Nothing to Disclose
Chimere Mba-Jonas, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mark Zoland, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Devon A. Klein, MD, MPH, New York, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Pelvic pain is a complex and challenging diagnosis which can arise from a variety of different pathological processes including neuropathic pain, referred pain, injuries, and inflammatory conditions. Ultrasound guided perineural injections allow the radiologist to play a crucial role in the diagnosis and treatment of chronic neuropathic pain in the lower abdominal wall and groin. Through the injection of anesthetic, or a combination of anesthetic and steroid, the radiologist may confirm the source of the patient's pain and guide further management. The radiologist may also assist in the work up of postoperative groin pain. As a tertiary referral center for chronic pelvic pain, we would like to share our experience with nerve blocks in the groin and compare our data with what has been published thus far.

TABLE OF CONTENTS/OUTLINE

Introduction Overview of pelvic pain imaging - Pubalgia protocol MRI Indications for procedure Diagnostic versus therapeutic Pre- and post-operative Ultrasound technique and approach Results Our institution Published data Ideas for further research Conclusion

MK312-ED-MOB11

You're Getting on My Nerves: A Review of Current and Future Applications of DTI Tractography of the Central and Peripheral Nervous System

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #11

Participants
Benjamin A. Laguna, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
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Vinil Shah, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jesse L. Courtier, MD, San Francisco, CA (*Abstract Co-Author*) Founder, Sira Medical, Inc; Consultant, Sira Medical Inc

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TEACHING POINTS

Learner should have a knowledge of current and future applications of DTI within the peripheral nervous system. Learner should have a basic understanding of the theoretical underpinnings of DTI.

TABLE OF CONTENTS/OUTLINE

1. Brief review of DTI physics 1a. Review of theoretical underpinnings. 1b. Review of tensors, eigen vectors, trace, and creation of processed DTI. 2. Brachial Plexus Injuries during Child Birth 2a. Mechanisms of injury 2b. Imaging injury 2c. Sequelae of injury and DTI applications 3. Brachial Plexus Lesions in Adults. 3a. Characterizing Plexiform Neurofibromas vs. Schwannomas. 3b. DTI applications in imaging the brachial plexus 3c. Problem solving using DTI and advanced imaging techniques in the plexus. 4. Imaging of peripheral nervous system in the Lower extremities 4a. Appearance of lesions along the sciatic nerve 4b. Surgical planning of peripheral nerve lesions 4c. Radiology added value with DTI and presurgical planning. 5 Future Applications (including incorporating VR/AR technologies) 5a. VR/AR tools for visualization 5b. Intraoperative applications of DTI 5c. Current advanced imaging techniques (including 7T and novel DTI sequences).

MK358-SD-MOB1

"Salt and Pepper" Sign on Fat Fraction Map by IDEAL-IQ: Useful MR Sign for Differentiating Bone Islands from Osteoblastic Metastases

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #1

Participants
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Kyu-sung Kwack, MD, PhD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Sung Yun, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Jun Jung, Suwon , Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To analyze the diagnostic performance of fat fraction map by complex-based chemical shift imaging-based MRI (CSE-MRI) differentiating between bone islands and osteoblastic metastases, with emphasis on the value of the "salt and pepper" sign, as compared with CT attenuation value.

METHOD AND MATERIALS

From April 2008 to March 2018, total 37 patients (age range, 39-82 years; mean age, 63 years) with 50 sclerotic vertebral bone marrow lesions (24 bone islands, 26 osteoblastic metastases) were included. All patients underwent CT and MR imaging, including CSE-MRI sequence with a 1.5T MR system. Salt and pepper sign was defined as speckled appearance of white and black pixels that is similar to the background air on fat fraction map. Receiver operating characteristic (ROC) curve analysis was assessed to compare the diagnostic performance between salt and pepper sign, halo sign on fat-suppressed T2-weighted image, and CT attenuation value for differentiating bone islands from osteoblastic metastases.

RESULTS

The salt and pepper sign was present in 100% (24/24) patients with bone islands and 3.8% (1/25) patients with osteoblastic metastases. Area under the curve (AUC) were 0.981 (95% confidence interval (CI), 0.895-1.000) for salt and pepper sign on fat fraction map, 0.921 (95% CI, 0.810-0.979) for halo sign on fat-suppressed T2-weighted image, and 0.989 (95% CI, 0.908-1.000) for mean CT attenuation value. There was no significant difference, although halo sign on fat-suppressed T2-weighted image showed relatively lower diagnostic performance for differentiation between bone islands and osteoblastic metastases.

CONCLUSION

The salt and pepper sign on fat fraction map by IDEAL-IQ is featured in bone islands, and it can be a useful finding to differentiate from osteoblastic metastases.

CLINICAL RELEVANCE/APPLICATION

Salter and pepper sign on fat fraction maps by CSE-MRI allows to assess sclerotic bone marrow lesions and can improve diagnostic accuracy differentiating bone islands and osteoblastic metastases on MRI.

MK359-SD-MOB2

Septic Arthritis in Shoulder: Diagnostic Clues on Indirect MR Arthrography

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #2

Participants
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PURPOSE

The purpose of this study is to determine the diagnostic clues for septic arthritis in shoulders on indirect MR arthrography by comparing MR findings between shoulders with septic arthritis and full-thickeness rotator cuff tears.

METHOD AND MATERIALS

Twenty-two patients (8 male and 14 female; mean age, 67.8 years) who underwent arthroscopic lavage for treatment of septic arthritis of shoulders were included as a study group. Forty-three patients (17 male and 26 female; mean age, 64.6 years) who underwent arthroscopic repair for treatment of full-thickeness rotator cuff tear were included as a control group. Both groups underwent preoperative indirect MR arthrography of shoulders. MR findings analyzed were the presence of low signal intensity of the fluid in axillary recess, subcoracoid recess, subscapular recess, and subacromial-subdeltoid bursa (SASD) on T1-weighted image (T1WI) (which was presumed as a diffusion-restriction of contrast media) and on T2-weighted image (T2WI), bone edema, and soft tissue edema. The volume of the glenohumeral joint, recesses and bursa were measured using a software (Aquarius iNtuitionTM).

RESULTS

Low signal intensity of fluid in the recesses and bursa on T1- and T2WI and edema in the soft tissue and bone were statistically significant findings for septic arthritis of shoulders in univariate analysis. However, in multivariate analysis, low signal intensities of fluid in the subscapular recess and SASD on T1WI were the only reliable findings (odds ratio = 75.8, p-value = 0.023 in subscapular recess; 46.3, 0.027 in SASD). The positive predictive values for low signal intensity in the subscapular recess and SASD were 94% and 92%, respectively. The volumes of the glenohumeral joint, recesses, and bursa were not statistically significant factors for septic arthritis of shoulders.

CONCLUSION

Low-signal intensities of the fluid in the subscapular recess and SASD on T1WI, presumed as diffusion-restriction of contrast media in the fluid, were the most reliable findings for diagnosing septic arthritis of shoulders on indirect MR arthrography.

CLINICAL RELEVANCE/APPLICATION

Indirect MR arthrography of the shoulder could give strong clues for diagnosis of septic arthritis by finding of diffusion-restriction of contrast media in joint fluid.

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MK360-SD-MOB3

Benign Bone Tumors Percutaneous Treatment: There is Life Beyond Osteoid Osteoma

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #3

Participants
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PURPOSE

We review our experience with percutaneous treatment of benign tumour bone conditions different from osteoid osteoma.

METHOD AND MATERIALS

For the last fifteen years, we have performed 46 percutaneous ablations for the treatment of different benign bone tumours other than osteoid osteoma. 26 (56.5%) patients were female and 20 (43.5%), male. Mean age: 26.1±1.9 years (range 8 to 58 years). Location: femur (13 cases), pelvic ring (9), spine (6), tibia (6), foot (5), humerus (2) hand (2), fibula (2) and radius (1). Follow-up period: 24-36 months. Percutaneous radiofrequency thermal ablation (RFA) was used in all of the patients in the first instance. Ablation was repeated in 6 cases (4 RFA and 2 cryoablations). In 10 cases these techniques were combined with cementoplasty. A biopsy was obtained in all cases in order to provide a histological diagnosis, although in 15 cases the sample was taken just before the ablation procedure. The histological results were: 9 chondroblastomas, 9 osteoblastomas, 6 giant cell tumours, 6 aneurysmal bone cysts, 3 enchondromas, 3 fibrous dysplasia, 2 osseous fibromas, 2 intraosseous ganglia, 2 mesenchymal tumours, and 4 other diagnoses (1 chondroma, 1 osteoblastomatosis, 1 eosinophilic granuloma and 1 osseous hemangioma).

RESULTS

All procedures were technically successful considering that the patients were pain-free by the seventh-tenth days, except in six patients (three osteoblastomas, two chondroblastomas, and one fibrous dysplasia) in which percutaneous ablation was repeated. A unique case of osteoblastoma needed further surgery. As delayed complications, three patients developed a pathologic fracture after RFA and two patients with intraarticular lesions developed osteoarthritis.

CONCLUSION

CT-guided percutaneous ablation treatment is a safe technique that can be applied with curative intend on benign bone tumours other than osteoid osteoma.

CLINICAL RELEVANCE/APPLICATION

Our aim is to share our experience with percutaneous thermal ablation in benign bone tumours other than osteoid osteoma to widespread its use as a modality of choice for the treatment of these lesions.

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MK383-SD-MOB4

DECT for Detecting Gout: Problem-Solving Technique versus Problem-Causing Technique - Evaluation of Clumpy Artifact in Foot and Ankle DECT from Gout-Free Patients

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #4

Participants
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PURPOSE

To evaluate the frequency and common sites of the clumpy artifact and see if it interferes with radiologists making a gout diagnosis, and to evaluate whether clumpy artifacts can be reduced by changing the minimum Hounsfield unit (HU) and using dual energy computed tomography (DECT) with a selective photon shield (SPS).

METHOD AND MATERIALS

Thirty-three gout-free patients underwent DECT. Set 1 was composed of 22 patients using DECT without an SPS with a minimum HU of 130 or 150. Three reviewers (2 musculoskeletal (MSK) and 1 general radiologist) checked the presence and site of green pixilation. A confidence level was assigned for clumpy artifacts based on a 4-point scale. Set 2 was composed of 11 patients using DECT with an SPS. Three reviewers checked for the presence of clumpy artifacts.

RESULTS

The frequency and volume of clumpy artifacts in set 1 decreased when minimum the HU was set to 150 compared with 130 (68% vs. 81%, p=0.48; 0.10 cm3 vs. 0.34 cm3, p<0.001). Though the difference did not reach statistical significance, the specificity was higher when the minimum HU was set to 150, and this was more evident with the general radiologist (MSK specialist=77.2% vs. 68.1%, p=0.31; general radiologist=68.1% vs. 45.4%, p=0.05). The confidence score increased when the minimum was HU set at 150 compared to 130 (MSK specialist=2.42 vs. 1.75, p=0.08; general radiologist=1.83 vs. 1.25, p=0.01). Clumpy artifacts were most common in the forefoot at minimum HU of both 150 and 130. Most clumpy artifacts (91%) were noted at tendons, the flexor tendon being the most common site, followed by the peroneus tendon and tibialis posterior tendon. While clumpy artifacts were frequent in set 1, no patients in set 2 showed clumpy artifacts.

CONCLUSION

Clumpy artifacts are very common with DECT without an SPS, and this interferes in making a diagnosis of gout. When the minimal HU is set to 150 compared to 130, the frequency and volume of clumpy artifacts decrease, and this increases specificity and confidence level, especially for general radiologists. With an SPS inserted in DECT, the clumpy artifact is not shown.

CLINICAL RELEVANCE/APPLICATION

From this study, radiologists will be able to optimize their settings and recognize common sites of clumpy artifacts. This will 1) minimize wrong diagnosis, 2) minimize unnecessary treatment, and 3) allow gout-mimicking lesions (including infection and inflammatory arthritis) to be diagnosed properly.

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MK385-SD-MOB6

Ultrafast Imaging of Shoulder MR Arthrography with Compressed Sensing Accelerated Isovolumetric 3D-THRIVE: Comparison of One Scan of Iso-Volumetric with Multiplanar Reconstruction (MPR) and Three Scans of Conventional MR Images

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #6

Participants
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Ho-Taek Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin-Suck Suh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of ultrafast shoulder MRI protocol consisting of isovolumetric 3D-THRIVE (T1 High Resolution Iso-Volumetric Examination) with multiplanar reconstruction (MPR) imaging with parallel imaging (PI) and compressed sensing (CS) to that of a standard 2D fast spin-echo (FSE) protocol.

METHOD AND MATERIALS

Seventy-three patients who underwent shoulder MRa including image sets of isotropic 3D-THRIVE sequence without CS and with CS were included. PI factor was 2 and CS acceleration factor was 1.5. In first session, 3D-THRIVE sequence without CS and with CS were compared in terms of image quality and diagnostic agreements. In second session, the MPR images of the 3D-THRIVE sequence without CS and with CS were evaluated with 2D axial, oblique-sagittal, oblique-coronal images of 2D FSE as reference images. Two musculoskeletal radiologists independently and blindly assessed randomized images. Diagnostic agreement for pathologic lesions of subscapularis tendons, supraspinatus tendons, infraspinatus tendons, biceps tendons, labrums, glenohumeral cartilages and bones were evaluated. Overall image quality scores, legibility, and motion artifacts were compared between two sequences using the paired t-test. Diagnostic agreement for pathologic shoulder lesions were evaluated using the weighted Kappa test.

RESULTS

Diagnostic agreement for pathologic findings between MPR images with CS and conventional 2D FSE images showed excellent agreements (kappa=0.849, 0.969, 0.953, 0.899 for subscapularis, supraspinatus, infraspinatus, and biceps tendons). Scan time of MPR with CS was significantly decreased compared to conventional 2D FSE (81 seconds vs. 188+188+190 seconds=9 min 26 seconds, $p<0.05$). Shoulder MRI wit MPR images of 3D THRIVE sequences using parallel imaging and CS showed similar accuracy to shoulder MRa standard protocol for evaluating rotator cuffs.

CONCLUSION

CS accelerated isotropic 3D-THRIVE shoulder MRA produces images of acceptable diagnostic performance with reduced scan time. Shoulder MRI with MPR images of 3D THRIVE sequences using parallel imaging could replace the standard 2D FSE sequences. However, better image sequence is necessary for evaluation of subscapularis tendinopathy and cartilage defect.

CLINICAL RELEVANCE/APPLICATION

Single scan of iso-volumetric 3D THRIVE shoulder MR arthrography with compressed sensing and MPR reconstruction could be used for ultrafast imaging.

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MK386-SD-MOB7

Weight-Bearing Syndesmotic Measurements in Ankle Injuries: Comparison with the Normal Side Using a Semi-Automatic Software

Monday, Dec. 2 12:45PM - 1:15PM Room: MK Community, Learning Center Station #7

Participants
Delaram Shakoor, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Mohamad Aghaie Meybodi, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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Wojciech Zbijewski, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Carestream Health, Inc; Research Grant, Siemens AG
Lew Schon, MD, Baltimore, MD (*Abstract Co-Author*) Royalties, DJO, LLC Royalties, Arthrex, Inc Royalties, DARCO International, Inc Royalties, Gerson Lehrman Group, Inc Royalties, Zimmer Biomet Holdings, Inc Royalties, Reed Elsevier Speakers Bureau, Tornier, Inc Speakers Bureau, Zimmer Biomet Holdings, Inc Speakers Bureau, BioMimetic Therapeutics, Inc Consultant, Zimmer Biomet Holdings, Inc Consultant, BioMimetic Therapeutics, Inc Consultant, Guidepoint Global, LLC Consultant, Gerson Lehrman Group, Inc Consultant, Tornier, Inc Consultant, Wright Medical Technology, Inc Consultant, Royer Medical, Inc Consultant, Carestream Health, Inc Stockholder, Tornier, Inc Stockholder, Royer Medical, Inc Stockholder, Bioactive Surgical, Inc Stockholder, HealthpointCapital Research support, Royer Medical, Inc Research support, Zimmer Biomet Holdings, Inc Research support, Tornier, Inc Research support, Arthrex, Inc Research support, SpineSmith LP Research support, BioMimetic Therapeutics, Inc Support, Bioactive Surgical, Inc Support, Educational Concepts in Medicine, LLC Support, Smith & Nephew plc Support, OrthoHelix Surgical Designs, Inc Support, Chesapeake Surgical Biocomposites Support, Olympus Corporation Support, Omega Surgical Instruments Ltd
Shadpour Demehri, MD, Baltimore, MD (*Abstract Co-Author*) Research support, General Electric Company; Research Grant, Carestream Health, Inc; Consultant, Toshiba Corporation

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PURPOSE

Assessment of syndesmotic injuries in ankle fractures can be a challenging task. Although CT images provide a comprehensive visualization of the ankle joint, prior reports on CT scan was not performed under weight bearing (WB). Besides, comparison to the normal side is recommended to provide a better assessment. Thus, we intend to perform syndesmotic measurements on WB images and compare the results with the normal contralateral side, using a semi-automatic software on images obtained from Cone Beam CT(CBCT)

METHOD AND MATERIALS

Patients with prior unilateral ankle injuries were recruited and were bilaterally scanned 12 weeks following the injury in both WB and non-weight-bearing (NWB) conditions.Twelve syndesmosis measurements were obtained by two readers using JMAT (Brehler et al SPIE Med Im 2017).This software package was developed to provide multi-planar rendering of the CBCT volumes to guide the user through selection of anatomical points and compute the measurements.At 10 mm above tibial plafond, 5 diastasis measurements including ATFD, PTFD,TFCS,diastasis and angular measurements,3 rotation and 2 translation measurements were performed. At 5 mm below talar dome, medial and lateral clear space(MCS and LCS) were obtained. WB and NWB measurements were compared between injured and normal ankles using paired t-test

RESULTS

Nine men and 16 women with mean age of 45 years were included.Fourteen patients underwent operative treatment for their ankle fracture without receiving syndesmotic fixation and the rest received non-operative treatment. In WB images, mean values of Tang rotation and MCS were significantly higher in the injured side than the normal ankle (P-value<0.05). In NWB images,mean values of Tang rotation were significantly higher in the injured ankle than the normal side (P-value<0.05).Mean values of angular measurement in both WB images(P-value<0.001) and NWB images (P-value=0.01) were significantly lower on the injured side

CONCLUSION

Comparison with the contralateral asymptomatic ankles,the ankles with fractures have distinct tibiofibular syndesmotic measurement differences between WB and NWB scan acquisitions

CLINICAL RELEVANCE/APPLICATION

In order to improve the detectibility of syndesmotic injuries, distinct tibiofibular syndesmosis measurements may be used in clinical practice according to the weight bearing mode of image acquisition (WB vs NWB) using dedicated extremity CBCT

MS224-ED-MOB1

Parasitic Infestations - Sights and Sites of Parasites: Ultrasound to the Rescue as a First Line Imaging Tool

Monday, Dec. 2 12:45PM - 1:15PM Room: MS Community, Learning Center Station #1

Participants
Rajas N. Chaubal, MBBS,MD, Thane, India (*Presenter*) Nothing to Disclose
Pooja U. Vyas, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Nitin G. Chaubal, MD, MBBS, Thane, India (*Abstract Co-Author*) Nothing to Disclose
Nirvikar Dahiya, MD, Phoenix, AZ (*Abstract Co-Author*) Nothing to Disclose
Bhargavi S. Sovani, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Increased global travel has resulted in increased prevalence of parasitic infestations in all countries. This exhibit offers a comprehensive pictorial review of sonographic presentation of various parasitic infestations. • Classification of parasitic infestations • Sonographic presentation of parasitic infestations • Ultrasound guided interventions for diagnosis and treatment • Imaging pitfalls and ways to avoid them

TABLE OF CONTENTS/OUTLINE

1. Review of literature on parasitic infestations affecting humans - including life cycles of commonly seen parasites. 2. Importance of selecting appropriate approach and scanning technique for maximizing detection of parasitic infestations on ultrasound including probe selection and use of Color Doppler 3. Discussion on characteristic ultrasound features of parasites - ascariasis, enterobiasis, trichuriasis, echinococcosis etc. 4. Detecting secondary complications due to parasitic infestations including obstruction, spread to peritoneal/ pleural cavity, spontaneous rupture of spleen in malaria etc. 5. Using techniques like Contrast Enhanced Ultrasound and Elastography to aid diagnosis. 6. Discussing role of ultrasound in treatment of parasitic infestations including aspiration, alcohol ablation, intracavitary instillation of scolicidal agents etc. 7. Assessing treatment response on ultrasound.

NM129-ED-MOB6

Prostate Cancer Imaging with 18F-Fluciclovine PET/CT: Physiologic Distribution, Clinical Applications, Interpretation Criteria and Pitfalls

Monday, Dec. 2 12:45PM - 1:15PM Room: NM Community, Learning Center Station #6

Participants
Daniella F. Pinho, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Asha Kandathil, MD, North Richland Hills, TX (*Abstract Co-Author*) Nothing to Disclose
Orhan K. Oz, MD,PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Discuss the indications of 18F-Fluciclovine PET/CT and its utility in prostate cancer 2. Overview of study interpretation, patters of uptake, pitfalls 3. Review of overall performance of the tracer based on current literature

TABLE OF CONTENTS/OUTLINE

1- Overview of prostate cancer 2- Biochemical recurrence - definition 3- Limitations of conventional imaging for recurrence evaluation (CT, bone scan, MRI) 4- Properties and kinetics 5- Imaging protocol 6- Physiologic distribution a. Bladder activity, muscular uptake 7- Interpretation criteria a. Prostate, prostatic bed, typical lymph nodes b. Atypical lymph nodes c. Bones 8- Pitfalls 9- Atypical presentations 10- Overall performance a. Compared to CT b. Compared to other prostate specific PET agents c. Performance in bone lesions 11- Fluciclovine PET/CT at initial staging 12- Impact on therapy management

NM130-ED-MOB7

What is That Bright Spot? Mimics and Pitfalls in PET CT Scans in Oncological Imaging

Monday, Dec. 2 12:45PM - 1:15PM Room: NM Community, Learning Center Station #7

Participants
Srujana Ganti, MBChB, Manchester, United Kingdom (*Presenter*) Nothing to Disclose
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Rohit Kochhar, MD, Manchester, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Yatin Jain, MBBS,FRCR, Manchester , United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

PET CT scans are becoming integral in the diagnosis and treatment surveillance in oncological imaging. The purpose of this exhibit is to present a comprehensive pictorial review of mimics and pitfalls to aid pattern recognition when evaluating these cases. The learner should aim to have a greater undertanding of the topic and be equipped with a framework to evaluate these cases in clinical practice.

TABLE OF CONTENTS/OUTLINE

The exhibit will include an overview of the pathophysiology of FDG uptake and showcase anatomical, physiological and pathological processes which may mimic malignancy. Tips and tricks to help with pattern recognition will also be provided. Pitfalls of poorly FDG avid/inavid malignancies are highlighted with examples of sites of metastases as well as incidentally identified tumours. Additionally, an interesting series of cases will be presented as a self assessment based on a similar theme to reinforce the learner's knowledge.

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NM209-SD-MOB1

18F-FDG PET/CT Predicts the Expression of PD-1/PD-L1 Before Immunotherapy in Multiple Cancer Types

Monday, Dec. 2 12:45PM - 1:15PM Room: NM Community, Learning Center Station #1

Participants
Huimin Shan, Guangzhou, China (*Presenter*) Nothing to Disclose
Wei Fan, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

18F-fluorodeoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) is a molecular imaging technique that can provide metabolic information on malignant tumors. PD-L1 is widely expressed in tumor cells and PD-L1 antibodies produce efficacious clinical responses in diverse cancers. The purpose of this study is to evaluate the ability of quantitative 18F-FDG PET/CT parameters to predict the PD-1/PD-L1 status of cancer.

METHOD AND MATERIALS

251 patients with newly diagnosed or refractory recurrent malignant tumors who underwent 18F-FDG PET/CT scans before immunotherapy from January 2015 to December 2018 were retrospectively enrolled(malignant lymphoma, n=164; bronchial carcinoma, n=21; malignant melanoma, n=15; nasopharyngeal carcinoma, n=11; other, n=40).Maximum standardized uptake values(SUVmax), metabolic tumor volume(MTV) and total lesion glycolysis(TLG), were measured for the most active tumor site from PET/CT images. The expression of tumor cell PD-L1/ T cell PD-1 in fresh or archived pathologic specimens was analyzed by immunohistochemistry.

RESULTS

SUVmax in PD-1/PD-L1 positive was clearly higher than that in PD-1/PD-L1 negative(14.16 ± 6.87 vs. 10.21 ± 3.76, p=0.0004;16.31 ± 8.65 vs. 7.26 ± 3.34, p<0.0001), moreover, there was a positive correlation between SUVmax and PD-1/PD-L1 expression(Kendall's tau-b=0.153, p=0.073; Kendall's tau-b=0.248, p=0.010). Both TLG and MTV was obviously higher in PD-L1 positive than that in PD-L1 negative (1158.95 ± 2577.07 vs. 275.24 ± 472.69, p=0.001; 152.67 ± 280.35 vs. 60.73 ± 103.32, p=0.004), however, TLG and MTV seem to be no statistical significance with the PD-1 status. ROC curves analysis revealed that using an SUVmax cut-off value of 10.94, PD-L1 status could be predicted with the sensibility of 70.7% and specificity of 96.6%, and AUC is 0.861. Further Chi-Square analysis showed that the positive expression rate of PD-L1 differed significantly (2.8% vs. 97.2%, p<0.001) between the groups with the low and high frequency of SUVmax(cutoff>=10.94).

CONCLUSION

Superior 18F-FDG uptake is significantly associated with higher PD-1/PD-L1 expression in the malignant tumor, and SUVmax could be used to infer the PD-L1 status.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/CT has the potential to become a useful complement to assist in making the clinical decision as to whether to use an anti-PD-1/PD-L1 antibody therapy.

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NM210-SD-MOB2

18F-FTC-146 PET/MR in Women with Chronic Pelvic Pain: Early Results

Monday, Dec. 2 12:45PM - 1:15PM Room: NM Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Chronic pelvic pain affects 15% of women and has multiple etiologies, including gynecologic, gastrointestinal, musculoskeletal, urologic, and psychosocial conditions. Studies have shown up to half of these patients lack a clear diagnosis. Additionally, half of patients have more than one potential cause of pain, and targeting the pain generator can be challenging. 18F-FTC-146 is a highly specific radioligand that targets the sigma-1 receptor, which is upregulated in inflamed tissues. Prior studies have shown promising results in targeting neuropathic pain. This study investigates the use of this radiotracer in diagnosing the etiology of chronic pelvic pain in women.

METHOD AND MATERIALS

This IRB approved prospective observational study identified 5 women (ages 25-69) with pelvic pain for greater than 6 months. Patients underwent full body 18F-FTC-146 PET/MR with diagnostic MR imaging of the pelvis and completed surveys describing their pain at the time of the study. SUV values were compared to a preexisting database of asymptomatic female control patients.

RESULTS

All patients had increased radiotracer uptake compared to asymptomatic controls. A patient with history of stage 4 endometriosis and another patient with prior lysis of adhesions showed intense uptake along the bowel with SUV max of 4.1 (Figure 1), compared to SUV average max of 1.5 (SD 0.12), which may reflect underlying adhesions, distant endometrial implants, or bowel pathology. Another patient showed intense vaginal uptake with an SUV max of 5.5 (Figure 2), compared to SUV average max of 2.1 (SD 0.46), and the patient was clinically suspected to have vaginismus. Two patients showed intense uterine uptake with an SUV max of 7.0 (Figure 3), compared to SUV max average of 3.2 (SD 0.70).

CONCLUSION

Early results demonstrate the potential use of 18F-FTC-146 PET/MR in diagnosing pain generators outside the established use in neuropathic pain. This radiotracer may be helpful in identifying conditions that are currently challenging to diagnose with imaging, such as adhesive disease or distant endometrial implants, which could potentially both help diagnose and guide treatment for chronic pelvic pain.

CLINICAL RELEVANCE/APPLICATION

Chronic pelvic pain in women is a complex, multidisciplinary problem that is challenging to diagnose and treat. 18F-FTC-146 PET/MR may be a novel approach to targeting the pain generator in these patients to guide diagnosis and treatment.

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NM211-SD-MOB3

Non-blood Sampling Assessment for Quantitative Cerebral Blood Flow in PET with 15O-labeled Oxygen Gas: Comparison with an Invasive Arterial Blood Sampling Method

Monday, Dec. 2 12:45PM - 1:15PM Room: NM Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
Yusuke Terakawa, Suita, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

Evaluation of cerebral blood flow (CBF) is necessary for the monitoring or preoperative assessment of cerebral arterial stenotic disease. Positron emission tomography with 15O-labeled oxygen gas (O-PET) provides a precise quantification of CBF; however, the current method (DARG; dual-autoradiography) requires arterial blood sampling. Therefore, we proposed a novel CBF measurement method that does not need blood sampling (NBS; non-blood sampling). The aim of this study was to compare the values obtained with NBS-CBF to those obtained with DARG-CBF.

METHOD AND MATERIALS

We retrospectively reviewed a total of 12 patients with significant stenosis in the cervical intracarotid artery who underwent both DARG and NBS O-PET examinations. Regional CBF values were measured in the basal ganglia and cortex of the cerebral hemisphere for the diseased and non-diseased sites, respectively. The right-to-left ratio (RLR) was also evaluated. The variability between the two methods was assessed by measuring the intraclass coefficient (ICC). The inter-observer reproducibility was also tested.

RESULTS

In total, 144 regions of interest showed a good overall correlation between DARG and NBS (ICC=0.80, P<0.01), where ICC=0.83 for the diseased site and ICC=0.78 for the non-diseased sites. The RLR also showed an excellent correlation (ICC=0.89, P<0.01). Inter-observer reproducibility was very high (ICC=0.93, P<0.01).

CONCLUSION

Non-blood sampling could be an alternative to the invasive blood sampling method used in 15O-labeled oxygen gas PET scans.

CLINICAL RELEVANCE/APPLICATION

Oxygen gas PET provides an accurate and high quality image of the brain; however, the current method requires blood sampling. Our proposed non-blood-sampling method is less invasive, more time efficient, and more reliable. This new method could therefore be an alternative to the current method.

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NM231-SD-MOB5

Trends in Brain Death Scintigraphy at a Tertiary Care Trauma Center

Monday, Dec. 2 12:45PM - 1:15PM Room: NM Community, Learning Center Station #5

Participants
Reza Assadsangabi, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
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Jacob G. Dubroff, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Ion Beam Applications SA; Research Grant, Voyager Therapeutics

PURPOSE

Nuclear medicine brain perfusion imaging is used as an ancillary test for determining the brain death per 2010 American Academy of Neurology guidelines (Neurology, 2010; 74(23) 1911-18.). The purpose of this study is to examine differences in demographics, precipitating events, and decision for organ donation of patients who underwent brain death scintigraphy.

METHOD AND MATERIALS

Nuclear medicine brain death perfusion studies conducted per standard of care within the University of Pennsylvania Health System from 2006 through 2018 were identified. Utilization was compared to historical studies performed from 1991-2005. These studies were analyzed for result (+/-), contributing event to clinical brain death status, patient demographics, and whether to proceed to organ donation.

RESULTS

126 studies were identified that were performed on 124 patients. 66% of patients were male with a mean age of 42.9 years (SD+/-19 years). Over the study period, a mean of 0.9 studies were performed per month and 93.5% of studies were positive for brain death, compared to 1 study per month with 74% positive from 1991-2005 representing a significant increase in the rate of positive studies (chi square, $p<0.0001$). Contributing causes included trauma (n=51, 41%), cardiopulmonary arrest (n=36, 29%), CVA (n=29, 23%), and toxin/other (n=8, 6%) who differed significantly in mean age (33.6, 50.1, 54, and 31.1, respectively, single factor ANOVA $p<0.0001$). Trauma cases were further subcategorized into gunshot wounds (n=29, 57%), motor vehicle accidents (n=15, 29%), and falls (n=7, 14%). These trauma subgroups also significantly differed in mean age (27.4, 37.3, and 50.9, respectively, single factor ANOVA $p<0.001$) and there were significantly (chi square, $p=0.03$) higher percentage of males relative the overall cohort ($p=0.03$). 60% (70/116) patients with positive studies went on to organ donation.

CONCLUSION

The rate of positive brain death scans has significantly increased while the utilization scintigraphy has mildly decreased relative to an internal historical comparison perhaps due to more stringent patient selection. The rate of organ donation has been stable (JAMA, 2002; 288(17): 2121-2.). Significant demographic differences exist based on precipitating event.

CLINICAL RELEVANCE/APPLICATION

Despite changes in utilization and results, brain death scintigraphy remains an important clinical tool as a bridge to organ donation.

NM233-SD-MOB4

Comparison of 18F-Fluciclovine PET/CT with Conventional Imaging in Prostate Cancer Patients with Biochemical Recurrence

Monday, Dec. 2 12:45PM - 1:15PM Room: NM Community, Learning Center Station #4

Participants
Hong Song, MD, Sunnyvale, CA (*Presenter*) Nothing to Disclose
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Farshad Moradi, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Guido A. Davidzon, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Carina Mari Aparici, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Andrei Iagaru, MD, Emerald Hills, CA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Progenics Pharmaceuticals, Inc Research Grant, Advanced Accelerator Applications SA

PURPOSE

18F-Fluciclovine (Axumin®) PET/CT was approved by the FDA for diagnostic workup and disease localization in prostate cancer patients with biochemical recurrent (BCR). Here we present our experience with 18F-Fluciclovine PET/CT and compare it to other available conventional imaging modalities for disease detection and impact on patient management.

METHOD AND MATERIALS

We retrospectively reviewed 114 prostate cancer patients with BCR (50 to 86 year old, 71.9 ± 9.1) (from 12/2017 to 12/2018) who had 18F-Fluciclovine PET/CT after definitive treatment with prostatectomy (69 patients) and/or radiation therapy (45 patients). A total of 84 out of 114 patients had concurrent scans by at least one of the other imaging modalities available at our institution: CT (21 patients), MR (33 patients), 99mTc MDP bone scan (39 patients), 18F-NaF PET/CT (10 patients), 68Ga-PSMA-11 PET/CT (11 patients) and 18F-DCFPyL PET/CT (7 patients). Changes in management after 18F Fluciclovine PET/CT were also recorded.

RESULTS

For anatomic imaging, 33/48 (69%) CT or MRI have congruent findings of BCR with Fluciclovine PET, while Fluciclovine PET was positive in 15/48 (31%) cases with negative CT or MRI. For detection of bone metastases, 35/47 (74 %) of dedicated bone imaging (30 bone scan and 5 NaF PET) were congruent with Fluciclovine PET findings, while 10/47 (21%) of positive dedicated bone imaging (6 bone scan and 4 NaF PET) had no corresponding uptake on Fluciclovine PET. When compared to PSMA based PET/CT, 10/18 (56%) PSMA PET (6 PSMA11 and 4 DCFPyL) were congruent with Fluciclovine PET positivity, while 4/18 PSMA PET (2 PSMA11 and 2 DCFPyL) detected different lesions from Fluciclovine PET. In addition, another 4/18 (22 %) patients with negative Fluciclovine PET had disease localization on PSMA PET (3 PSMA11 and 1 DCFPyL). The clinical management was changed by starting radiation therapy or androgen deprivation therapy based on Fluciclovine PET findings in 41/114 patients (36 %) who had negative conventional imaging.

CONCLUSION

18F Fluciclovine PET/CT is a useful diagnostic tool in the work-up of prostate cancer patients with BCR as it changed clinical management in 36 % of participants who had negative conventional images in our cohort.

CLINICAL RELEVANCE/APPLICATION

18F Fluciclovine PET/CT alters clinical management of prostate cancer patients with biochemical recurrence.

NR339-ED-MOB10

Zika Virus: A Problem Flying Right into Adult Minds

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #10

Awards
Certificate of Merit

Participants
Beatriz S. Alves, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose
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Cinthia G. Chaves, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Diogo Galheigo de Oliveira E Silva, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Osvaldo Nascimento, Niteroi, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Zika virus (ZIKV) infection is a big concern all over the world due to its several outbreaks worldwide. The main findings in congenital Zika syndrome are already well-established. However, attention should be paid to the spectrum of potential presentations of neurologic manifestations in adults, such as Guillain-Barré Syndrome (GBS), Radiculomyelitis, Acute Disseminated Encephalomyelitis (ADEM), that have been associated with a substantially increased incidence. Some observed abnormalities in neuroimaging findings are very similar to those seen in other flavivirus infections. However, in combination with clinical information, neuroimaging can be used to suggest the possibility of ZIKV infection, especially in endemic areas. ZIKV can trigger severe complications among individuals in different ages.

TABLE OF CONTENTS/OUTLINE

• Zika virus infection - clinical aspects and epidemiology. • Discuss the role that MR imaging plays in assessing the CNS of patients infected by the ZIKV. • Describe the neuroimaging findings in GBS, myelitis, meningoenchephalitis and ADEM, secondary to ZIKV. • Differential diagnosis. • Future perspectives.

NR340-ED-MOB11

Recognizing Radiation-Induced Changes in the Central Nervous System: Where and What to Look For

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #11

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Masaki Katsura, MD, PhD, Tokyo, Japan (*Presenter*) Nothing to Disclose
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Masaaki Akahane, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Harushi Mori, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Review the currently available methods for radiotherapy delivery and provide a pathophysiological basis of radiation-induced changes in the central nervous system. Discuss the timeline and the expected imaging appearances after radiation therapy. Recognize the characteristic imaging features after concomitant chemotherapy and radiation therapy. Identify the high-risk features that indicate tumor recurrence and discuss the role of advanced imaging techniques.

TABLE OF CONTENTS/OUTLINE

What happens during and after radiation therapy? Pathophysiology Acute, early-delayed and late-delayed phases What are the factors that contribute to radiation-induced injury? Radiotherapy-related factors Patient-related factors Overview of latency period and dose threshold Imaging after radiation therapy Reversible vasogenic edema Radiation-induced leukoencephalopathy Radiation necrosis Chronic encapsulated expanding hematoma Mineralizing microangiopathy Radiation-induced cavernous hemangioma Radiation-induced arteritis Radiation-induced neuritis Radiation-induced neoplasm Imaging after radiation therapy with concomitant chemotherapy Disseminated necrotizing leukoencephalopathy (with methotrexate) Pseudoprogression (with temozolomide)

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NR373-SD-MOB1

Cerebral Contrast Uptake on CT Angiography in Acute Ischemic Stroke: Automated Attenuation Measurements for Ischemic Core and Final Infarction Prediction

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #1

Participants
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Wolfgang G. Kunz, MD, Munich, Germany (*Abstract Co-Author*) Grant, Medtronic plc

PURPOSE

To explore the potential of software-based automated cerebral attenuation measurements at CT angiography (CTA) and noncontrast CT (NCCT) in Alberta Stroke Program Early CT Score (ASPECTS) regions to detect areas of ischemic core and predict final infarction in acute ischemic stroke.

METHOD AND MATERIALS

Out of 274 prospectively enrolled stroke patients who underwent thrombectomy due to large vessel occlusion, we selected all patients with complete imaging dataset including CT perfusion (CTP), NCCT and CTA. Tissue attenuation in all ASPECTS regions were measured in Hounsfield Units (HU) using automated software on NCCT and CTA source images (CTASI). Regional contrast uptake was defined as HU difference between regional attenuation on CTASI and attenuation on NCCT. For all ASPECTS regions, presence of ischemic core was assessed on CTP maps and final infarction was determined on follow-up imaging. Area under the curve (AUC) values were calculated using receiver operating characteristics (ROC). Cut-off values were determined by Youden´s method for best discriminatory value.

RESULTS

Seventy-nine patients were included. Regional contrast uptake was able to significantly classify CTP-based ischemic core in all ASPECTS regions except Caudate Nucleus. Best classification was achieved for Insula, Lentiform Nucleus and M3-Cortex (AUC=0.76-0.77, p=0.001 or <0.001, Sensitivity: 63-93%, Specificity: 60-82%). Presence of final infarction was significantly predicted in all regions except M3 and M6 with best performance in M2- and M4-Cortex as well as Lentiform Nucleus (AUC=0.74-0.80, p=<0.001, Sensitivity: 68-89%, Specificity: 60-87%).

CONCLUSION

Automated measurements of cerebral contrast uptake using tissue attenuation on noncontrast CT and CTASI were able to classify almost all ASPECTS regions according to the presence of ischemic core and to the subsequent development of infarction on follow-up.

CLINICAL RELEVANCE/APPLICATION

Stroke centers without access to CTP face challenges with newly recommended CTP triage for late time window thrombectomy. Here, automated analysis of NCCT and CTA may help to simplify decision making.

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NR374-SD-MOB2

What if MRI is Used as First Line Imaging for ED Patients with Suspected Acute Ischemic Stroke?

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #2

Participants
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PURPOSE

CT-based imaging including non-contrast CT (NCCT), CTA or CT perfusion (CTP), has been widely adopted as first-line imaging of choice in patients with suspected acute ischemic stroke (AIS), despite potential for false negative results particularly within the first 24 hours after symptom onset. MRI is frequently performed 1-2 days after the initial CT . The purpose of this study was to investigate potential clinical impacts in management of AIS if MRI was performed as the first-line imaging study for emergency department (ED) patients presenting with suspected AIS.

METHOD AND MATERIALS

We retrospectively reviewed patients evaluated for possible AIS at our ED (6/1/18- 12/31/18). All patients who had both CT-based imaging followed by MRI within 48 hours were included. Those with traumatic injuries, recent neurosurgical procedures, and intracranial masses were excluded. After reviewing patients' clinical notes and radiology reports, the final diagnosis (AIS vs. stroke mimic), hospital length of stay (LOS), presence of large vessel occlusion on CTA and infarct/penumbra size estimated by CTP were recorded.

RESULTS

A total of 105 patients were evaluated, all having had both NCCT and MRI, while 103 patients had CTA and 33 had CTP. The imaging data and their respective sensitivity and specificity are summarized in Table 1. NCCT had a false negative rate of 47.2% (35/74). When MR was negative for acute infarct (n=39), no other CT-based study was positive. Of those patients with negative MR, 14 of 39 (36%) were discharged home from the ED (7/39) or on hospital day 1 (7/39), influencing LOS and ED time. When MR was positive, no patient was discharged before HD 2.

CONCLUSION

Our preliminary results suggest that earlier and more definitive diagnosis can be achieved if MRI is used as first line ED-based imaging for suspected AIS, which may have downstream impacts on improved care and potential cost savings. Study limitations included a retrospective design, small sample size, and not including patients contraindicated for MRI. Our findings need further confirmation in future studies with outcome correlation and economic analyses from multiple perspectives.

CLINICAL RELEVANCE/APPLICATION

There is potential for earlier diagnosis and ED / hospital discharge if MRI is used as first-line imaging for acute ischemic stroke.

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NR375-SD-MOB3

When the Drains are Clogged: Can CT Attenuation Value Help to Increase the Diagnostic Sensitivity of Acute Cerebral Venous Sinus Thrombosis on Non-Enhanced CT Head Scans?

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #3

Participants
Snehansh R. Chaudhary, MBBS, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose
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PURPOSE

To find out: 1) The diagnostic sensitivity of acute cerebral venous sinus thrombosis (CVST) on non-enhanced CT (NECT) head scans in absence of overt clinical suspicion 2) A HU cut-off that can be used to confidently suspect acute CVST on NECT head studies 3) Annual incidence of acute CVST in a 1.4 million population county in the UK

METHOD AND MATERIALS

1) Retrospective multi-centre case-control study (7 hospitals - 2 University Hospitals, 2 District General Hospitals and 3 Specialty-specific Hospitals) 2) Analysed consecutive 255 CT Head Venograms (CTV) performed from 1st January to 31st December 2018 (12 months) through regional integrated Radiology Information Systems (RIS) 3) Exclusion criteria - known chronic cases of CVST, intracranial post-surgical cases, trauma, artefacts 4) For all confirmed cases of acute CVST, the HU value was retrospectively recorded at the site of highest perceived density in the thrombus on the NECT head scan (using the location of clot identified on CTV), performed within 14 days of the CTV 5) As control, for all negative cases on CTV, HU value was recorded at torcula on the NECT 6) Independent samples t-test analysis in SPSS was used to compare the two means

RESULTS

1) 11 positive cases of acute CVST with an annual incidence rate of 0.8 per 100,000 population 2) Diagnostic sensitivity of 56% for acute CVST on the initial NECT head scan in the absence of overt clinical suspicion of such 3) The mean HU for all positive cases was 81.9, while that for our control group was 49. Using independent samples t-test analysis, this was found to be statistically significant with a p-value of <0.001 4) All positive cases had a HU density of above 70 atleast on NECT head scans 5) 2 out of 11 patients have died as of 25th March 2019 (predictive mortality 18%)

CONCLUSION

With rising number of NECT head scans being performed every year, the potential of missing out on subtle pathologies like acute CVST also increases. Our robust multi-centre study draws attention to the importance of looking for high density in the anatomical distribution of the dural venous sinuses on NECT head studies, and using the HU value as a tool to confidently raise the possibility of acute CVST.

CLINICAL RELEVANCE/APPLICATION

To increase the diagnostic sensitivity of acute CVST on NECT head studies, a HU value of greater than 70 HU can be used by the radiologist to suspect acute CVST.

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NR400-SD-MOB4

Simultaneous Multi-Angular-Relaxometry of Tissue (SMART) MRI Identifies Myelin-Related Tissue Damage in Multiple Sclerosis

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #4

Participants
Biao Xiang, MA, Saint Louis, MO (*Presenter*) Nothing to Disclose
Jie Wen, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Anne H. Cross, Saint Louis, MO (*Abstract Co-Author*) Consultant, Biogen Idec Inc; Consultant, Celgene Corporation; Consultant, Novartis AG; Consultant, Merck KGaA; Consultant, F. Hoffmann-La Roche Ltd; Consultant, TG Therapeutics
Dmitriy A. Yablonskiy, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Rapid, pathologically specific and quantitative MRI techniques are needed to assess tissue damage in multiple sclerosis (MS), particularly in progressive MS. The purpose of this study was to demonstrate that SMART MRI metrics can distinguish non-relapsing progressive MS from relapsing-remitting MS (RRMS) and to examine correlations with clinical assessments.

METHOD AND MATERIALS

22 non-relapsing progressive MS and 11 RRMS subjects were scanned at 3T. SMART data with isotropic 1 mm3 resolution were acquired using a three dimensional multi-gradient-echo sequence with five flip angles a (5°, 10°, 20°, 40°, 60°) and three gradient echoes (TE: 2.3, 6.2, 10.1ms) for each a. A phase-based technique was implemented for a-mapping. MS tissue damage, assessed by SMART metrics of macromolecule proton fraction (MPF) and R1 (1/T1) in normal-appearing cortical gray matter (NAGM) and subcortical normal-appearing white matter (NAWM), were correlated with Expanded Disability Status Scale (EDSS), 25-foot timed walk, nine-hole peg test (9HPT), paced auditory serial addition test (PASAT) and Symbol Digit Modality tests. Spearman rank test was used to compute rho values.

RESULTS

MPF was higher in NAWM than in NAGM, consistent with the high macromolecular content in myelin (Fig. 1). MPF measurement demonstrated relatively stronger correlations with the motor related clinical assessments EDSS and 9HPT ($p<0.001$), while a higher quantitative R1 metric showed significant correlations with better cognitive related PASAT scores ($p=0.004$). Interestingly, the left hemisphere showed stronger correlations than right hemisphere when assessing correlations between MPF and motor related clinical tests. Additionally, MPF in NAWM had significantly stronger correlation with clinical assessments than MPF of cortical NAGM. Higher MPF measurements in both GM and WM readily differentiated the relapsing-remitting group from the group with non-relapsing progressive MS ($p<0.01$).

CONCLUSION

Results from this study suggest that SMART MRI has high potential for assessing myelin content and MS-related damage.

CLINICAL RELEVANCE/APPLICATION

Without applying either MT or 180° radiofrequency pulses, SMART MRI generates high resolution quantitative images and is safe for high-field MRI, making it a useful outcome measure in clinical trials.

NR401-SD-MOB5

Improved Imaging for Neurovascular Interventions Using Dual-Resolution Detector and Region of Interest Dose Reduction using Convolutional Neural Network

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #5

Participants
Swetadri Vasan Setlur Nagesh, MS,PhD, Buffalo, NY (*Presenter*) Nothing to Disclose
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Adnan Siddiqui, MD, PhD, Buffalo, NY (*Abstract Co-Author*) Grant, Canon Medical Systems Corporation
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PURPOSE

Visibility of both peripheral support devices such as guide catheters as well as treatment devices such as stents during neuroendovascular interventions is critical to achieve a successful outcome. A new angiographic imaging technique having improved visualization of treatment devices, while providing visualization of peripheral devices such as guide catheters at reduced patient dose, is presented.

METHOD AND MATERIALS

A stent was deployed in a 3D printed vascular phantom using image guidance with the large 8 inch FOV, 194 µm resolution flat panel mode and the small 3 inch FOV, 75 µm high resolution Hi-Def mode of a dual resolution imaging system. Simultaneous imaging of the same projection view with both modes, with FPD mode showing both guide catheter positions and stent deployment at regular resolution and the small FOV Hi-Def mode showing stent deployment only at higher resolution, was simulated. Images from the large FOV mode were dose reduced using an attenuator over the periphery region outside the stent deployment area. The image quality in the dose-reduced region was restored using a CNN. Both the FPD mode and Hi-Def mode images are displayed at a resolution of 1k x 1k.

RESULTS

A 62% reduction in kerma-area-product was achieved due to attenuator usage. The visual quality of the stent deployment was better in the magnified small FOV Hi-Def mode. Also with the use of the attenuator, there is less scatter and improved contrast within the unattenuated ROI Hi-Def mode image. The neurointerventionalist performing the simulated procedure indicated that, compared to using Hi-Def mode alone, simultaneous imaging with the two modes should reduce risk and increase patient safety.

CONCLUSION

The use of simultaneous imaging improves the utility of the dual-resolution imaging system by providing an improved high resolution visualization of the treatment area, as well as a standard resolution visualization of the peripheral regions. Using the attenuator, the patient dose in the periphery as well as the scatter in the Hi-Def ROI can be reduced.

CLINICAL RELEVANCE/APPLICATION

The imaging technique presented in this work improves the visualization of the treatment procedure at reduced patient doses, thus minimizing patient risk.

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NR402-SD-MOB6

The Effect of Artificial Intelligence-Based Intracranial Hemorrhage Detection on Study Turnaround Time for Emergent Care Non-Contrast Head CT: A Prospective Randomized Clinical Trial

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #6

Participants
Larry Stockmaster, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
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Stephen J. Kwak, MD, Rochester, NY (*Presenter*) Nothing to Disclose

PURPOSE

To examine the effect of automatic identification of intracranial hemorrhage in emergent care setting head CT scans on study turnaround time in a prospective randomized clinical trial.

METHOD AND MATERIALS

A total of 1936 consecutive non-contrast head CT scans from 2 CT scanners used for inpatient and emergency room patients at a large academic hospital were prospectively acquired over a time period of 47 consecutive days. Immediately following image acquisition, scans were automatically analyzed for the presence of intracranial hemorrhage (ICH) using commercially available software (Aidoc, Tel Aviv, Israel). Cases identified as positive for ICH by AI (ICH-AI+) were automatically flagged in the radiologists' reading worklists, where flagging was randomly switched off with a probability of 50%. Study turnaround time (TAT) was measured automatically as the time difference between study completion time (=study accessible to radiologists for reporting) to study reporting time (=first report visible to clinicians, regardless whether preliminary or final). Time stamps for calculating TAT were automatically retrieved from various radiology IT systems. TATs for flagged and non-flagged ICH-AI+ cases were compared using Wilcoxon signed-rank test. Total sensitivity, specificity, and accuracy for ICH detection were calculated for all analyzed 1936 cases, where final radiology reports served as ground truth.

RESULTS

A total of 381 ICH-AI+ cases were found, of which 190 cases were flagged. TATs for flagged cases (52 ± 25 min) were significantly lower than TATs for non-flagged (82 ± 31 min) cases ($p<0.05$, Wilcoxon signed-rank test). 329 of the 383 ICH-AI+ cases were true positive reads. Total sensitivity, specificity, and accuracy over all analyzed 1936 cases was 95.0%, 96.7%, and 96.4%, respectively.

CONCLUSION

Notifying radiologists on automatically detected ICH statistically significantly reduces TAT for reporting ICH to clinicians in emergency setting head CT scans, as shown by our prospective, randomized clinical trial. Such reduced TAT may expedite clinically indicated therapeutic interventions.

CLINICAL RELEVANCE/APPLICATION

Automatic identification of ICH significantly reduces study TAT for ICH in emergent care head CT settings, which carries the potential for improving clinical management of ICH by accelerating clinically indicated therapeutic interventions.

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NR403-SD-MOB7

Utility of Stress MRI in the Evaluation of Degenerative Disease of the Lumbar Spine: A Study Done on 3T MRI

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #7

Participants
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PURPOSE

To evaluate the dynamic effects of Stress MRI in patients with degenerative disease of the lumbar spine ,on DSCA (Dural Sac Cross Sectional Area , DSAPD (Dural Sac AnteroPosterior Diameter) ,DSTD (Dural Sac Transverse Diameter) and to correlate the change in DSCA (Dural Sac Cross Sectional Area) with change in DSTD (Dural Sac transverse Diameter) & DSAPD (Dural Sac Antero-Posterior Diameter)

METHOD AND MATERIALS

60 patients with history of chronic low back pain associated with either sciatica or neurogenic claudication were included in the study after approval from ethics committee . Routine Conventional MRI was performed in the supine flexed position followed by application of stress in the form of axial load of a maximum of 50% patient's body weight using the DynaWell Axial Compression Device for atleast 5 minutes, following which the MRI was repeated . Both the sets of images were evaluated for the changes in DSCA, DSAPD and DSTD at 5 intervertebral levels (L1/L2 to L5/S1) on the application of load.

RESULTS

There were 23% of disc levels with DSCA less than 100mm2 in the Psoas relaxed position (PRP) on conventional MRI and 41% of disc levels with DSCA less than 100mm2 in the axial compression in extension (ACE) position on Stress MRI. Significant decrease in DSCA was seen in 41.9% disc levels and in 76% of the patients. The reduction in the DSCA was greatest at L5/S1 level, followed by L4/L5 level. New relative stenosis was detected at 37 disc levels and new absolute stenosis was detected at 35 disc levels. Additional level of stenosis was identified in 21% of the patients. On Stress MRI with loading of the spine, there was decrease in both the DSAPD and DSTD at all the levels, which was statistically significant ($P<0.001$)with maximal decline at L5-S1.Moderate correlation was seen between the change in the average values of DSAPD and DSTD with that of DSCA which however was statistically significant.Also there was increase in the thickness of ligamentum flavum during axial loading was statistically significant

CONCLUSION

Stress MRI is a valuable additional investigation that should be done alongside conventional MRI in patients with signs of neurologic claudication and in selected patients with sciatica to optimize the radiologic diagnosis

CLINICAL RELEVANCE/APPLICATION

Stress MRI can be useful in cases with neurogenic claudication ,when there is a discrepency between clinical symptoms and findings on Conventional MRI.

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NR404-SD-MOB8

Measurement of Cerebral Blood Flow by Area-Detector CT Perfusion is Improved by Bayesian Estimation with Advanced Noise Reduction Relative to Standard Singular Value Decomposition

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #8

Participants
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Hiroshi Toyama, Toyoake, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To examine cerebral blood flow (CBF) measurements with area-detector CT perfusion (CTP) in patients with cerebrovascular disease, using 123I-IMP SPECT as a standard of reference. We compared standard singular value decomposition (SVD) to a novel Bayesian estimation with advanced noise reduction (BEANR).

METHOD AND MATERIALS

Thirty-two consecutive patients (24 males, 8 females; average age of 66.3 years) with suspected both acute and chronic cerebrovascular disease underwent CTP on a 320 detector-row CT (Aquilion ONE, Canon Medical Systems, Otawara, Japan) and 123I-IMP SPECT examinations within average 42.5 days. CBF was calculated from SPECT and CTP data. For CTP, a standard SVD method and a novel BEANR was applied to create CBF data using commercially available software (Vitrea, Canon Medical Systems). ROIs were placed on SPECT data and correspondingly angled CTP data to measure regional CBF. Then, regional CBF in both ischemic and contralateral region was assessed by ROI measurements on CBF maps generated for both CTP and SPECT data and the ratio between ischemic and contralateral region was calculated. Pearson's correlation and Bland-Altman analysis were used to compare the ratio of CBF obtained with the two CTP techniques relative to SPECT as a reference standard. Mean difference of CBF measurements between each CTP method and SPECT was compared using a paired t-test.

RESULTS

Ratio of CBF derived from BEANR showed significantly better correlation with SPECT ($r = 0.51$) than the SVD method ($r=0.21$, $p<0.0001$). The mean difference between CTP-derived CBF and SPECT was significantly smaller for BEANR (mean ± standard deviation [SD]: -0.074 ± 0.143) than for the SVD method (0.124 ± 0.275, $p<0.001$). The limits of agreement between CTP-derived CBF and SPECT were smaller for BEANR (mean ± 2SD: 0.0785 ± 0.153) than for the SVD method (0.152 ± 0.158).

CONCLUSION

Measurement of CBF by area-detector CTP is improved by BEANR relative to standard SVD method.

CLINICAL RELEVANCE/APPLICATION

BEANR should be preferred over SVD for calculating CBF in patients with cerebrovascular disease and may have the potential to substitute for 123I-SPECT in patients with cerebrovascular disease.

NR405-SD-MOB9

Hippocampal DTI Changes in Patients with Temporal Lobe Epilepsy

Monday, Dec. 2 12:45PM - 1:15PM Room: NR Community, Learning Center Station #9

Participants
Markus Lammle, MD, New Orleans, LA (*Presenter*) Nothing to Disclose
Olivier Darbin, Mobile, AL (*Abstract Co-Author*) Nothing to Disclose
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Juan Ochoa, Mobile, AL (*Abstract Co-Author*) Speaker, Sumitomo Dainippon Pharma Co, Ltd; Speaker, Compumedics

PURPOSE

To evaluate for possible hippocampal DTI changes in patients with long-standing temporal lobe epilepsy for guidance of medical management and surgical treatment.

METHOD AND MATERIALS

Retrospective blinded review of MR images of patients with temporal lobe epilepsy with decicated DTI of the mesial temporal lobes and special attention to the hippocampi. The bilateral hippocampal fiber tracts were visualized and analyzed based on coronal imaging and quantified for statistical analysis using Wilcoxon signed-rank test. Quantitative measures included coronal cross sectional surface of the hippocampus, number of hippocampal fibers, median minimal distances between the nearest ipsilateral fibers, median of the distances of the individual fibers to the center of mass of all ipsilateral fibers using average position of all fibers weighted by their surfaces and median of the distances between the individual fibers based on the center of the fibers.

RESULTS

Statistical analysis revealed a significant difference in distribution in the density of hippocampal fibers with the amount of fibers being decreased on the affected side in patients with long-standing temporal lobe epilepsy, with a p value of 0.087.

CONCLUSION

Our pilot study demonstrated a significant difference in distribution in the density of hippocampal fibers with the amount of fibers being decreased on the affected side in patients with long-standing temporal lobe epilepsy.Temporal lobe epilepsy may be associated with local anatomical changes, possibly pre-existing mesial temporal sclerosis or secondary tissue changes, possibly sclerosis as result from recurrent longstanding seizures.

CLINICAL RELEVANCE/APPLICATION

A pilot study demonstrating measurable hippocampal DTI changes in patients with long-standing temporal lobe epilepsy with the potential to provide guidance for medical management and selective surgical treatment

OB177-ED-MOB1

Evolution of Diagnosis and Management of Adnexal Masses on Ultrasound: Where We Are in 2019

Monday, Dec. 2 12:45PM - 1:15PM Room: OB Community, Learning Center Station #1

Participants
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Phyllis Glanc, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Understand important principles of adnexal mass evaluation on ultrasound including lesion characterization by pattern recognition, use of standardized terminology, evaluation of risk of malignancy and appropriate referral to gynecology oncology for suspicious masses. Be familiar with evolving concepts in diagnosis and management of adnexal masses from 2000 to present including IOTA Lexicon and Simple Rule, Society for Radiologists in Ultrasound Consensus, First International Consensus on Adnexal Masses and Ovarian-Adenxal Reporting and Data System (ORADS) Lexicon and Risk Stratification. Introduce ORADS terminology and risk stratification with examples for ultrasound detected adnexal masses.

TABLE OF CONTENTS/OUTLINE

OUTLINE - Review importance and challenges of adnexal mass classification and risk stratification - Review prior major work in this field including Society for Radiologists in Ultrasound Consensus Statement, IOTA Lexicon and Simple Rules, First International Consensus Report on Adnexal Masses and Ovarian-Adnexal Reporting and Data System (ORADS) highlighting similarities, differences and major contributions of each - Pictorial review applying 2018 ORADS Lexicon and Risk Stratification to spectrum of adnexal masses

OB178-ED-MOB2

Adnexal Torsion: A Review of the Radiological Appearances

Monday, Dec. 2 12:45PM - 1:15PM Room: OB Community, Learning Center Station #2

Awards
Identified for RadioGraphics

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Victoria Stewart, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Siham A. Sudderuddin, MRCP, FRCR, Middlesex, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrea G. Rockall, FRCR,MRCP, London, United Kingdom (*Abstract Co-Author*) Speaker and Chairman, Guerbet SA
Nishat Bharwani, FRCR,MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

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TEACHING POINTS

? To review the clinical presentation of adnexal torsion, and the common predisposing ovarian tumors ? To review the typical multimodality imaging features of adnexal torsion ? To highlight atypical imaging features of adnexal torsion ? To demonstrate how to differentiate atypical features from possible mimics

TABLE OF CONTENTS/OUTLINE

Background/Epidemiology, including important definitions (ovarian vs. adnexal torsion). Clinical Presentation. Typical appearances on US, CT and MR with case examples (including potential pitfalls).Ovarian enlargement with a string of pearls: Lead mass Edematous, hemorrhagic ovary Twisted pedicle Pulled uterus Peritoneal inflammation Differential diagnosis (to include): Ruptured hemorrhagic cyst Torted fibroid Ovarian carcinoma Quiz. Summary of imaging findings and teaching points.

PD175-ED-MOB6

Spotlight on the Pediatric Eye: A Review of Orbital Anatomy and Congenital Orbital Pathologies

Monday, Dec. 2 12:45PM - 1:15PM Room: PD Community, Learning Center Station #6

Awards
Certificate of Merit

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TEACHING POINTS

To provide a basic review of orbital embryology, anatomy, and pediatric congenital orbital pathologies with emphasis on radiological findings. Use of imaging in narrowing the differential diagnosis and guiding clinical management.

TABLE OF CONTENTS/OUTLINE

Essential orbital embryology with illustrations are depicted. Relevant orbital anatomy on multisequence MRI and multiplanar CT is demonstrated. Pediatric congenital and developmental orbital disease entities as diagnosed on CT/MRI imaging are presented with correlative clinical images.

PD176-ED-MOB7

Visualizing 4D Airway Data from Dynamic CT

Monday, Dec. 2 12:45PM - 1:15PM Room: PD Community, Learning Center Station #7

Participants
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TEACHING POINTS

Dynamic CT of the airway during respiration and cardiac motion (4DCT) may help in airway assessment in children with craniofacial or structural abnormalities such as Robin sequence or airway malacia; however, evaluating large 4DCT data sets is cumbersome. We will provide a practical demonstration of an optimized workflow using 3D Slicer, an open source software platform, for generating interactive, dynamic, volumetric models of the airways, including creation of cinematic external and endoluminal views. These visualization tools can help assess the location and mechanism of airway obstruction. Moreover, these models can serve as a foundation for automated calculations of airway volumes over the respiratory cycle, including detection of maximal airway obstruction.

TABLE OF CONTENTS/OUTLINE

1. Outline acquisition parameters for 4DCT 2. Use 3D Slicer to import 4D dynamic CT data 3. Use custom module to set up and easily navigate viewing options a. Automatically generate 3D model of air-tissue interface b. Determine flight path of virtual endoscopy fly thru c. Optionally link multiplanar images to endoscopic camera location d. View breath cycle animation at any time in any view simply by pressing a "play" button 4. Endoscopy comparison 5. Future enhancements

PD209-SD-MOB1

Imaging of Childhood Pulmonary Langerhans Cell Histiocytosis

Monday, Dec. 2 12:45PM - 1:15PM Room: PD Community, Learning Center Station #1

Participants
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PURPOSE

Langerhans cell histiocytosis (LCH) is a multi-system disease in childhood. Pulmonary lesions have been found in less than 10% of children with a solitary site of involvement in LCH. Radiologists should be familiar with imaging features of pulmonary LCH that is important in the early diagnosis of this entity. The aim of this presentation is to present imaging findings in LCH with pulmonary involvement in childhood.

METHOD AND MATERIALS

We retrospectively analyzed children who had LCH from the radiology archives between 2007-2018 years. 52 patients found from this search. Thirty-seven patients (19 boys, 18 girls; age between 2 months and 17 years, mean age 4.8 years) who had chest X-ray and thorax computed tomography (CT) were included in the study. All examinations were evaluated according to location of the lesion and presence of cyst, nodule, ground-glass pattern, consolidation, mosaic perfusion, atelectasis, emphysema, air-trapping, fibrosis, lymphadenopathy, pleural effusion, pneumothorax and involvement of thymus and costophrenic angle.

RESULTS

Four patients had mediastinal-hilar lymph node enlargement. 4 patients had spontaneous pneumothorax. 4 patients had thymic involvement with diffuse enlargement and calcification. 9 patients had costovertebral angle involvement. 18 of 37 patients had nodules. 15 of 18 patients had nodules on upper and mid zones on bilateral lungs. Only one patient had cavitary nodules. Nodules are distributed randomly in both lungs and whole lobes with predominantly both subpleural and centrilobular (58 %) location, followed by only subpleural (38.1 %) and only centrilobular (23.8 %). 14 of 37 patients had cysts. 13 of 14 patients had cysts on upper and mid zones on bilateral lungs. All of patients had smaller than 10 mm cysts with thin-wall.

CONCLUSION

Imaging features of pulmonary LCH are variable but recognizable. Thus, bilateral symmetric cysts and nodules which are particularly detected upper and mid zones in lungs should be kept in mind for uncommon entities of LCH.

CLINICAL RELEVANCE/APPLICATION

The most common radiological findings of LCH are bilateral cysts and nodules, hovewer it can rarely present with spontaneous pneumothorax and thymus involvement.

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PD210-SD-MOB2

Role of Diffusional Kurtosis Imaging in Distinguishing Abdominal Neuroblastic Tumors of Various Histological types and Differentiation Grades: Preliminary Results

Monday, Dec. 2 12:45PM - 1:15PM Room: PD Community, Learning Center Station #2

Participants
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PURPOSE

To evaluate whether diffusional kurtosis imaging (DKI) allow discrimination of abdominal neuroblastic tumors of various histological types and differentiation grades.

METHOD AND MATERIALS

This study was IRB approved and informed consent was obtained. Forty-one pediatric patients with peripheral neuroblastic tumors (pNTs) in abdomen (18 girls and 23 boys, aged from 3 months to 10 years) were enrolled in this study. All subjects underwent transverse, respiratory-triggered, single-shot spin-echo echo-planar DKI of abdomens. DKI with 15 directions and 3 b-values (0, 500, 1000 s/mm2) was performed on a 3.0T MR scanner (GE DISCOVERY MR 750, USA). Maps of mean diffusivity (MD) and mean kurtosis (MK) were produced and analysed. Statistical comparisons were conducted using Independent Samples T test.

RESULTS

In the 41 patients with pNTs, ganglioneuroma (GN) was in 2 cases, ganglioneuroblastoma-intermixed (GNBi) in 4, ganglioneuroblastoma-nodular (GNBn) in 14 and neuroblastoma (NB) in 21. Among 14 cases of GNBn, 9 cases had poorly differentiated nodules and 5 had differentiated nodules. In 21 cases of NB, differentiated, poorly differentiated and undifferentiated tumors were respectively, in 4, 16 and 1 cases. The GNBn/NB (n=35) had significantly higher MK, lower MD than the GN/GNBi (n=6) (P<.001, P=0.002). In GNBn/NB detection, the cut-off values were 1.215 on MK and 1.225×10-3mm2/s on MD. The GNBn/NB with poorly differentiated lesions (n=25) had significantly higher MK, lower MD than those with differentiated composition (n=9) (P<.001, P=0.001). In GNBn/NB with poorly differentiated lesions detection, the cut-off values were 1.600 on MK and 1.017×10-3mm2/s on MD.

CONCLUSION

DKI has high potential value for differentiation of abdominal neuroblastic tumors of various histological types and differentiation grades.

CLINICAL RELEVANCE/APPLICATION

DKI has very high potential value for helping to predict prognosis of abdominal PNTs, guide their therapy and evaluate their chemotherapy response.

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PD211-SD-MOB3

Sonographic Evaluation of Rectoanal Inhibitory Reflex (RAIR) in Patients with Hirschsprung Disease

Monday, Dec. 2 12:45PM - 1:15PM Room: PD Community, Learning Center Station #3

Awards
Trainee Research Prize - Fellow

Participants
Daniel Fadaei Fouladi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
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PURPOSE

To determine the diagnostic value of RAIR in patients with suspected Hirschsprung disease.

METHOD AND MATERIALS

After being approved by the Ethics Committee of our university (No. 88/3-5/5) a total of 32 neonates and children with suspected Hirschsprung disease were enrolled in this study. The rectum and anal canal were visualized transperineally by using sonography. RAIR was elicited by injecting normal saline into the rectum and changes in the bowl were recorded for offline evaluation. All patients underwent barium enema. Surgical findings (biopsy) were considered as the standard method of choice.

RESULTS

The study group comprised 14 males and 18 females with a mean age of 33.7±44.6 months (8 days-14 years). Hirschsprung disease was confirmed in 14 cases (43.8%). According to barium enema and RAIR findings Hirschsprung disease was present in 15 (65.2%) and 23 (71.9%) patients, respectively. Accordingly, the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of barium enema in diagnosing Hirschsprung disease were 100%, 94% (95% confidence interval, CI, 73%-100%), 93% (95%CI, 68%-100%), 100% and 97% (95%CI, 95-100%), respectively. The corresponding values for RAIR were 100%, 50% (95%CI, 26%-74%), 61% (95%CI, 39%-80%), 100% and 72% (95%CI, 65%-81%), respectively.

CONCLUSION

Transperineal sonographic examination of RAIR is a sensitive method in diagnosing Hirschsprung disease.

CLINICAL RELEVANCE/APPLICATION

RAIR is a safe and sensitive method in diagnosing Hirschsprung disease and could be considered as the initial modality in suspected patients.

PD232-SD-MOB4

3D UTE-MRI for Combined Morphologic and Functional Imaging in Pediatric Patients with Pulmonary Disease: Initial Experience

Monday, Dec. 2 12:45PM - 1:15PM Room: PD Community, Learning Center Station #4

Participants
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Andreas M. Weng, Wuerzburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To demonstrate initial results of lung MRI using sequences with ultrashort echo times (UTE-MRI) for combined morphologic and functional imaging in pediatric patients with pulmonary diseases.

METHOD AND MATERIALS

Seven patients (f=5; m=2; mean age 13yrs) with the following pulmonary diseases and a healthy volunteer (f, 11 yrs) were included into the prospective study: Cystic fibrosis (CF) with atelectasis, CF with acute bronchopulmonary aspergillosis (ABPA), primary ciliary dyskinesia (PCD), post-infectious bronchiolitis obliterans (PIBO), congenital lobar emphysema, congenital pulmonary airway malformation (CPAM) and pulmonary hamartoma. Data was acquired during a breath-hold of 15s on a 3T MRI scanner using a prototypic 3D UTE sequence. Morphologic images were reconstructed employing an iterative parallel imaging algorithm. To calculate functional ventilation maps, scans were repeated in 5 different breathing states and quantitative ventilation maps were calculated. Proton density weighting of UTE sequences allows for calculation of the local air volume fraction (AVF), which was illustrated on color-coded maps representing the percentage of air in the respective voxel.

RESULTS

UTE imaging was able to illustrate both 'plus' pathologies with disease-associated gains in tissue/fluid and 'minus' pathologies, which cause loss of parenchyma and have been challenging for pulmonary MRI in the past. Atelectasis in CF and PCD patients, consolidations in ABPA and a pulmonary hamartoma were clearly identifiable in morphologic UTE images and functional lung maps illustrated the corresponding deficits in AVF and ventilation. Concerning minus pathologies, air trapping in PIBO and lobar emphysema were clearly visible in morphologic UTE, whereas in the CPAM patient the AVF maps crucially improved distinguishability between lung parenchyma and cystic parts of the lesion.

CONCLUSION

UTE sequences are supposed to be feasible for morphologic and functional imaging of both plus and minus pathologies in pulmonary MRI with functional lung maps being particularly helpful in patients with minus pathologies.

CLINICAL RELEVANCE/APPLICATION

UTE-MRI has great potential in diagnostic imaging and monitoring of pulmonary diseases, conceivably reducing radiation exposure in thoracic radiology.

PH132-ED-MOB8

Pocket Guide for Understand (and Successfully Apply) US and MRI Elastography Techniques

Monday, Dec. 2 12:45PM - 1:15PM Room: PH Community, Learning Center Station #8

Awards
Cum Laude

Participants
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Marcelo Potolicchio, MD, Cadiz, Spain (*Abstract Co-Author*) Nothing to Disclose
Alvin C. Silva, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD,PhD, Jaen, Spain (*Abstract Co-Author*) Speaker, Canon Medical Systems Corporation; Speaker, Koninklijke Philips NV; Speaker, Siemens AG

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TEACHING POINTS

1. Review the physical basis of elastography techniques applied to ultrasound (US) and magnetic resonance imaging (MRI). 2. Explain, from an educational point of view, the differences between the diverse types of elastography techniques focusing on strain imaging and shear-wave imaging. 3. Show the potential applications of both US and MRI elastography approaches in several clinical scenarios

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. General concepts about elastography 3. US elastography: Physical basis and technical adjustments. 4. MRI elastography: Physical basis and technical adjustments. 5. US elastography: Clinical scenarios 1. Liver and other abdominal organs 2. Thyroid and salivary glands 3. Breast 4. MSK 5. Testes 6. MRI elastography: Clinical scenarios 1. Liver 2. Spleen 3. Pancreas 5. General considerations and Potential applications a. When do I have to perform DTI for skeletal muscle evaluation? b. Is necessary to integrate DTI in routine protocols? c. How should I report DTI studies? d. Quantitative assessment of fiber tracking? e. Skeletal muscle trauma and sport injuries related lesions f. Primary and secondary myopathies g. Training and Treatment monitoring 6. Conclusions and take home messages

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PH206-SD-MOB1

Proton Radiography for Pre-Treatment Range Verification in Proton Beam Therapy

Monday, Dec. 2 12:45PM - 1:15PM Room: PH Community, Learning Center Station #1

FDA Discussions may include off-label uses.

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PURPOSE

Proton radiography yields anatomic information that x-ray radiography does not offer. Recent advances in detector technology makes proton imaging for proton therapy patients more practical than ever. Proton radiographs give a direct measure of the water equivalent path length (WEPL) across the radiation field in beam's eye view and can therefore detect daily anatomic changes prior to treatment that may affect the depth of the Bragg peak in the patient. In this paper we analyze the proton radiographs of various phantoms taken at the Northwestern Medicine Chicago Proton Center for image quality.

METHOD AND MATERIALS

We report here on a novel detector, its spatial resolution from a line pair resolution phantom, and WEPL resolution from a custom phantom with inserts of known densities from 0.2 to 1.6 g/cm3. Inserts of varying densities are interchanged in a pediatric head phantom and proton radiographs are taken with the phantom in the same location. Difference maps of the WEPL are generated between the images to determine the sensitivity of the detector to WEPL changes.

RESULTS

The proton radiograph show that the WEPL of all inserts in the custom phantom are correct to within 1.5%. In addition, the modulation transfer function calculated on the line pair resolution phantom demonstrates that line pairs with 1.6 mm spacing, center to center, can be resolved. We will report the detector sensitivity to WEPL changes in the phantom.

CONCLUSION

Proton radiographic images have adequate spatial resolution and provide accurate WEPL measurements across the field of view. They may also be useful for detecting range errors prior to proton treatments.

CLINICAL RELEVANCE/APPLICATION

Proton radiography may be a useful tool to detect proton range changes before proton therapy treatment.

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PH207-SD-MOB2

Comparison of Image Quality and Subjective Acceptance in Abdominal CT by Ultrahigh-Resolution CT at Different Radiation Doses Between Model-Based Iterative and Deep Learning Reconstructions: Phantom and Clinical Pilot Studies

Monday, Dec. 2 12:45PM - 1:15PM Room: PH Community, Learning Center Station #2

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PURPOSE

Ultrahigh-resolution CT (UHRCT) improves spatial resolution but increases image noise. State-of-the-art model-based iterative (MBIR) and deep learning reconstructions (DLR) have been clinically introduced to reduce image noise in abdominal CT by UHRCT. We performed phantom and clinical pilot studies to compare image quality and subjective acceptance in abdominal CT by UHRCT at different radiation doses between MBIR and DLR.

METHOD AND MATERIALS

We scanned a quality assurance phantom by UHRCT at 100 and 120kV with 896 (NR mode) and 1792 channels (HR mode) using automatic exposure control with noise index (SD) settings of 15-40HU (5-HU interval) and reconstructed the images by hybrid IR (HIR), MBIR, and DLR. Using the phantom images acquired at 120kV, NR mode, and SD 15 by HIR (our routine protocol) as the reference, we compared modular transfer function (MTF) and noise power spectrum (NPS); 12 observers compared subjective acceptance based on texture for these images at 100kV, HR mode, and 5 SD settings of 20-40 between MBIR and DLR. Using the routine protocol as the reference, 2 independent observers used a 5-point scale (1, much worse; 3, similar; 5, much better) to grade subjective acceptance based on image quality and diagnostic confidence in abdominal CT at 100kV, HR mode, and SD 20 and 35 by MBIR and DLR in 11 patients. We used Wilcoxon signed-rank test to compare both the acceptance between MBIR and DLR and κ-statistics to assess the interobserver agreement.

RESULTS

Compared with the reference, at 100kV and HR mode, sharpness was similar at SD 35 and 40 by MBIR but always greater by DLR with MTF; low-frequency noise at SD 35 and 40 was greater by MBIR but similar by DLR with NPS. Significantly less SD settings achieved the acceptance by MBIR (1.5±0.5; only SD 20 in 50%) than by DLR (4.2±0.6; SD 20-35 in 67%) (P=0.002). The subjective acceptance in clinical abdominal CT was significantly better by DLR than by MBIR at SD 20 (P=0.014) and 35 (P=0.003) and <3 by MBIR at SD 35 in 91%. The interobserver agreement was excellent (κ=0.87).

CONCLUSION

DLR can more robustly preserve image quality and acceptance in abdominal CT even at low doses than MBIR.

CLINICAL RELEVANCE/APPLICATION

Combined use of UHRCT and DLR is useful for improving spatial resolution and preserving image quality and acceptance in abdominal CT with lower radiation dose and reasonable computation time.

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PH231-SD-MOB4

Denoising and Scatter Correction for Contrast-Enhanced Digital Breast Tomosynthesis

Monday, Dec. 2 12:45PM - 1:15PM Room: PH Community, Learning Center Station #4

FDA Discussions may include off-label uses.

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PURPOSE

Contrast-enhanced digital breast tomosynthesis (CEDBT) is being investigated for cancer detection and lesion assessment. However, its image quality is still limited. The scatter radiation in DBT projections leads to cupping artifacts and reduces the contrast of iodine signal, especially for high energy (HE) acquisition. Low projection dose results in high noise level and dual energy (DE) image subtraction further increases the noise in CEDBT, which hinders the detection of low-contrast signal. We aim to develop noise reduction and scatter correction techniques to improve the image quality for CEDBT.

METHOD AND MATERIALS

Scatter correction is based on the scatter point spread functions (PSF) generated from Monte-Carlo simulation for various projection angles and breast thicknesses. Convolution of the scatter kernel with the raw image forms the initial guess of scatter, which was then updated iteratively after scatter-free image was estimated. The noise reduction for DBT projections utilizes a deep-learning based convolution neural network (CNN). A generative adversarial network was trained using low and high dose projection images of digital breast phantoms simulated from a virtual clinical trial software (OpenVCT) and emulating the acquisition geometry of Siemens Mammomat Inspiration DBT system. To process clinical CEDBT images, the low energy (LE) and HE projection images at each angle were first aligned by image registration. Scatter correction was then applied on LE and HE images separately, followed by noise reduction. Logarithmic weighted subtraction was performed to generate DE-subtracted projections. Images were reconstructed by filtered-back-projection (FBP) using a ramp filter with non-zero response at zero frequency and a spectral apodization filter. The proposed method was tested on CEDBT images from an IRB-approved pilot clinical study and compared with images without correction.

RESULTS

Our results show reduced noise and suppressed cupping artifacts in CEDBT after correction. The contrast to noise ratio (CNR) of the contrast-enhanced lesions is increased.

CONCLUSION

The proposed scatter correction and denoising technique improves the image quality of CEDBT.

CLINICAL RELEVANCE/APPLICATION

The improvement in CEDBT image quality could benefit the detection and 3D assessment of contrast enhanced breast lesions, and the evaluation of background parenchymal enhancement.

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PH232-SD-MOB5

The Safety and Feasibility of Intravenous Contrast-Enhanced Sonography in Children - A Single Center and Prospective Study in China

Monday, Dec. 2 12:45PM - 1:15PM Room: PH Community, Learning Center Station #5

Participants
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CONCLUSION

The adverse effects of CEUS in children is similar to that in adults. It is safety and feasible for the pediatric applications of CEUS using SonoVue®.

Background

Intravenous contrast-enhanced ultrasound (CEUS), using the second-generation ultrasound contrast agent SonoVue®(Bracco, Switzerland) , has already been approved for pediatric applications in 2018 by American Food and Drug Administration (FDA). However, it has not been approved by Chinese Food and Drug Administration (CFDA). The study was to evaluate the safety and feasibility of CEUS in children prospectively at a single center in China.

Evaluation

A total of 312 Chinese children (179 boys, 133 girls; from one month to 14.5 years old; weight (4.7-62) kg) were enrolled in clinical trials in Shenzhen Children's Hospital between November 2015 and April 2019. Contrast agent was given intravenously with two different doses of SonoVue®, including 2.4ml/time before June 2016 and 0.03ml/kg After June 2016. A total of 600 intravenous injections was performed for evaluating adverse effect and the diagnostic accuracy comparing with the pathology and enhanced CT.

Discussion

(1) 312 subjects underwent CEUS successfully. Most of studies were performed for evaluating renal microcirculation and assisting renal biopsy (193/312[61.9%]), which had a 98.4% of effective rate of the pathological specimens. Some were used to identify the mass, including 103(33.0%) cases for the liver (36 cases), retroperitoneum(14 cases), Abdominal cavity(12 cases), mediastinum(6 cases), kidney(9 cases), testicle(4 cases) and so on, which had a 98.7% high accuracy. The others were for identifying 16(5.13%) cases for trauma, vascular malformation, infection, thrombosis, hemorrhage and infarction, which had the same accuracy compared with enhanced CT. (2) In the renal CEUS, the wash-out time of dose 0.03ml/kg was shorter than that of dose 2.4ml/time, and there was significant difference ($P<0.05$). (3) Adverse drug reactions, there were 3 cases of transient rash and 2 cases of hypotension in the 600 intravenous injections, and total of six patients (5/312[1.60%]), and the patients recovered quickly after anti-allergic treatment of intravenous methylprednisolone and epinephrine.

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PH233-SD-MOB6

Discussion on the Accurate Measurement of Organ Dose in CT Scanning

Monday, Dec. 2 12:45PM - 1:15PM Room: PH Community, Learning Center Station #6

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To investigate the method of accurate measurement of organ dose in CT scan.

METHOD AND MATERIALS

Background:When measuring the dose of CT scanning organs, it was found that the same parameters were repeatedly measured more than ten times, and almost every measurement was not equal, and the extreme difference was even more than 40 %; Analyzing the reason, the X-ray tube rotates to a random position in the frame and begins scanning, so that the TLD or long rod ionization chamber receives different radiometric angles from the X-ray tube: the ionization chamber is before the X-ray tube rotates to the human body but in the next lap, the back is rotated to the ionization chamber, and the dose measurement is the highest, whereas the measurement is the lowest. MATERIALS:GE RevolutionTM CT,a long rod ionization chamber. METHODS: Based on the clinical chest scanning scheme, the chest module was scanned using a combination of two detector widths(40, 80 mm) and three pitches(0.500, 1.000, and 1.375) under the same parameters. The long rod ionization chamber was placed in a fixed position in front of the right breast area. Each group of scanning parameters is repeatedly measured 7 times to record the measured breast skin dose D. The two groups of D values with detector widths of 40 and 80 mm respectively were compared using independent sample T test, and the radiation dose of three groups(0.500, 1.000, and 1.375) was compared using single factor variance analysis.

RESULTS

The same parameters were repeated and the difference between the maximum and minimum values of D measured 7 times was from 14.5 % to 44.4 %. 80 mm detector width standard deviation greater than 40 mm; The greater the pitch, the greater the standard deviation; the difference of the dose between the detector width and among the pitches was statistically significant were statistically significant.

CONCLUSION

When measuring organ dose in CT scan, the average value needs to be measured several times. In this way, the organ dose can be more accurately assessed.

CLINICAL RELEVANCE/APPLICATION

The organ dose in CT scan may also be different or even very different from the same parameter repeated scan; Even if the left and right sides are measured at the same time or multiple points, they are still not accurate enough and must be measured multiple times to assess the dose.

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PH234-SD-MOB7

Clinical Trial Qualification of PET-CT Scanners in Onco-Haematological Clinical Trials Performed with 68Ge Pre-Filled Phantom Permits to Achieve a Lower Inter-Scanner Variability Respect to Standard 18F Phantoms

Monday, Dec. 2 12:45PM - 1:15PM Room: PH Community, Learning Center Station #7

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PURPOSE

The aim of this study was to compare the Clinical Trial Qualification (CTQ) performed with 68Ge pre-filled phantom respect to standard 18F phantoms. The two approaches were adopted within several PET-driven onco-haematological clinical trials conducted by the Italian Foundation on Lymphoma (FIL), the Grupo Espanol de Linfomas/Transplante Autologo de Medula Osea (GELTAMO), the International Extranodal Lymphoma Study Group (IELSG) and the Swiss Group for Clinical Cancer Research (SAKK).

METHOD AND MATERIALS

The CTQ process consisted in the scanning with the default acquisition and reconstruction parameters used for whole-body oncological PET/CT studies of the same model of NEMA/IEC image quality phantom. In the standard approach the phantom background and spheres were filled with a 18F solution by local imaging experts. In the other approach the phantom's background and the six spheres were all pre-filled with a 68Ge epoxy. Background activity concentration (BAC) was defined as the difference between the average activity concentration in a large homogenous region and the expected activity concentration. Sphere to background ratio (SBR) was defined as the ratio between the maximum of the activity concentration in the largest 37 mm diameter sphere and the BAC. Inter-scanner variability (ISV) was estimated as the 95% confidence level of BAC and SBR. The 18F phantom was used in IELSG, GELTAMO and FIL-1 (first phase) clinical trials while the 68Ge phantom was used in SAKK and FIL-2 (second phase).

RESULTS

For the 18F approach the ISV BAC, ISV SBR values vary between (39-62)% and (44-62)% respectively, the CTQ was obtained at the first round in the (30-35)% of the PET/CT scanner. For the 68Ge approach the ISV BAC, ISV SBR values vary between (20-25)% and (20-24)% respectively, the CTQ was obtained at the first round in the (65-95)% of the PET/CT scanner.

CONCLUSION

68Ge approach permits to achieve a lower inter-scanner variability respect to 18F one. Indeed, ISV of both BAC and SBR are reduced of 2-3 times. This is mostly due to the difficulty in phantom preparation for 18F phantom. Moreover, the number of iterations required to achieve the clinical trial qualification is much lower and 64%-95% of CTQ are done at first round.

CLINICAL RELEVANCE/APPLICATION

Clinical trial qualification of PET-CT scanners performed with 68Ge pre-filled phantom permits to achieve a lower inter-scanner variability respect to standard 18F phantoms.

PH235-SD-MOB3

Deep Learning Image Reconstruction for CT Neuro Perfusion Imaging

Monday, Dec. 2 12:45PM - 1:15PM Room: PH Community, Learning Center Station #3

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PURPOSE

We investigated the performance of a deep learning based image reconstruction algorithm (TrueFidelity) from GE Healthcare (GE) in CT neuro perfusion imaging.

METHOD AND MATERIALS

Perfusion imaging of the brain was performed on two pigs after intravenous bolus injection of iodinated contrast at 150, 100, 75, 50 and 25 mA tube current with a GE Revolution CT scanner using the following settings: 80 kV tube voltage, 0.28 s gantry speed, 20 axial scans every 2.1 sec. Images were reconstructed using TrueFidelity and 100% Adaptive Statistical Iterative Reconstruction V (ASIR-V). The TrueFidelity algorithm is an image reconstruction technique employing deep convolution neural network (CNN) based models, including millions of trained parameters, to emulate very high dose filtered backprojection (FBP) image texture, low noise, and high resolution. TrueFidelity and 100%ASIR-V images were analyzed with CTP4D (GE) to generate brain perfusion maps. Regions of interest encompassing the whole brain were drawn on 16×2.5 mm slices to obtain the mean and standard deviation (SD) of perfusion values. The quality of TrueFidelity and 100%ASIR-V perfusion maps was characterized by the figure of merit (FOM), calculated as the ratio of SD to mean.

RESULTS

The average brain perfusion measured from the TrueFidelity maps over the five mA levels in two pigs was 39.2±7.1 mL/min/100g, which was almost identical to that measured from the 100%ASIR-V images (38.0±6.2 mL/min/100g). At each individual mA level, perfusion and the corresponding FOM from the TrueFidelity maps were within 5% of the 100%ASIR-V maps.

CONCLUSION

TrueFidelity and 100%ASIR-V maps showed comparable neuro perfusion and FOM. These results suggest the robustness of the TrueFidelity algorithm in reducing noise presented in the perfusion scans at a wide range of dose settings, even though the algorithm was not trained with data acquired at extremely low dose levels.

CLINICAL RELEVANCE/APPLICATION

TrueFidelity similar to 100%ASIR-V can reduce excessive image noise arising from low dose scanning to facilitate extremely low dose neuro perfusion imaging with CT.

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QI015-EB-MOB

A New Strategy Preventing Medical Errors Caused by Unread Imaging Interpretation Reports: Star Search Project

Monday, Dec. 2 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

The role of the radiologist in patient care does not end with appropriate reporting of imaging studies. Timely, effective communication of reports to health care providers (i.e. referring physicians) is also important. Failure to communicate findings in a timely, appropriate manner is a potential cause of malpractice action against not only radiologists, but also referring physicians. The purpose of our study was to propose a new strategy preventing medical errors caused by unread imaging interpretation reports.

METHODS

In April 2018, our radiology department began a trial measure in which radiologists did the following to confirm that interpretation reports were appropriately utilized by referral physicians. 1) Medical emergencies were prefixed with three stars (***) in the diagnostic impression sections of the imaging interpretation reports, and the referring physician was contacted by telephone as soon as possible (this action had been performed on a regular basis long before this trial began). 2) Semi-emergencies (medical issues needing addressing within two weeks) were prefixed with two stars (**). After two weeks, the duty radiologist reviewed starred reports and patient charts to confirm that the information had been correctly conveyed. This trial included the reports of CT, MRI, NM and ultrasonography examinations. The results of this system being implemented for eleven months (Apr. 2018 - Feb. 2019) were retrospectively evaluated. The ethical committee of our institution approved this study, and the committee waived informed consent from patients, radiologists and referring physicians.

RESULTS

The total number of reports during the period was 56,978 (5,180 per month). Two hundred ninety-two reports contained ** (0.51%, 1.31 reports/day. The medical issues addressed as semi-emergencies are summarized in Table 1. The most frequent issue was new, unexpected malignant tumors (or findings suggestive of them) (56.8%; 166/292), followed by unexpected spread of known malignant tumor. There was incomplete transmission of relevant information in 20 cases (6.85% of all two-starred reports; CT, n=14; MRI, n=6). Causes of incomplete transmission were 1) reports not being opened (n=14), 2) relevant information on reports being overlooked (n=5), and 3) the wrong report being opened (n=1; the referring physician incorrectly opened and read the report of the patient's annual CT examination performed the previous year). In these 20 cases, although the primary purposes of the CT examinations varied, the most frequent medical issue addressed as semi-emergency was new, unexpected (suspected) malignant tumors (n=12) (Table 2). Sixty-one reports contained *** (0.11%, 0.27 reports/day; In many cases with emergency findings, if radiologists thought that their communication was sufficient [e.g. they were able to speak directly to the referring physician by telephone to convey relevant findings and implications], they did not prefix with three stars. Thus, the incidence of emergency findings is greatly underestimated in this study). The two medical issues most frequently addressed as emergencies were acute abdominal diseases, such as intestinal perforation and ileus, and pulmonary artery thromboembolism/ deep vein thrombosis. Fourty (65.6%) were starred for diagnoses unrelated to the initial target organs of the CT examinations.

CONCLUSION

Our new "risk-based approach" allows prioritization of intervention based on severity of risk (appropriate measures are taken focusing on high-risk cases). This is more efficient and more economical compared to the conventional approach of reviewing all radiology reports to confirm their having been read by referring physicians. In this strategy, we ensured only the correct transmission of important information. This did not require a medical informatics system upgrade, and the additional effort required by radiologists was reasonable. We found this strategy to be effective, since important information was not appropriately transmitted to the referring physicians (without intervention) in 6.85% and intervention allowed us to avoid communication errors that could lead to medical incidents at least in 20 semi-emergency cases during 11 months. In emergency cases, communication by telephone or in person is usually performed, so we suspect that communication errors are less likely. A possible drawback of this strategy is that referring physicians may come to depend on this system and not read reports not marked with stars as carefully. We must reemphasize that it is the basic responsibility of the referring physicians to read reports in a careful and timely manner. The professional approach to quality practice in radiology requires radiologists to take responsibility beyond writing reports in order to influence patients' care. This measure can be implemented immediately regardless of the size of the facility.

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QI016-EB-MOB

Semi-Structured Clinical Event Documentation of Acute Adverse Reactions to Contrast

Monday, Dec. 2 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

Allergic-like and physiologic reactions can occur acutely following contrast media administration. An on-site radiologist, often a radiology trainee, is typically the first physician responder to such events. Key assessments of the event inform immediate as well as future management, including identifying the culprit contrast class and specific agent, the type of reaction mechanism, and the severity of the reaction. The responding radiologist should record these assessments explicitly and communicate a plan for contrast administration to those who may order or protocol radiologic exams for this patient in the future, rather than delegate these details for non-expert providers to record, for the patient to relay, or for future clinicians to infer. However, documentation of clinical events in the electronic medical record (EMR) is a skill that radiologists infrequently practice, so important elements may be forgotten at the point of care. Further, as the responding radiologist may not be the one who interprets the corresponding study, the documentation in the event note and radiology report can be disjointed. We propose that providing a semi-structured clinical documentation support tool can improve the completeness of radiologists' notes on acute contrast reactions.

METHODS

Contrast Incident Support and Reporting (CISaR) is a web-based application for acute contrast event documentation. Users select options specifying the following elements: the type of event (extravasation or reaction), the contrast agent class (iodinated or gadolinium), the reaction mechanism and severity based on specific signs/symptoms (as defined in the American College of Radiology Manual on Contrast Media), and the treatments provided. Based on those assessments, CISaR generates a recommendation for future contrast-enhanced studies. The user can edit or append free-text details and recommendations, and then CISaR creates an event report under an imaging accession (in Epic) and appends a brief statement in the associated radiology report (in PowerScribe). We collected baseline data for three months and, after introducing the tool to trainees with a three-week wash-in period, post-intervention data for four months. Events included were acute contrast reactions identified by safety reports (submitted by radiology technologists or nurses) or CISaR reports. Extravasation events, delayed reactions, and acute drug reactions other than to contrast were excluded. Charts were reviewed, excluding the allergy history module, for completeness of event documentation by radiologists. Comparisons of baseline and post-intervention data on documentation elements were made using Fisher's exact test.

RESULTS

Fifty acute contrast reactions were identified in the baseline period and 82 in the post-intervention period. In the baseline and post-intervention periods, 32 (64%) and 62 (76%) events had radiologist documentation, respectively. When available in the post-intervention period, CISaR was the preferred but not only method of radiologist event documentation, used in 50 events (61% of total). When considering all radiologist documentation, CISaR availability was associated with a significantly higher proportion that specified the culprit contrast agent or class (78% vs. 95%, p=0.03) and rated the reaction severity (78% vs. 94%, p=0.04). Non-significant positive differences were seen in the proportion that classified the reaction mechanism type (81% vs. 92%, p=0.18) and provided a recommendation on future contrast administration (75% vs. 86%, p=0.26).

CONCLUSION

High quality clinical documentation of acute contrast events by radiologists was observed following implementation of a semi-structured documentation tool that integrates with both the EMR and radiology reporting software. Greater than 90% of reports included the key assessments of the culprit contrast agent or class, reaction severity, and reaction mechanism type. Documentation quality, including rates of making recommendations for future management, remains limited by lapses in using the documentation tool or in documenting the events at all. Further work is planned to improve the usability and acceptability of the CISaR interface and output.

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QI017-EB-MOB

Evaluation and Reduction of Acoustic Noise in PET/MR

Monday, Dec. 2 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

Excessive acoustic noise during MR scanning poses a risk of injury to patients if steps are not taken to reduce sound levels at the patients' ears. Typical measures used to reduce acoustic noise for the patient include utilizing foam ear plugs and / or acoustic noise attenuating earphones, as well as modifications to pulse sequences, e.g. to limit gradient amplitude. Our institution recently installed a PET/MR scanner (SIGNA PET/MR, GE Healthcare), and it was initially subjectively observed that the PET/MR scanner was louder than other MR-only scanners at our institution. It has been suggested that scanner design modifications to allow insertion of the PET detector ring may contribute to increased acoustic noise in the bore of the scanner. In the course of clinical scanning, 3 patients expressed complaints of excessive acoustic noise with documented transient hearing loss in one patient. Since acoustic noise attenuating earphones do not fit in the head coils, patients with head scans must use foam ear plugs only. The ear plugs must be inserted properly and must not shift out of position during scanning. The purposes of this project were to evaluate acoustic noise levels for all clinical sequences used for head and neck imaging, to reduce sequence noise levels when possible while maintaining adequate image quality, and to educate staff regarding noise levels and methods used to reduce risk to patients.

METHODS

A sound level meter with MR Safe microphone and cable (Bruel & Kjaer model 2250L) was used to measure A-weighted sound levels (dBA) for each clinically approved sequence used with the head coils. The microphone was positioned in the head coil adjacent to a spherical phantom in a location approximating ear level, and then positioned at isocenter. Sequences with measured sound levels above a conservative 105 dBA were identified to be modified to reduce sound levels. Acoustic noise for these sequences was re-measured to determine modified sound level. The modified sequences were then scanned on a volunteer with images reviewed by Radiologists to identify any image quality issues that may need to be addressed. In conjunction with the acoustic noise measurements, other aspects of our safety program related to hearing protection were reviewed.

RESULTS

Acoustic noise measurements conducted on imaging pulse sequences resulted in a range of sound levels from 104.9 to 122.6 dBA. Modifications were made to 42 sequences in an attempt to reduce sound levels. Initial adjustment was made simply by turning ON the vendor supplied 'quiet' option for the pulse sequence; manual modifications were made to several sequences. The average sound level for un-modified sequences was 112. 4 dBA. After modifications the average sound level of these sequences was 101 dBA, resulting in an overall average decrease of 11 dBA. The reduction in sound level resulted in decreased resolution or increased scan time for many sequences, thus these aspects were carefully considered in the decision to keep the new sequence or revert to the louder sequence. It should be noted that measurements by manufacturer service indicated that acoustic noise levels of our PET/MR scanner were within FDA and manufacturer specifications. During review of our hearing protection safety program, we discovered or were reminded of several important factors: 1. Proper technique must be used when inserting ear plugs. 2. Ear plugs are not 'one-size-fits-all.' Patients with small ear canals should be given appropriate sized ear plugs. 3. Improperly inserted or incorrect size ear plugs may shift in position during scanning, reducing effectiveness. 4. Technologists should communicate with patients about acoustic noise, just as they communicate with patients about other risks such as RF warming. 5. Hearing protection combination of ear plugs plus ear phones may be used for non-head coil scans. Ear phones may not fit in head coils, thus ear plugs alone must be used possibly exposing patient to increased risk if ear plugs do not fit well or are not inserted properly. 6. Some patients (e.g. those with pre-existing conditions, and those undergoing certain types of chemotherapy) may be more sensitive to acoustic noise issues.

CONCLUSION

Patients may be subject to increased risk of damage to hearing when a combination of conditions exists including: scans in which ear plugs only are used, improperly inserted or incorrect size ear plugs are used, and use of particularly loud pulse sequences. Ear plugs plus ear phones should be used when possible. Technologists should be well educated regarding the use of hearing protection and should instruct patients to notify them if they experience excessive acoustic noise levels.

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QI111-ED-MOB1

Enhancing Undergraduate Clinical Radiology Education in A University Teaching Hospital- A Two-year Mixed Methods Evaluation of Learner Feedback to Improve Practice

Monday, Dec. 2 12:45PM - 1:15PM Room: QR Community, Learning Center Station #1

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PURPOSE

Integration of clinical radiology is a key component within the UK undergraduate curriculum with outcomes and capabilities aligned the UK Regulator's (General Medical Council) outcomes framework. Medical students are introduced to imaging across the medical curriculum with a requirement that newly qualified medical practitioners have the necessary knowledge and skills to arrange and correctly interpret basic radiological investigations. However, delivering a learner-centred undergraduate programme in a busy radiology department is challenging with competing service and research demands. Our institution is aligned to a major UK medical school with >500 undergraduate students in each year group. All are required to undertake a placement in clinical radiology with Radiologist-led clinical teaching and exposure to all general imaging modalities. The core curriculum is composed of four components: 1) Fundamental principles 2) Common emergency conditions 3) Imaging in other common presentations 4) The role the radiologist as part of the multidisciplinary team. Clinical teaching is grounded in Adult Learning theory; we deliver teaching and learning using a constructivist approach using role-modelling and work-based learning techniques. This enables medical students to experience interpreting a spectrum of clinical cases in a safe environment with targeted feedback and practical skills acquisition. We obtained prospective feedback from learners to guide quality improvement and alignment to their learning outcomes. Our standard is to achieve 100% of feedback responses to be satisfactory or above. We present quantitative and qualitative data over two years from direct anonymised feedback from medical students.

METHODS

A mixed methods approach of evaluation of teaching and learning was undertaken. The radiology registrars (residents) lead this programme, supervised by a Radiology Consultant. Quantitative data was collected using Likert scales (visual analogue) over a linear time period. Qualitative data was collected using open questions and thematic analysis. Feedback was then used at each time point over the two year period to enact changes in our departmental curriculum and teaching programme. This was then subject to ongoing learner feedback, as described above.

RESULTS

Feedback is given by each medical student for each session, using a Likert scale; 'Very Unsatisfactory', 'Unsatisfactory', 'Satisfactory', 'Good' or 'Excellent'. In 2015-16 academic year, 93.1% of learners rated teaching as Satisfactory or above (standard: 100%). A detailed breakdown is outlined. Thematic analysis of qualitative data included a need for; 1). Improved structure 2.). Clearer objectives sessions 3). Clarity of the learners' role in clinicoradiological meetings. In 2016-17 98.3% of learners rated teaching as Satisfactory or above (standard: 100%). A detailed breakdown is outlined. Thematic analysis of qualitative data included demonstrated increased satisfaction in but one of the previous themes with 'clarity of the learners' role in clinicoradiological meetings remaining an area where learners feel they need more guidance. Specific responses to improved teaching delivery included 'Emphasis on structured teaching was excellent...' and 'practical ultrasound very useful'.

CONCLUSION

The role of the radiologist in contemporary clinical practice and medical education is multi-faceted: However, medical students traditionally have limited exposure to Consultant-delivered teaching and departmental experience. Using established educational theories of role-modelling and work-based learning we have developed a practical and feasible curriculum blueprint for learner-centred teaching in a busy, service-led departmental setting. Using mixed methods evaluation techniques we have gathered quantitative and qualitative feedback to demonstrably improve the medical student experience. We believe that this is a feasible and effective template for other Radiology departments to set learning objectives to achieve the best outcomes for undergraduate radiology education.

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QI112-ED-MOB2

Modified Imaging Algorithm for Patients Presenting with Suspected Acute Cord Compression (ACC) in the Emergency Room

Monday, Dec. 2 12:45PM - 1:15PM Room: QR Community, Learning Center Station #2

Awards
Quality Improvement Reports Award

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PURPOSE

To improve the speed (order to scan start) in which patients with suspected acute cord compression receive diagnostic MRI imaging by 20%. To reduce the 'table' time to complete the total spine MRI performed for acute cord compression by 20% by creating a targeted MRI protocol specifically for ruling in or ruling out ACC.

METHODS

Baseline data was obtained from 10/1/17 - 3/31/18 for all patients presenting to one of our health network facility locations who obtained a total spine MRI for suspected acute cord compression (n=55). Metrics assessed included MRI order to start time, total MRI imaging time, and total time from order entry to MRI completion. After initiating the ACC redesign, the same data was re-assessed from 7/1/18 - 2/28/19, assessing the impact of new protocol (n=28). Lean QI techniques were utilized including A3 form completion and process mapping. A new electronic medical record order was created for the protocol.

RESULTS

The ACC protocol exceeded our goal reductions in scan start time and total scan 'table' time. Median total MRI scan 'table' time was reduced by 44% (from 48 to 27 minutes) post intervention. Median time from order placement to exam begin was reduced by 50% (from 248 minutes to 124 minutes) post intervention. The rate of positive exams pre and post intervention was 35% and 32%, respectively.

CONCLUSION

Acute spinal cord compression (ACC) is a neurosurgical emergency where rapid radiological diagnosis via MRI has the potential to greatly impact clinical care and patient outcomes. Our QI project aimed at re-structuring the diagnostic work-up for patients presenting to the emergency room with symptoms of acute cord compression to allow for more streamlined diagnoses and decreased delays for these cases that often reflect a surgical emergency. Through creation of a new multi-specialty designed/approved EMR order set in conjunction with a new MRI ACC protocol, we were able to surpass our goal metrics with reductions in MRI scan 'table' time by 44% and decrease delay from MRI order to MRI begin by 50%. Creation of a new diagnosis specific protocol required detailed data analysis before and after intervention and close collaboration between multiple specialties involved in the management of these patients. The rate of positive exams pre and post intervention was 35% and 32%, respectively. Through this collaboration we were able to reach agreement on which patients this expedited algorithm should be employed, with sustainment of appropriate order set utilization and maintenance of goal metrics.

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QI113-ED-MOB3

Determining Radiologists' Preferences for Quality Reporting in Peer-learning and Score-based Peer-review Systems

Monday, Dec. 2 12:45PM - 1:15PM Room: QR Community, Learning Center Station #3

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PURPOSE

To determine radiologists' use of and preferences for a peer-learning (PL) case submission module incorporated into the score-based (SB) randomly assigned peer-review system in efforts to improve patient care in radiology.

METHODS

A voluntary peer-learning (PL) case submission module was added to the internally developed score-based (SB) traditional peer-review system for cases encountered during clinical workflow. Submitted cases represented opportunities for improvement in interpretation and reporting, patient care, or results communication or were 'great calls.' Cases were categorized by modality, subspecialty, anatomy, and type of pathology. PL conferences were organized by the section chiefs. The quality reviewed PL cases for inclusion into the teaching archive. An anonymous 22 question survey was constructed and distributed using SurveyMonkey following literature review and approved by the quality committee to identify radiologists preferences and opinions regarding traditional SB peer review and the new PL system. An email was sent with a link to the survey to all 137 radiologists at our institution. A reminder was sent at 1 week and the survey was closed after 2 weeks.

RESULTS

A total of 583 of cases were identified during the first 30 months of PL from January 2016 to June 2018, with 519 (89%) of cases considered peer learning opportunities and 64 (11%) considered "great calls." Average case submission volume varied by month with a progressive increase over time. A total of 123 radiologists received PL, ranging from 1 to 30 per individual radiologist, and a total of 63 radiologists submitted PL, ranging from 1 to 70 cases per radiologist. Sixty-six responses were obtained for a 48% response rate representing individuals from all subspecialty sections. The average years in practice was 16.5 ± 9.8 years. PL cases were identified most often during routine clinical work including comparison studies (67%). The preferred methods of communication to others were the PL website (30%), phone call (21%), direct email (18%) or in-person conversation (18%). Most (63.5%) respondents believe the addition of peer learning to the traditional score-based peer review system has been an improvement, 29% were unsure and 7.5% responded no. Most (56%) respondents agreed the additional time needed to send peer learning is worthwhile; 36% were unsure and 8% responded no. PL increased the number of reported cases for 32% of respondents and was the same for 27%. Most (67%) respondents indicated peer learning cases contribute more important learning material than the random auditing of cases, 25.5% were unsure and 7.5% responded no. A minority (29%) of radiologists reported being more comfortable pointing out errors with the peer learning method of reporting rather than with the traditional scoring system; 15% responded no more comfortable and 56% responded the same comfort level. Approximately half of radiologists (48%) indicated they prefer that peer learning cases be anonymized, 26% were unsure and 26% responded no.

CONCLUSION

A majority 74% of radiologists using both PL and SB peer review believe the best method to provide peer feedback and improve care is through the combination of traditional peer review and peer learning. None reported that only traditional peer review is the best method and a minority (10%) believed that using only PL is the best method to provide feedback and improve care. Radiologists indicate that the time commitment for PL is considered much less based on cases encountered in daily clinical workflow, which according to our survey is how radiologists learn most about errors, rather than a truly random SB review based on assignment of randomized cases. PL conferences which focus on those areas of greatest educational need were mostly well received although radiologists noted preferences for direct communication face-to-face, via an IM link to the case and commentary, for reporting.

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RO204-SD-MOB1

Quantitative T1 Mapping Technique in Enhanced MRI to Assess Response to Chemoradiotherapy in Rectal Cancer

Monday, Dec. 2 12:45PM - 1:15PM Room: RO Community, Learning Center Station #1

Participants
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PURPOSE

In evaluation of the diagnostic value of T1 mapping in enhanced MRI for the assessment of response to chemoradiotherapy in rectal cancer.

METHOD AND MATERIALS

This prospective study recruited 22 patients with locally advanced rectal cancer who were treated with preoperative neoadjuvant chemoradiotherapy (CRT) followed by surgery. Enhanced T1 mapping MRI were performed before CRT and presurgery. T1 relaxation times pre- and post-contrast before CRT and presurgery were measured by using whole-tumor volume (WTV) methods respectively. Reduction rates of T1 relaxation times between pre- and post-contrast (ΔT1) were calculated as [(T1pre - T1post)/ T1pre × 100%]. Receiver operating characteristic (ROC) curves were calculated to evaluate performance in determining good responders (GRs) from pre- and post-CRT T1pre and ΔT1. Patients with pathological complete or near-complete response (tumor regression grade 1-2) were classified as GRs.

RESULTS

In GRs, mean T1pre values and ΔT1 before CRT and presurgery were 2453.01 ± 468.99, 66.06 ± 7.00%, 2228.51 ± 274.34, 72.38 ± 4.59%, respectively. In moderate/poor responders, mean T1pre values and ΔT1 before CRT and presurgery were 2703.91 ± 492.27, 68.17 ± 9.20%, 2478.51 ± 595.62, 70.17 ± 7.47%, respectively. The area under the ROC curves (AUC) for native T1 values before CRT was 0.71 with moderate diagnostic value. The AUC for the difference of ΔT1 between pre- and post-CRT was 0.69. Other parameters resulted in AUCs with values of around 0.62 for ΔT1 pre-CRT, 0.58 for ΔT1 post-CRT, 0.55 for T1pre values pre-CRT.

CONCLUSION

T1 mapping were useful for assessing response after CRT and the T1pre before CRT might be more useful.

CLINICAL RELEVANCE/APPLICATION

The need for reliable selection methods to select responders and nonresponders to preoperative CRT is increasing because of the introduction of organ-sparing treatments in rectal cancer. For rectal cancer response assessment, quantitive T1 mapping may be a promising modality to identify good treatment responders after CRT.

RO205-SD-MOB2

Outcomes of Stereotactic Radiotherapy for Vestibular Schwannoma

Monday, Dec. 2 12:45PM - 1:15PM Room: RO Community, Learning Center Station #2

Participants
Asuka Takahira, Nagasaki, Japan (*Presenter*) Nothing to Disclose
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Nobuyuki Hayashi, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuto Ashizawa, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate the safety and efficacy of stereotactic radiotherapy for vestibular schwannomas in our institution.

METHOD AND MATERIALS

We conducted a retrospective analysis of consecutive 38 patients with vestibular schwannomas who were treated with stereotactic radiotherapy between March 2008 and November 2014. They were 21 women and 17 men, and the median patient age was 66 years old (range; 47 - 80 years old). Twelve patients received stereotactic radiosurgery (SRS), and 26 patients received fractionated stereotactic radiotherapy (FSRT). The prescribed dose of SRS ranged from 11 to 13Gy, and the prescribed dose of FSRT was 50Gy in 25 fractions. We evaluated local control rate and hearing function and other crania nerve disorders in both groups.

RESULTS

The median follow-up time was 61 months (range; 12 - 108 months). The 5-year local control rate was 91.7% and 92.3% in SRS and FSRT, respectively. Clinically significant acute adverse events developed in 3 patients (facial nerve dysfunction in 2 patients and trigeminal nerve dysfunction in one patient) by transient tumor expansions. All acute adverse events were transient. Audimetry examinations were performed before and after treatment in 22 patients, and decline of hearing was observed in 20 out of these 22 patients. There were no other late adverse events.

CONCLUSION

SRS and FSRT are both regarded safe in terms of cranial nerve toxicity. Local control rates are comparable in both groups.

CLINICAL RELEVANCE/APPLICATION

FSRT and SRS are both regarded safe in terms of cranial nerve toxicity, and local control rates are comparable in both groups. Therefore, these methods are useful in the treatment of vestibular schwannomas even in the operable cases.

UR182-ED-MOB7

Penile Lumps: From Common to Rare and Unusual Diseases

Monday, Dec. 2 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #7

Awards
Cum Laude
Identified for RadioGraphics

Participants
Sandy van Nieuwenhove, MD, Brussels , Belgium (*Presenter*) Nothing to Disclose
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Helene Dano, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Michele Bertolotto, MD, Trieste, Italy (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review penile's anatomy on US and MRI. 2. To recognise common disease when imaging plays a crucial role in clinical managment using US and MRI 3. To be aware of uncommon diseases and to correlate abnormalities observed with histopathology

TABLE OF CONTENTS/OUTLINE

1. Anatomy using US and MRI techniques 2. Traumatic diseases 3. Inflammation cases 4. Benign lesions 5. Malignant lesions 6. Summary

UR183-ED-MOB8

Imaging Findings in Genitourinary Tuberculosis

Monday, Dec. 2 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #8

FDA Discussions may include off-label uses.

Awards
Magna Cum Laude
Identified for RadioGraphics

Participants
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Cary L. Siegel, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Christine O. Menias, MD, Chicago, IL (*Abstract Co-Author*) Royalties, Reed Elsevier

TEACHING POINTS

1. To review the imaging findings in genitourinary tuberculosis. 2. To review some imaging mimics/differentials in genitourinary tuberculosis.

TABLE OF CONTENTS/OUTLINE

Outline. Renal and Calyceal Tuberculosis. Ureteral, Bladder and Uretheral Tuberculosis. Adrenal tuberculosis. Tuberculosis of the male and female genital tract. Imaging mimics and differentials in some of the tuberculosis cases such as BCG granuloma after intravesical therapy, salpingitis isthmica nodosa mimicking fallopian TB.

VI133-ED-MOB9

Algorithmic Approach to Assess Pulmonary Embolism on Dual-Energy Spectral Detector Computed Tomography (SDCT): Overcoming the Pitfalls of Conventional CT

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #9

Participants
Amit Gupta, MBBS, Cleveland, OH (*Presenter*) Nothing to Disclose
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Elias Kikano, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Kevin R. Kalisz, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Dhiraj Baruah, MD, Troy, MI (*Abstract Co-Author*) Educator, Boehringer Ingelheim GmbH
Sachin S. Saboo, MD, FRCR, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Understand the basic physics and reconstructions available from SDCT. Learn the implementation of spectral reconstructions to better assess pulmonary embolism and its hemodynamic significance. Explore the various conditions that mimic pulmonary embolism on iodine density maps Discuss various pitfalls of conventional CT and how to eliminate them using SDCT.

TABLE OF CONTENTS/OUTLINE

Basic physics Basic concepts of dual energy CT Various approaches to dual energy CT. Physics behind the spectral reconstructions, with special emphasis on VMIlow images and Iodine density maps. An algorithmic approach to pulmonary embolism studies using spectral CT, using clinical examples. VMIlow for salvaging non diagnostic exams and better detection of pulmonary emboli. Iodine density maps/overlay images for finding occult emboli and improving diagnostic confidence. Iodine density maps/overlay images for predicting the hemodynamic significance of the embolism. Various conditions mimicking pulmonary embolism on iodine density maps. Pitfalls and limitations of conventional CT and how these can be eliminated by SDCT reconstructions: Inherent limitations of conventional CT False positive pulmonary embolism on conventional CT False negative pulmonary embolism on conventional CT

VI134-ED-MOB8

Radiofrequency Ablation Guided by Ultrasonography: Tips and Tools to Improve Results in Benign Thyroid Nodules

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
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TEACHING POINTS

Radiofrequency ablation (RFA) guided by US is a safe and effective alternative to surgery with an increasing number of therapeutic indications, including hyperfunctionating ormalignant thyroid nodules. Objectives: - To provide a comprehensive review of anatomical landmarks of cervical region - To highlight technical tips to improve results of RFA - To evaluate usefulness of contrast-enhanced ultrasonography (CEUS) during RFA - To evaluate usefulness of elastography in management of nodules - To evaluate effects of RFA on immunitary system - To evaluate usefulness of RFA in hyperfunctionating thyroid nodules

TABLE OF CONTENTS/OUTLINE

99 patients treated with RFA, women (81%) with clinically benign thyroid nodules. Evaluation of vocal cord movement was performed by US. Elastography performed before and after RFA to define possibility of success. Trans-isthmic approach to better define cervical landmarks. Initial position of the needle depends on length of the active-tip. Moving-shot to create a conus-shape cylinder of ablation. CEUS defines untreated areas. Volume reduction of 61% at 6 months, with significant reduction of symptomatic scores. Similar results were observed in hyperfunctionating nodules (10%) with normalization of hormone levels. There were no changes in anti-TG and anti-TPO IgG after RFA.

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VI207-SD-MOB2

The Role of Magnetic Resonance Imaging in Predicting the Outcome of High-Intensity Focused Ultrasound Treatment of Adenomyosis

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
Nguyen Minh Duc, MD, Ho Chi Minh, Vietnam (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate the role of magnetic resonance imaging (MRI) in predicting the treatment outcome of high-intensity focused ultrasound (HIFU) ablation of adenomyosis defined as the immediate non-perfused volume (NPV) ratio.

METHOD AND MATERIALS

A total of 50 women (40.3 ± 6.0 years with a range of 30-56 years) with symptomatic adenomyosis underwent MRI-guided HIFU ablation. Multivariate linear regression analyses were carried out on multiple pre-treatment MRI parameters including (i) baseline anatomical features, (ii) T2 signal intensity (SI) and (iii) semiquantitative perfusion analysis. The ability of these parameters to predict the final NPV ratio was investigated. Generalized estimating equation (GEE) of all the significant screening MRI parameters acquired from the multivariate analyses were used to predict the immediate NPV ratio.

RESULTS

The results of multivariate analyses revealed that there were four statistically significant predictors ($p < 0.05$): abdominal subcutaneous fat thickness, T2 SI ratio of adenomyosis to myometrium, relative enhancement ratio of adenomyosis to myometrium, time to peak enhancement ratio of adenomyosis to myometrium were significant factors affecting NPV ratio. GEE analysis generated linear equation for predicting the immediate NPV ratio with four statistically significant predictors derived from multivariate analyses : $y = 165.952 + 0.119x1 - 10.514x2 - 56.177x3 - 39.812x4$, where x1 = abdominal subcutaneous fat thickness, x2 = T2 SI ratio of adenomyosis to myometrium, x3 = relative enhancement ratio of adenomyosis to myometrium, x4 = time to peak ratio of adenomyosis to myometrium. The Pearson test revealed strong correlation between the GEE predicted value with NPV ratio (rho = 0.783, $p < 0.001$)

CONCLUSION

The study suggests that the prediction of MRI-guided HIFU treatment of adenomyosis based on multivariate analyses and prediction model appears to be clinically possible.

CLINICAL RELEVANCE/APPLICATION

Based on the prediction model introduced, the role of each significant MRI parameter in the screening phase must be considered to predict the treatment outcome of HIFU ablation of adenomyosis.

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VI208-SD-MOB3

Value of 3D Rotational Epidurography on Percutaneous Epidural Adhesiolysis

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
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PURPOSE

We aimed to evaluate the association between the outcome of percutaneous epidural adhesiolysis (PEA) and 3D-rotational epidurography (3D-RE).

METHOD AND MATERIALS

After ethics board approval and written informed consent were obtained, we performed 30 PEA in 26 patients, and evaluated their post-PEA image findings. Two independent clinicians categorized and recorded the occurrence of contrast at extra-foraminal and ventral regions on conventional epidurography (CE); and contrast at dorsal canal (DC), ventral canal (VC), dorsal foramen (DF), and ventral foramen (VF) on 3D-RE. Reproducibility was assessed using the intra-class correlation coefficient (ICC). The symptom relief after one month for the patients receiving PEA and the contrast distribution patterns of CE and 3D-RE and were determined.

RESULTS

The rate of patients with symptoms relief > 50% after PEA was 63.3%. The inter-reader agreement was higher on 3D-RE (ICC = 0.955) than CE (ICC = 0.793) among different operators ($p<0.05$). The presence of contrast at DF and VC adjacent to the irritated root on 3D-RE was a predictor for successful response ($p=0.015$).

CONCLUSION

The contrast distribution patterns on 3D-RE may be associated with better outcomes after PEA.

CLINICAL RELEVANCE/APPLICATION

3D-rotational epidurography could provide more accurate information of epidural contrast distribution than conventional epidurography and be used to determine the outcomes after percutaneous epidural adhesiolysis.

VI224-SD-MOB1

Transperineal US-Guided Focal Laser Ablation (TPLA) in Treatment of Low and Intermediate Risk Prostate Cancer: Feasibility Multicentric Study at 6- and 12-Month Follow-Up

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #1

Participants
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PURPOSE

The purpose of this study is to evaluate therapy success, complications and technical feasibility and safety of transperineal US-guided focal laser ablation as primary treatment for focal unilateral prostate cancer.

METHOD AND MATERIALS

Fifteen patients with newly diagnosed, histopathologically proven unilateral prostate cancer were treated with US-guided transperineal focal laser ablation as primary treatment. Inclusion criteria were no previous prostate treatment, a prostate specific antigen (PSA) level <=20, Gleason Score (GS) <=7, Lesion <= T2b N0M0 and a MRI-visible cancer lesion (PIRADS >= 4). All US-guided focal laser ablation procedures were performed under local transperineal anesthesia. A needle guide 21G was inserted and guided into the tumor lesion and after correct alignment, the laser fiber (Elesta EchoLaser, Calenzano Florence, Italy) was inserted. Procedure was considered complete when 1800J was reached for each laser fiber. Directly after the ablation a mpMRI of the prostate was acquired. Follow-up consisted of PSA-level measurement and multiparametric prostate MR examination at 1,3,6,12 months with US/MRI Fusion-guided biopsy at 6 and 12 months.

RESULTS

Fifteen patients were successfully treated with transperineal US-guided focal laser ablation. No complications occurred. All patients were dismissed on the same day of treatment. The IPSS and SHIM did not significantly change after treatment. Mean operation time was 38.2 minutes (range 32.6-42.5), mean ablation time was 21.7 minutes (range 18.3-26.8), mean energy deployed 3606J (range 3212-3804), mean hospital stay 113 minutes (range 55-178) and mean catheterization time 261 minutes (range 95-412). At the 6- and 12-month follow-up, prostate mpMRI and US/MRI Fusion-guided biopsy showed neither evidence of local residual disease nor recurrence.

CONCLUSION

Transperineal US-guided focal laser ablation has shown encouraging results, however further follow-up is necessary to confirm oncological long term control.

CLINICAL RELEVANCE/APPLICATION

Transperineal Laser Ablation can treat focal cancerous prostate lesions effectively without short-term complications.

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VI234-SD-MOB6

Qualitative Study of Patients with Low-Flow Venous Malformation: Symptom Experiences and Content Validity of Patient-Reported Outcome Measures

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #6

Participants
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Heather L. Gelhorn, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
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Clifford R. Weiss, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Merit Medical Systems, Inc Research Grant, BTG International Ltd Medical Advisory Board, Clear Guide Medical LLC Founder, Avasys, LLC Officer, Avasys, LLC

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PURPOSE

No standard set of patient-reported outcome (PRO) measures or clear method for evaluating symptom or functional improvement after venous malformation (VM) treatment has been established. The purpose of this study is to determine important symptoms and functional effects of VMs and to assess content validity of commonly used patient-reported outcome (PRO) measures for use with VM patients.

METHOD AND MATERIALS

This cross-sectional, qualitative study involved cognitive interviews with participants with VM aged >=14 years. From February to June 2016, 11 participants (8 female) with a mean (± standard deviation) age of 31 ± 15 years were recruited from 3 clinical sites. The following subgroups were evaluated: 5 adults (aged >=18) with trunk/extremity VMs; 3 adolescents (aged 14-17) with trunk/extremity VMs; and 3 adults with head/neck VMs. We evaluated the content validity of the Worst Pain Numeric Rating Scale (NRS), Patient-Reported Outcomes Measurement Information System (PROMIS) Pain Interference 8-item short form, and PROMIS Physical Function 8-item short form.

RESULTS

The most common participant-reported VM symptoms were swelling (n=10), skin discoloration (n=8), acute episodic pain (n=8), chronic pain (n=7), numbness (n=7), and tingling/burning (n=6). Participants reported that VMs affected their physical function (n=10), appearance (n=10), relationships/social activities (n=7), and emotional health (n=3). The Worst Pain NRS and PROMIS Pain Interference measures were relevant to all participants' VM experience. All adults with head/neck VMs found the PROMIS Physical Function measure to be irrelevant. The assessed PRO measures did not address several symptoms commonly reported by VM patients (swelling, skin discoloration, numbness, appearance).

CONCLUSION

These results suggest that several VM symptoms are not assessed fully by commonly used PRO measures, and that the relevance of functional limitation questions may vary by VM location.

CLINICAL RELEVANCE/APPLICATION

As VMs vary widely in clinical presentation and response to treatment, these findings can inform future development of location-specific and comprehensive PROs for VM patients.

VI235-SD-MOB7

Impact of an Electromagnetic Navigation System on Dose Radiation Exposure: A Comparative Retrospective Study

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #7

Participants
Christophe Teriitehau, Saint Denis, France (*Presenter*) Nothing to Disclose

PURPOSE

To assess the impact of a navigation station (CT-Navigation system by IMACTIS) on radiation doses delivered to patients during percutaneous vertebroplasty.

METHOD AND MATERIALS

In this retrospective comparative trial, 38 patients requiring percutaneous vertebroplasty were included. All procedures were conducted at CCN (Centre Cardiologique du Nord, Saint-Denis, France), by the same radiologist and using the same model and CT scan with identical parameters. The Dose length product (DLP), representing the absorbed dose by the length of explored organs, was acquired in 15 consecutive patients who underwent a conventional procedure (CT group), and in 23 patients who underwent a vertebroplasty assisted by a navigation system (Nav group). The difference in DLP between the two groups was evaluated using Student T-test.This study was approved by CCN's ethical committee; all patients provided informed consent.

RESULTS

The mean of DLP dose for the NAV group was 365.1 mGy.cm; this represents a 62.86% reduction compared with that of the CT group (mean 983 mGy.cm; $p < 0.001$).

CONCLUSION

The use of a navigation system reduced the radiation dose compared to conventional vertebroplasty method.

CLINICAL RELEVANCE/APPLICATION

lower dose to vertebroplasty under CT

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VI236-SD-MOB5

Magnetic Resonance Imaging for Tracking Tumor Progression and Identifying Optimal Timepoint for Intervention with Embolization Treatment

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #5

Participants
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Dilip R. Maddirela, MD, Milwaukee, WI (*Abstract Co-Author*) Research support, Instylla
Sarah B. White, MD, Milwaukee, WI (*Abstract Co-Author*) Research support, Guerbet SA; Research support, Siemens AG; Research support, Instylla; Research support, InSightec Ltd; Consultant, Guerbet SA; Consultant, BTG International Ltd; Consultant, Cook Group Incorporated; Consultant, Strategies MD

PURPOSE

Hepatocellular carcinoma is the most common form of primary liver cancer, and globally it is the sixth most common cancer. In patients with unresectable hepatocellular carcinoma, trans-arterial embolization or chemoembolization procedures can be conducted, which require specific targeting of tumors. In this study, we show MRI capability for tracking pre-procedure tumor progression to identify optimal treatment timepoint and allow for accurate tumor targeting.

METHOD AND MATERIALS

New Zealand white rabbits (males=5, females=4) underwent tumor fragment (3-4 mm3) implantation in the liver under ultrasound guidance. The rabbits were imaged at different timepoints post implantation (10 days (n=4), 21 days (n=8), and 35 days (n=2)) to track solid tumor growth and identify optimal timepoint for the treatment procedure based on tumor size and location. Anesthetized rabbits were scanned on a 3T GE MRI scanner using a 18-channel knee coil and fast spin-echo sequence to generate T2 maps. Axial and coronal stacks of parallel images covering the liver were acquired. As we are imaging a relatively small animal (weight ~3kg) on a human MRI scanner, imaging parameters were optimized to improve resolution and SNR while minimize motion artifacts. Signal intensities from the acquired echoes were fitted to mono-exponential decaying curves to generate T2 maps.

RESULTS

The T2 maps showed tumor growth at different timepoints post implantation. After careful setup of the colormap, tumors can be clearly identified on the T2 maps. T2 value was 67±12 ms and 32±2 ms in the tumor and normal liver tissue, respectively. Tumor grew in size from 4.5±0.7 mm to 8.9±1.4 mm to 10.7±0.7 mm at 10, 21, and 35 days post implantation, respectively. Based on these results, the 21-days timepoint was identified as the optimal time for intervention with treatment, which allows for accurate tumor targeting.

CONCLUSION

This study showed the capability of noninvasive, non-contrast MRI T2 mapping for tracking tumor progression in the liver for selection of optimal treatment timepoint and accurate identification of the tumor location and size for proper treatment planning and optimal outcome.

CLINICAL RELEVANCE/APPLICATION

The developed technique allows for non-invasive tracking of tumor growth and accurate identification of its location and size for proper trans-arterial chemoembolization planning and optimal outcome.

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VI237-SD-MOB4

Comparison between Percutaneous Balloon Vesselplasty and Percutaneous Vertebroplasty in Chronic Painful Compression Fractures of Dorsolumbar Spine

Monday, Dec. 2 12:45PM - 1:15PM Room: VI Community, Learning Center Station #4

Participants
Akhil Monga, MD,MBBS, New Delhi, India (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate the efficacy and safety of percutaneous vesselplasty in non-traumatic vertebral fractures of the thoracolumbar spine and compare it with percutaneous vertebroplasty.

METHOD AND MATERIALS

A total of 50 patients with chronic vertebral compression fracture with duration of more than 12 weeks, severe pain (VAS: more than or equal to 7) and disability attributable to the vertebral fracture were included. They underwent vertebral augmentation procedure out of which 27 patients underwent vertebroplasty and remaining 23, vesselplasty. Clinical and imaging follow up was done for both the groups and they were evaluated for pain, disability scores, increase in anterior vertebral body height and volume of cement injected. Rate of complications was also compared in the study

RESULTS

The mean decrease in pain score was 4.27 in the vertebroplasty group and 4.45 in the vesselplasty group (p=0.448). The mean increase in the physical functionality scores was 27.4 in the vertebroplasty group and 35.9 in the other group which was statistically significant (p=0.005).The mean amount of cement injected was 3.84 ml in the vertebroplasty group and 4.68 ml in the other group which was significantly higher (p=0.008).The mean change in anterior vertebral height was 0.63 mm in the vertebroplasty group and 2.47 mm in the vesselplasty group which was significant (p<0.001).There were cement leaks seen in 34% patients in the vertebroplasty group which were minor and mainly involved the paravertebral and intradiscal regions, whereas in the other group, no cement leaks were seen

CONCLUSION

Vesselplasty is superior to vertebroplasty in terms of improvement in disability scores, increase in anterior vertebral body height and volume of cement injected, with extremely low complication rate.

CLINICAL RELEVANCE/APPLICATION

Vertebroplasty has been done for pain alleviation but can rarely cause spinal cord compression if there is epidural leakage of PMMA. Vesselplasty promises to eliminate this catastrophic complication,

AI141-ED-TUA1

Practical Guide to Natural Language Processing Research in Radiology

Tuesday, Dec. 3 12:15PM - 12:45PM Room: AI Community, Learning Center Station #1

Awards
Certificate of Merit

Participants
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TEACHING POINTS

This abstract illustrates how to use natural language processing to automatically extract information from radiological reports. By walking through the steps including preprocessing and classification of reports, we systematically demonstrate how to: - Do text segmentation - Preprocess and normalize data to handle misspelling or abbreviation - Perform semantic analysis to identify concepts in reports - Train, validate, evaluate, and optimize classification models with NLP tools & packages - Apply models to practical scenarios

TABLE OF CONTENTS/OUTLINE

Background: - Reasons for using NLP in radiological research Practical Overview of Creating a Machine Learning Model to Extract Information from Clinical Reports - Preparing Data - Data loading - Segmentation - Boundary detection - Word normalization - Syntactic & semantic analysis - Negation detection - Correcting Imbalanced Data - Upsampling & downsampling - Model Training & Validation - Rule-based models vs. ML models - Common algorithms - Underfitting & overfitting - Evaluation - Evaluation metrics - Result visualization - Optimization - Hyperparameter tuning - Ensembling Generalization & Application - Diagnostic surveillance - Query-based case retrieval - Quality assessment Summary of tools for NLP in Radiology

AI145-ED-TUA2

Generative Adversarial Networks (GANs): A Primer for Radiologists

Tuesday, Dec. 3 12:15PM - 12:45PM Room: AI Community, Learning Center Station #2

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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Andreas Bucher, MD, Frankfurt am Main , Germany (*Abstract Co-Author*) Travel support, Guerbet SA;
Ivana Isgum, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV Research Grant, 3mensio Medical Imaging BV Research Grant, Koninklijke Philips NV

TEACHING POINTS

The past few years have seen many applications of neural network-based deep learning to image analysis in radiology. The use of generative adversarial networks (GANs) has been a relatively recent development. GANs consist of two neural networks that are jointly optimized: one network tries to synthesize samples that resemble real data points, while a second network is trained to differentiate synthesized samples from real samples. This concept can be used to generate synthetic diagnostic images (e.g. from chest X-ray) but also for image annotation. GANs generate impressive results, but their apparent complexity makes it difficult to grasp their real value in image processing. It is important that radiologists are aware of the potential of this technique, but also of its pitfalls. In this exhibit, we will provide a basic introduction to GANs discuss applications of GANs and adversarial methods in radiology paint a realistic picture of current limitations and pitfalls of GANs

TABLE OF CONTENTS/OUTLINE

The exhibit will be adapted to an audience with a basic understanding of machine learning. Review of key deep learning concepts Basic introduction to (conditional) GANs Applications in radiology: synthesis, reconstruction, segmentation Pitfalls and caveats Outlook: prognosis, precision radiomics

AI148-ED-TUA3

Computer-Aided Assessment of Catheters and Tubes on Radiographs: How Good is Artificial Intelligence for Assessment?

Tuesday, Dec. 3 12:15PM - 12:45PM Room: AI Community, Learning Center Station #3

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Participants
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Scott J. Adams, MD, Saskatoon, SK (*Presenter*) Nothing to Disclose
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TEACHING POINTS

1. Computer-aided assessment of catheters/tubes on radiographs will require integration of a variety of approaches including detection, classification, and tracing to determine whether a catheter is in a satisfactory position. 2. Current algorithms have demonstrated highest detection accuracy for endotracheal tubes, with lower detection accuracy achieved for nasogastric tubes. 3. Computer-aided detection systems that can automatically detect and localize catheters on radiographs may promote patient safety and increase radiologists' efficiency by prioritizing cases with potentially malpositioned catheters for interpretation and automatically inserting text indicating the placement of catheters in radiology reports.

TABLE OF CONTENTS/OUTLINE

Introduction to catheter assessment as a use case for artificial intelligence development Key questions/tasks related to catheter assessment • Q1: Is a catheter present? • Q2: Where is the tip of the catheter? • Q3: What is the course of the catheter? • Q4: Which type of catheter is it? • Q5: Is the catheter in a satisfactory position? For each of the above five questions, the following will be discussed: • Current computer-aided approaches and relevant prior work • Recommended evaluation metrics Integration of computer-aided catheter detection systems into radiology workflow and reporting systems

BR203-ED-TUA8

Breast Radiotherapy: What the Breast Radiologist Should Know

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #8

Participants
Matthew Parsons, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Kristine Kokeny, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Nicole S. Winkler, MD, Cottonwood Heights, UT (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to: 1. Familiarize radiologists with current breast radiotherapy approaches in the setting of breast conserving therapy 2. Explain the rationale behind radiation treatment approaches including data from selected landmark trials 3. Review indications and techniques for post mastectomy radiation and how imaging impacts decision making 4. Review common radiation related side effects and the natural history of the radiated breast both clinically and on imaging 5. Address frequently asked patient questions with regard to breast radiation

TABLE OF CONTENTS/OUTLINE

-Basics of breast radiotherapy -Radiation oncology workflow and general treatment timeline -Radiation in the setting of breast conserving therapy -Whole vs. partial breast irradiation -Nodal management -Omission of radiation in selected patients -Radiation for DCIS -Post mastectomy radiation -Toxicity of breast radiation

Printed on: 10/29/20

BR204-ED-TUA9

How Artificial Intelligence May Help Improve Accuracy and Reading Times in the Interpretation of Digital Breast Tomosynthesis Screening Studies

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #9

Participants
Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, Advisory Panel, iCAD, Inc; Speaker, iiCME
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TEACHING POINTS

Artificial Intelligence (AI) may help radiologists improve the accuracy of digital breast tomosynthesis (DBT) interpretations while also decreasing reading times when AI data is presented concurrently compared to reading DBT without AI. The AI data is presented at the lesion-level as outlines on DBT slices. AI confidence of malignancy scores are also provided at the lesion-level and case-level.Although AI may have high standalone performance, it will miss some cancers, so readers should not overly rely on AI when suspicious lesions are not outlined by AI. Conversely, AI may outline some non-malignant lesions, and readers must balance the lesion score with their characterization of such lesions to determine the appropriate action.

TABLE OF CONTENTS/OUTLINE

This exhibit demonstrates concurrent use of a deep learning-based AI system for DBT that detects soft tissue and calcific lesions in DBT slices and provides lesion outlines and calibrated confidence scores at the lesion-level and case-level.Example cases are from a reader study with 24 radiologists each reading 65 cancer and 195 non-cancer cases both with and without AI showing significant improvements, on average, in AUC, sensitivity, specificity, recall rate and reading time. Cases include examples where AI either increased or decreased sensitivity and/or specificity and reading time.

BR205-ED-TUA10

Abbreviated Breast MRI: Past, Present, and Future

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #10

Participants
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TEACHING POINTS

The purpose of this exhibit is: - To present the current status and the future applicability of abbreviated MRI. - To discuss the different abbreviated MRI protocols. - To demonstrate how the use of abbreviated MRI can reduce examination time, reading time and costs. - To show the limitations of abbreviated MRI. - To compare the differences in performance between abbreviated and full protocol MRI.

TABLE OF CONTENTS/OUTLINE

- Introduction and history of the development of abbreviated MRI. - The importance of reducing MRI costs for health systems. - The impact in clinical practice of reducing examination time and reading time. - A systematic approach to the use of abbreviated MRI on screening. - Technique of the various abbreviated MRI protocols. - Differences in sensitivity and specificity of MRI between abbreviated and full protocols. - Limitations of abbreviated MRI. - Future directions: what is on the horizon for abbreviated MRI. - Summary and conclusion.

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BR233-SD-TUA1

Overweighting of Individual Outcomes is the Main Source of Base Rate Neglect in Mammography

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #1

Participants
Fallon Branch, MS, Augusta, GA (*Presenter*) Nothing to Disclose
Jay Hegde, PhD,MS, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantitatively characterize the roles of various contributing factors to base rate neglect (or base rate fallacy) in mammography, wherein radiologists fail to adequately take into account the prevalence of a given outcome (e.g., breast cancer) in the relevant patient population.

METHOD AND MATERIALS

Fourteen practicing radiologists volunteered for this study. Subjects were simultaneously given three pieces of information: (1) The base rate of breast cancer in the given cohort of patients, (2) The hit rate and false alarm rate of a machine learning system for breast cancer detection, and (3) The binary decision of the system (+ve or -ve for cancer) for a given mammogram from the present patient cohort. Using only this information, subjects had to estimate, using an on-screen slider, the percent chance that the mammogram in question is actually positive breast cancer. We systematically varied the above three pieces of information and measured its effect on the subjects' reports.

RESULTS

The estimated probability of cancer was significantly anti-correlated with the theoretically expected probabilities (r = -0.39; df = 3148; t = -23.41, p << 0.05; see figure), indicating that base rate neglect had a significant biasing effect in this case. A general linear model of the data revealed that item #3 above (i.e., binary decision) made a large, statistically significant contribution to the outcome (t = 20.87; p < 2e-16). The false alarm rate had a modest effect (t = -2.28; p = 0.02). Base rate (item #1 above) did not have a significant effect (t = -0.33; p = 0.74).

CONCLUSION

Information about the cancer status in individual case, 'individuating information', had a disproportionately large effect, and the base rate had a statistically insignificant effect on the subjects' estimates of the probability of cancer. This is consistent with the results of previous studies of the sources of the base rate fallacy in other, non-clinical contexts.

CLINICAL RELEVANCE/APPLICATION

This study suggests, albeit does not prove, that base rate neglect in mammography arises primarily because radiologists attach too much importance to individuating information, i.e., the cancer status of individual mammograms.

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BR234-SD-TUA2

The Usefulness of Bayesian Network in Assessment of Triple-Negative Breast Cancer Risk

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #2

Participants
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PURPOSE

To determine whether a Bayesian network model learned from epidemiologic, clinical, and pharmacokinetic quantitative dynamic contrast-enhanced (qDCE) MRI parameters can aid in preoperative classification of triple-negative breast cancer (TNBC)

METHOD AND MATERIALS

The institutional review board exempted this retrospective study from requiring informed consent. 197 women (mean age ± standard deviation, 50.43±10.25 years) with breast cancer confirmed by surgical pathology were included from April 2016 to August 2017. All patients underwent DCE MRI within one week before surgery. The pattern of the time of intensity curve and pharmacokinetic parameters were derived from DCE-MRI for each lesion. The epidemiologic and clinical parameters were also collected. By using 5-fold cross validation, a Bayesian network model was trained and tested to estimate TNBC risk based on epidemiologic, clinical, and qDCE MRI pharmacokinetic parameters. Probability estimates were used to build receiver operating characteristics (ROC) curves, and the performance of the Bayesian network was evaluated by using area under the ROC curves (Az), positive predictive value (PPV), and accuracy.

RESULTS

The established Bayesian network consisted of 21 features that were conditionally dependent on each other. Posttest probability table of the deterministic node showed that patients with age 0.186 tend more likely to have TNBC, while patients with age < 35 years and a mass-like lesion, or patients with age between 35 and 50 with non-mass-like lesion are almost impossible to have TNBC. The Bayesian network model showed good performance in terms of Az (0.731, 95% CI: 0.635-0.828), PPV (0.397, 95% CI: 0.257-0.538), and accuracy (0.834, 95% CI: 0.738-0.930) when the threshold level of posttest probability was set as 0.163 (95% CI: 0.114-0.211).

CONCLUSION

Bayesian network model with integration of epidemiologic, clinical, and qDCE MRI pharmacokinetic parameters can be used to predict the risk of TNBC in women with breast cancer.

CLINICAL RELEVANCE/APPLICATION

Bayesian network model can be used to predict the risk of TNBC in women with breast cancer by using epidemiologic, clinical, and qDCE MRI findings..

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BR235-SD-TUA3

Independent Validation of Diagnostic Machine Learning Radiomics on a Large Clinical Dataset of Consecutive Breast MRIs

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate radiomic machine learning in the task of distinguishing between malignant and benign breast lesions on a consecutive, independent MRI clinical dataset from China.

METHOD AND MATERIALS

Retrospective analysis was conducted of consecutive breast MRI images from 1,483 breast cancer and 496 benign patients who underwent MRI examinations between February 2015 and October 2017. The age range of the cancer and benign patients were 19 to 77 and 16 to 76 years old with an average of 48.1 and 42.1 years, respectively. Database was divided into a training dataset (years 2015 & 2016; 1444 cases) and an independent testing dataset (year 2017; 535 cases) based on MRI examination date. Once a lesion is localized on the radiomics workstation, the computerautomatically segments and extracts radiomic features, which are merged with an SVM (support-vector machine) yielding a lesion signature malignancy score. On the independent, consecutive clinical dataset, the area under the ROC curve served as the primary figure of merit in the classification task for all lesions as well as only mass lesions and only non-mass lesions.

RESULTS

In the task of distinguishing malignant and benign breast lesions on DCE-MRI, the trained radiomic signature yielded an AUC value of 0.89 (se = 0.02) on the independent test dataset. For mass lesions only and non-mass lesions only, the trained signature yielded AUC values of 0.88 (se = 0.02) and 0.90 (se = 0.03), respectively. Compared with the actual clinical management decisions, the predictive model achieved 99.5% sensitivity with 9.6% fewer recommended biopsies.

CONCLUSION

On an independent, consecutive clinical dataset from China, a trainedMRI radiomics signature yielded high performance in distinguishing between malignant and benign breast lesions.

CLINICAL RELEVANCE/APPLICATION

Our computerized radiomic analysis method has potential to aid clinicians in improving breast cancer diagnosis and patient management.

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BR265-SD-TUA4

Diffusion Tensor MRI in the Diagnostic Workup of Pregnancy Associated Breast Cancer (PABC): Clinical and Technical Considerations

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #4

Participants
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PURPOSE

To review the preliminary data of breast DTI studies among pregnant and lactating patients, focusing on the opportunities for additive diagnostic value in screening, diagnosis and management of PABC, as well as the current drawbacks and technical challenges

METHOD AND MATERIALS

All patients were prospectively scanned on 1.5T MRI. Pregnant patients (n=40) were scanned in prone position using unenhanced protocol including DTI and T2-weighted sequences, whereas lactating patients (n=43) were scanned by DTI together with conventional protocol, including dynamic contrast enhanced (DCE). Imaging indications included pre-treatment evaluation of newly diagnosed PABC (n=24) as well as screening of high-risk patients and diagnosis of breast symptoms. DTI was acquired applying 32 diffusion gradients in using b-values of 0, 700 s/mm2 during 09:38min. DTI parametric maps were generated and analyzed at pixel resolution and were compared with reference to conventional imaging and pathology.

RESULTS

All scans of pregnant patients were technically completed and reached diagnostic quality, except one with notable motion artifacts due to positional discomfort. Examinations of lactating subjects were characterized with better signal-noise ration and reduced artifacts. The newly diagnosed PABC lesions were visible on the DTI maps of λ1, λ 2, λ 3, mean diffusivity (MD), and λ 1- λ3, with substantial parametric contrast compared with the apparently normal contralateral fibroglandular tissue ($P<0.001$ for all), except for two sub-centimeter lesions that were below the detection resolution. A representative example of DTI results in pregnant patient is given in Fig1. Comparison of the contrast-noise ratio between DTI and DCE among lactating patients, revealed higher CNR for λ1 and MD. Further comparison with tumor measurements between the two MRI methodologies showed high congruency. Negative findings were found in the screening and symptomatic cohorts.

CONCLUSION

DTI is well tolerated and may serve as a standalone technique in evaluation of pregnant patients, and as a valuable adjunct modality during lactations. Yet, further clinical trials are required to demonstrate the additive value of this approach in achieving earlier diagnosis of PABC.

CLINICAL RELEVANCE/APPLICATION

This work may open the door for new screening and diagnosis strategies during the periods of pregnancy and lactation, in which current practice is limited.

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BR266-SD-TUA5

Perceived Realism of Generative Adversarial Network-Derived Synthetic Mammograms

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #5

Participants
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Tobias Rijken, London, United Kingdom (*Presenter*) Stockholder, Kheiron Medical Technologies Ltd

PURPOSE

Quality assessment of generative adversarial network (GAN)-derived images, both during training to detect model collapse and more importantly afterwards for model performance evaluation and comparison purposes, is notoriously difficult to do. Several metrics (inception, Frechet inception and sliced Wassestein's) have been proposed, but none provide an objective assessment of perceived realism. We designed a simple randomised comparison study to determine whether high resolution GAN-derived medical images could be distinguished from real ones as a proxy measure for perceived realism.

METHOD AND MATERIALS

Mammographic MLO-views were selected from a pool of 1000 real and 1000 high resolution GAN-derived images. Randomly assigned GAN-derived/real image pairs were displayed in a custom tablet app, with image pinch and zoom capability, and assigned to the left and right of the screen on a 'coin-toss' upon presentation. Attendees at a large radiology conference were asked to assess 10 randomly-paired cases with no time limit, and select which of the two presented images were real. No two image pairs were ever identical, and once presented an image was removed from the pool for that participant's session.

RESULTS

117 participants took part: 55 were radiologists (82% board certified, 60% specialised in breast radiology). The remaining 62 were non-radiologists. Chi-square goodness-of-fit test with the null hypothesis being that our observations were drawn from a binomial distribution with success probability $n = 0.5$ gave a p-value of 0.999, which indicates failure to reject the null hypothesis at any significance level for all participant groups. Radiologists had a slightly wider distribution spread, but no significant increase in performance compared to non-radiologists.

CONCLUSION

The spectrum of correct identification rate for real images from the GAN-derived/real image pairs approximated to a normal distribution for all sub-groups (all participants, radiologists and non-radiologists) indicating that participants were effectively random in their choice. This suggests that GAN-derived synthetic mammography images are perceived to be as realistic as, and therefore indistinguishable from, real mammography images.

CLINICAL RELEVANCE/APPLICATION

GAN-derived medical images are indistinguishable from real ones. Further research is required to assess whether these can be used to augment training/validation datasets for machine learning tasks.

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BR267-SD-TUA6

Weakly-Supervised Deep-Learning Modeling on Sub-Volumes for Pre-Assessment of Digital Breast Tomosynthesis

Tuesday, Dec. 3 12:15PM - 12:45PM Room: BR Community, Learning Center Station #6

Participants
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Wendie A. Berg, MD, PhD, Gibsonia, PA (*Abstract Co-Author*) Nothing to Disclose
Shandong Wu, PhD, MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Digital breast tomosynthesis (DBT) is a quasi-3D imaging modality which can increase cancer detection and reduce false recalls. It, however, entails a much larger volume of imaging data to read, decreasing the time-efficiency of radiologists. In this study, we leverage a weakly supervised approach to build deep learning models to improve radiologists' reading, where the model performs a pre-reading to DBTs to identify potential examinations that are more likely to have malignancy or be breast cancer free.

METHOD AND MATERIALS

This retrospective study includes 546 patients (205 malignant and 341 benign cases, all confirmed by pathology), each having a DBT acquired between 2017-2018 at the same institution. Considering the 3D nature of DBT and the varying length of slice numbers (ranging 31 to 111) per breast across the patients, we proposed a sub-volume (i.e., 11 consecutive slices)-based scheme for 3D-based classification. A total of 1005 and 1753 sub-volumes were generated from the malignant and benign cases, respectively, for multi-sub-volume-based analysis. No lesion segmentation/labeling was performed in any slices; instead, only a weak label of 'malignancy' or 'benign' was given to each sub-volume. We constructed 3D convolutional neural network models using the shallow VGG-19 to perform three binary-classification tasks: (1) malignant vs. all benign, (2) malignant vs. BI-RADS 2&3 benign (109 cases), and (3) malignant vs. BI-RADS 4a&4b&4c benign (168 cases). Patient-wise 10-fold validation was performed, using AUC and sensitivity/specificity to measure model performance.

RESULTS

Average AUC was 0.72 (range 0.70-0.74) when using all benign cases in task 1. For the sub-group analysis, we observe an increased AUC of 0.74 (range 0.72-0.77) in task 2 and a decreased AUC of 0.60 (range 0.50-0.69) in task 3. In particular, a high specificity (0.89) is observed for task 1 and high sensitivity (0.91) is observed for task 2. The ROC curves are given in the attached figure.

CONCLUSION

Without the need of lesion segmentation and labeling, our deep learning method can effectively identify potential concerning DBT scans of reader's interests (more likely to have malignancy or be normal).

CLINICAL RELEVANCE/APPLICATION

Volumetric deep learning models can be a helpful tool to pre-read DBT scans for radiologists, with the promise to optimize reading priority, shorten reading time, and reduce unnecessary biopsy.

CA163-ED-TUA7

Cardiovascular 4D Flow MRI: From Basic Principle to Emerging Clinical Application

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CA Community, Learning Center Station #7

Participants
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TEACHING POINTS

Cardiovascular 4D Flow MRI has been clinically available on most of commercial MRI. Though the flow dynamic assessment has gained attention as aa novel imaging biomarker, it is not widely distributed in the clinical setting because its physics, scan and analysis are complicated. We will present step-by-step guidance about basic principle, scan parameters, analysis technique and emerging clinical application.

TABLE OF CONTENTS/OUTLINE

1, Basic principle A. Bipolar gradient and phase image B. Sampling scheme C. Cardiac gating D. Respiratory gating 2. Scan technique A. Basic parameters; voxel size, flip angle, VENC, heart phase, k-space segmentation B. Acceleration techniques; parallel imaging, view sharing, k-t undersampling, compressed sensing C. Multi-VENC scan 3. Analysis A. Pre-processing B. Velocity and flow volume measurement C. Flow direction assessment using streamline and pathline D. Wall shear stress calculation E. Energy loss estimation by calculating viscous energy loss and turbulent kinetic energy 4. Target diseases A. Valvular diseases B. Hypertrophic cardiomyopathy C. Aortic dissection D. Aortic aneurysm

CA164-ED-TUA8

Understanding Care and Challenges of Left Ventricular Assist Devices (LVADs)

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CA Community, Learning Center Station #8

Participants
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Nagaraj-Setty Holalkere, MD, Boston, MA (*Abstract Co-Author*) Founder and CEO, Imaginglink Inc

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TEACHING POINTS

This exhibit will provide a framework for evaluating LVADs by CT, with an emphasis on several complications that may occur during LVAD therapy. Some clinical management of LVADs will be reviewed to provide perspective. Teaching points include: normal LVAD orientation, and mechanical, bleeding, and infection complications.

TABLE OF CONTENTS/OUTLINE

1. LVAD Introduction. 2. Normal appearance of HeartMate II and HeartWare devices. 3. Pump thrombosis and mechanical complications. 4. Infectious complications. 5. Bleeding complication.

Printed on: 10/29/20

CA212-SD-TUA1

T1 and T2 Mapping Cardiovascular Magnetic Resonance to Predict Left Ventricular Remodeling Following an Acute Myocardial Infarction

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CA Community, Learning Center Station #1

Participants
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PURPOSE

Quantitative tissue characterization by novel T1 and T2 Mapping CMR techniques could provide incremental information to predict left ventricular (LV) remodeling after an acute myocardial infarction (AMI). We investigated the clinical utility of an approach using novel Mapping techniques in comparison to standard CMR techniques to predict LV remodeling.

METHOD AND MATERIALS

Seventy-four patients with first-time reperfused AMI were enrolled. T2w, T2, T1 mapping and late gadolinium enhancement (LGE) CMR were obtained at 8 ±5 days after AMI (baseline). Cine SSFP sequences were used to determine LV remodeling at baseline and 6 months after infarction. Parametric CMR acquisitions were performed on end-diastolic LV short-axes. Myocardial T2 relaxation times were quantified using a free-breathing, navigator-gated multiecho sequence. Myocardial T1 relaxation times were measured using the modified Look-Locker inversion recovery sequence before and after administration of 0.075 mmol/kg gadobenate dimeglumine. T2, T1, and ECV maps were generated using a plug-in for OsiriX software (Pixmeo, Bernex, Switzerland). Regions of interest were placed in the infarcted areas using LGE as a reference standard.

RESULTS

A total of 11 patients (15%) developed LV remodeling following AMI. ECV and infarct size had the best predictive performance to identify patients at risk of LV remodeling after an AMI with AUCs of 0.843 and 0.806, respectively. Infarct size was significantly better than native T1 with an AUC of 0.549 ($P<0.05$). T2 and edema size also showed good AUCs of 0.768 and 0.743, respectively. The optimal cut-off of >=57% for ECV provided a sensitivity and specificity of 86% and 85%, respectively. The optimal cut-off of >=17.2 %LV for infarct size provided a sensitivity and specificity of 82% and 76%, respectively. The optimal cut-offs for the other CMR parameters were: >=88ms for T2, edema size >=27 %LV and >=1236ms for native T1.

CONCLUSION

ECV and infarct size determined by LGE CMR in the early phase of AMI are the best predictors for the development of LV remodeling within a follow-up period of 6 months and show a better discriminatory performance than non-contrast standard and parametric mapping techniques.

CLINICAL RELEVANCE/APPLICATION

Major clinical application would be stratification of patients with AMI, who are at risk for the development of LV remodeling, enabling a timely anti-remodeling therapy.

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CA213-SD-TUA2

Prognostic Value of Coronary Artery Disease-Reporting and Data System (CAD-RADS) Score for Major Adverse Cardiac Events in Patient with Acute Chest Pain from the Emergency Department

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CA Community, Learning Center Station #2

Participants
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PURPOSE

The coronary artery disease-reporting and data system (CAD-RADS) was recently developed to standardize coronary artery disease (CAD) classification and incorporate clinical management. However, there is no data regarding the prognostic value of CAD-RADS for emergency department (ED) patients. The aim of this study was to determine prognostic performance of the CAD-RADS score in comparison with that of the traditional CAD classification for predicting major adverse cardiac events (MACE) in patients presented in the ED with acute chest pain.

METHOD AND MATERIALS

From January 2010 to December 2016, 779 patients with acute chest pain at low to intermediate risk for CAD underwent cardiac computed tomography angiography (CCTA). The CAD-RADS scores and CAD extent classification were used to evaluate the CCTA images. The primary end point was MACE such as cardiovascular death, myocardial infarction, angina requiring hospitalization and revascularization. For the assessments of the prognostic value of CAD-RADS in the study group, we developed the following models: model 1, clinical risk factors; model 2, clinical risk factors plus the CAD-RADS classification; and model 3, clinical risk factors plus the CAD extent classification. The C-index was calculated to predict the prognostic power of each model.

RESULTS

Of the 779 patients (47.3%, male; mean age, 55.8 years ± 14.5), 82 patients (10.5%) experienced MACE with 2.06 years of median follow-up period. There were 55.8% of patients classified as CAD-RADS 0, 14.2% as CAD-RADS 1, 14.5% as CAD-RADS 2, 7.4% as CAD-RADS 3, 5.5% as CAD-RADS 4A, 0.5% as CAD-RADS 4B and 2.1% as CAD-RADS 5. The CAD-RADS scores and CAD extent classification independently stratified the risk of future MACEs (all $p<0.05$). The C-statistics revealed that both the CAD-RADS scores and CAD extent classification improved the risk stratification beyond the clinical risk factors (C-index: 0.907 vs 0.805, and 0.898 vs 0.805, respectively, all $p<0.001$).

CONCLUSION

The CAD-RADS score had prognostic value for future MACE compared to the traditional CAD classification and better risk discrimination compared with clinical risk factors alone in ED patients with acute chest pain.

CLINICAL RELEVANCE/APPLICATION

The CAD-RADS score can be used as an independent risk predictor for future MACE in patients presented in ED with acute chest pain at low to intermediate risk for CAD.

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CA246-SD-TUA5

Right Ventricular Deformation Impairment Persists in Different Stages of Experimental Autoimmune Myocarditis in Rats - Assessed by Cardiac Magnetic Resonance Tissue Tracking

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CA Community, Learning Center Station #5

Participants
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PURPOSE

Myocarditis is an inflammatory disease of the myocardium, which is associated with adverse cardiac outcomes. Right ventricular (RV) impairment and dysfunction in myocarditis is rarely reported. Using experimental autoimmune myocarditis (EAM) rat model, the aim of present study was to investigate whether RV myocardial deformation impaired before the onset, the acute and chronic stages of myocarditis.

METHOD AND MATERIALS

Male Lewis rats were immunized with 0.1mg porcine myocardial myosin into the footpads on day 0 and day 7,respectively. 7.0 T preclinical cardiac magnetic resonance (CMR) examinations were performed on day 0 (n=25) before immunization, and on days 14 (n=20), 21 (n=15), 35 (n=10) after EAM induction. RV global radial strain (GRS), global circumferential strain (GCS), global longitudinal strain (GLS) were measured by CMR tissue tracking (CMR-TT). At least 5 rats were randomly sacrificed for pathological investigation at each of the indicated time points.

RESULTS

RV function was impaired over the course of myocarditis. GRS were 50.93±11.86%, 38.46±11.84%, 32.58±12.13%, 33.55±6.84% on day 0,14,21,35,respectively. GCS were -22.89±3.03%, -18,97±3.82%, -15.95±5.01% ,-17.40±2.03% on days 0,14,21,35,respectively. GLS were -21.83±2.59%, -18.77±3.97%, -12.12±4.19%, -18.36±2.24% on days 0,14,21,35, respectively. There were significantly differences in GRS,GCS,GLS values on day 0 compared with each time point after EAM induction (all $P<0.001$). GLS was statistically different on day 21 compared with other time points (all $P<0.001$). All deformation parameters were poorest on day 21, subsequently,functional recovery being found on day 35, but still inferior to day 0. Immunized rats with histopathological examination showed that biventricular wall thickness increased, myocardium necrosis and inflammatory infiltration.

CONCLUSION

This study demonstrated that RV deformation variously impaired in different phases of myocarditis. Assessment of RV strain may not only noninvasively distinguish between healthy myocardium and myocarditis, but discriminate the acute stage from other stages of the disease. RV deformation function evaluation should be conventionally applied in myocarditis diagnosis and follow-up.

CLINICAL RELEVANCE/APPLICATION

RV strain analysis allowed to assess the severity and monitor the course of myocarditis in a preclinical model,providing the opportunity for further research of the disease and assessing novel therapy

CA248-SD-TUA4

Imaging of Coronary Plaques and Stents with Conventional and Photon-Counting CT

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CA Community, Learning Center Station #4

Participants
Jayasai R. Rajagopal, BA, Durham, NC (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate the potential for photon-counting CT (PCCT) to improve visualization of coronary plaques with and without stents

METHOD AND MATERIALS

A prototype scanner (Siemens, Germany) with photon-counting and conventional (EID) CT subsystems was used to image a coronary artery phantom containing cylindrical probes that simulate different plaque compositions (fatty, fibro-fatty, calcified) and stenosis (15-75%). The phantom was imaged with and without coronary stents placed over the probes. Images were acquired and reconstructed with a dose matched clinical protocol. PCCT images were also reconstructed with a high-resolution photon-counting kernel. Regions of interest (ROIs) were drawn around probes in both unstented and stented cases and mean intensity images were generated. An automated region growing algorithm was used to segment ROIs which were then evaluated for object diameter, local contrast-to-noise ratio (CNR), and object circularity.

RESULTS

Visually, EID and PCCT images reconstructed with the clinical protocol were comparable, while high-resolution PCCT images showed less beam hardening artifact and clearer resolution of internal plaque structures. Compared to the nonstented cases, measured diameter increased in stented images by 24.9%, 22.4%, and 17.0% for EID, PCCT, and high-resolution PCCT respectively. Local CNR increased in stented images by 67.3%, 72.7%, and 102.9% for the same order. Circularity increased for stented images by 5.7%, 5.4%, and 32.0%.

CONCLUSION

The presence of coronary stents lead to beam hardening artifact and an increase in segmented diameter, circularity, and local CNR. High-resolution PCCT images showed less artifact and better preservation of plaque shape and size.

CLINICAL RELEVANCE/APPLICATION

High-resolution photon-counting CT images can improve visualization and characterization of coronary plaque, even in the presence of coronary stents.

CH225-ED-TUA8

Lung Cysts: Uncommon and Rare Etiologies with Clinical and Pathological Correlation

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CH Community, Learning Center Station #8

Participants
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TEACHING POINTS

• A pulmonary cyst is a parenchymal air lucency with a wall of variable thickness and well-defined interface with the surrounding lung. • Lymphangioleiomyomatosis, pulmonary Langerhans cell histiocytosis, lymphoid interstitial pneumonia (LIP) are a classic differential diagnosis of cystic lung disease. • Emphysema, bronchiectasis, honeycombing, and pulmonary cavities are common mimics of cystic lung disease. • Lung cysts can be a manifestation of a rare disease such emphysema with placental transmogrification and Birt-Hogg-Dubé syndrome; or an uncommon manifestation of other diseases such neurofibromatosis type 2, amyloidosis, light chain deposition disease, and Ehlers-Danlos syndromes.

TABLE OF CONTENTS/OUTLINE

• Birt-Hogg-Dubé syndrome: Chest CT findings and photographs of skin manifestation. • Light chain deposition disease: Chest CT and pathology findings. • Emphysema with placental transmogrification: Radiographic, chest CT, and pathology findings • Ehlers-Danlos syndromes: Chest CT findings. • Neurofibromatosis type 1: Chest CT findings with additional radiological diagnostics clues. • Amyloidosis: imaging findings. • A table summarizing the clinical and imaging features of the presented rare and uncommon cystic lung disease.

CH226-ED-TUA7

Precision Cancer Therapies in Lung Cancer: Current Status and Role of the Image

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CH Community, Learning Center Station #7

Participants
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TEACHING POINTS

Recent advances in understanding the molecular mechanisms of cancer have opened a new era of precision medicine for cancer treatment, especially in lung cancer. Precision cancer therapies target specific molecules that are responsible for cancer development and progression, and they achieve marked treatment benefits in specific cohorts of patients. However, these therapies are also associated with a different response criteria and variety of complications that are often unique to specific groups of anticancer agents. The purpose of essay is to review, list, explain and demonstrating the variety of responses and adverse events related about the precision cancer therapies in lung cancer, with which the radiologist should be familiar.

TABLE OF CONTENTS/OUTLINE

The objectives: • Brief overview of new oncology drugs in lung cancer: targeted drugs and immunotherapy • Key points of response patterns according iRECIST • Examples and discussion of events related to new oncologic treatments, including clinical and imaging findings Imaging findings: • Treatment response patterns according iRECIST - partial response, complete response, stable disease, unconfirmed progression and confirmed progression • Targeted-related adverse events • Immune-related adverse events

CH227-ED-TUA6

Cardiopulmonary Physiology in the ICU: Understanding Commonly Monitored Parameters with Illustrative Cases and Radiographic Findings

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CH Community, Learning Center Station #6

Awards
Cum Laude

Participants
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TEACHING POINTS

Educate the radiologist on commonly monitored hemodynamic and pulmonary parameters in the ICU to promote shared understanding with clinicians. Educate the radiologist on the abnormal cardiopulmonary physiology of ICU patients to promote the informative reporting of bedside chest radiographs.

TABLE OF CONTENTS/OUTLINE

Cardiopulmonary physiology for the radiologist:Starling Equation (hydrostatic lung edema)Campbell Diagram (ARDS and COPD)Frank Starling Curve & Guyton Analysis (heart-lung interactions)West-Zone Physiology (COPD and PAC placement)Invasive hemodynamic monitoring devices, and basic interpretation of commonly monitored cardiopulmonary parameters:Devices: Pulmonary arterial catheter (PAC), central venous catheterHemodynamic parameters: central venous pressure, pulmonary arterial pressure, wedge pressure, cardiac output, pulmonary vascular resistance, systolic vascular resistancePulmonary parameters: mean airway pressure, positive end-expiratory pressure, SpO2, PaO2/FiO2Commonly encountered cardiopulmonary pathophysiology in the ICU and correlative radiographic findings: Cardiogenic Shock Urosepsis and extra-pulmonary ARDSRespiratory failure from influenza and pulmonary ARDSIatrogenic hypervolemic pulmonary edemaRespiratory failure from massive pulmonary embolismRespiratory failure from COPD exacerbation

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CH254-SD-TUA1

Improving Image Quality of Bronchial Arteries with the Combination of Low Energy Images in Dual-Energy Spectral CT and Adaptive Statistical Iterative Reconstruction Improving Image Quality of Bronchial Arteries with the Combination of Low Energy

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CH Community, Learning Center Station #1

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PURPOSE

To evaluate the application value of combining low energy images in dual-energy spectral CT with a new adaptive statistical iterative reconstruction (ASIR-V) to improve the image quality of bronchial arteries.

METHOD AND MATERIALS

We retrospectively analyzed patient images in contrast-enhanced CT scans using dual-energy spectral imaging mode. The monochromatic images in the 40-70 keV energy range (every 10keV) and reconstructed with the combination of ASIR-V with weightings of 40%, 60%and80%were analyzed. A circular region-of-interest (ROI) with 2.8 mm2 was placed at the center of bronchial artery, and on the vertical muscle as background to measure CT value and standard deviation and to calculate signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) for the artery, set as group B, group A as the control group (system default 120Kvp-like single energy group) of labyrinthine artery for objective evaluation ,Two radiologists Use 5 points also evaluated the subjective score in terms of the sharpness and clarity of displaying bronchial arteries and their branches. The data collected were analyzed statistically and subjective scores were checked for consistency.

RESULTS

With the decrease of single energy, the CT value and noise of the bronchial arteries increased. Joint ASIR-V effectively reduced the image noise and increased the CNR and SNR group weights. 80% ASIR-V combined with 40kev BA (CT: 1385.75±317.79; CNR: 145.51±111.9; SNR: 43.76±34.97) was superior to 120Kvp-like combined with 40% ASIR-V BA (CT: 416.55±91.285; CNR: 43.93± 27.79; SNR: 28.14±19.28), P-value <0.05; Subjective image quality reached a maximum at 40 keV, 50 keV combined with 80% ASIR-V binding.

CONCLUSION

The 40kev dual-energy spectroscopy combined with 80% ASIR-V monochromatic images on subjective and objective scores increases the contrast between the bronchial arteries and the surrounding tissue to optimize the image quality of the bronchial arteries.

CLINICAL RELEVANCE/APPLICATION

The 40kev dual-energy spectroscopy combined with 80% ASIR-V monochromatic images can show the length, number, origin, branching, shape, diameter and wall condition of the bronchial artery. The clinical treatment of various lung diseases and the evaluation of their efficacy provide helpful help.

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CH255-SD-TUA2

The Value of Intravoxel Incoherent Motion Diffusion-Weighted Imaging in Predicting the Pathologic Response to Neoadjuvant Chemotherapy in Locally Advanced Esophageal Squamous Cell Carcinoma

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CH Community, Learning Center Station #2

Participants
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PURPOSE

To explore the value of intravoxel incoherent motion diffusion-weighted imaging (IVIM-DWI) for the prediction of pathologic response to neoadjuvant chemotherapy (NAC) in locally advanced esophageal squamous cell carcinoma (ESCC).

METHOD AND MATERIALS

Forty locally advanced ESCC patients treated with NAC followed by radical resection were prospectively enrolled from September 2015 to May 2018. MRI and IVIM were recommended to be performed within one week before and 2-3 weeks after NAC, prior to surgery. The calculated apparent diffusion coefficient (ADC), diffusion coefficient (D), perfusion coefficient (D*) and perfusion score (f) pre- and post- NAC, the definite changes (ΔADC, ΔD, ΔD*, Δf) were analyzed for the efficacy of predicting pathologic response to NAC. The pathologic response was evaluated according to the AJCC (7th edition)-tumor regression grade (TRG) system.

RESULTS

Twenty-two patients were identified as TRG2 (responders), 18 as TRG3 (non-responders) in pathologic evaluation. No patients were identified as TRG0 or TRG1. The ADC (1.97±0.50 vs 2.51±0.49 ×10-3 mm2/s, P<0.01), D(1.28(1.10, 1.41) vs 1.77(1.45, 1.92)×10-3 mm2/s, P<0.01) and f values (0.34±0.14 vs 0.40±0.15, P<0.05) were significantly increased after NAC. Post-NAC D (1.82±0.27 vs 1.52±0.39 ×10-3 mm2/s, P <0.01) and ΔD values (0.65 (0.35, 0.82) vs 0.25(-0.08,0.31)×10-3 mm2/s, P<0.01) were significantly higher in patients with responders compared with non-responders. Receiver operating characteristic (ROC) curve analysis was performed to determine the best cut-off value for prediction of pathologic response. With an area under curve (AUC) of 0.722, post-NAC D exhibited a specificity 66.7 %, a sensitivity of 77.3%, when 1.685 ×10-3 mm2/s was used as the cut-off value. With a cut-off value for ΔD above 0.350 ×10-3 mm2/s, responders may be detected with a specificity of 83.8 % and a sensitivity of 77.3 % (AUC=0.859).

CONCLUSION

IVIM-DWI can be used as a new imaging modality to assess and predict the pathologic response to NAC in locally advanced ESCC, among which the post-NAC D and ΔD were reliable predictors. High post-NAC D and ΔD indicated a good response.

CLINICAL RELEVANCE/APPLICATION

This study may help to discriminate responders from non-responders at an early stage of neoadjuvant therapy, for the sake of individualizing the following treatments.

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CH256-SD-TUA3

Lung Cancer Screening in an Underserved Asian American Population

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CH Community, Learning Center Station #3

Participants
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PURPOSE

To describe the preliminary results of our clinical low-dose CT (LDCT) lung cancer screening program targeting an underserved, high-risk, Asian American population different from that studied in the National Lung Screening Trial (NLST).

METHOD AND MATERIALS

Candidates were recruited from a community clinic with an underserved Korean American population, as well as media outreach on Korean radio stations. All participants met USPSTF and/or NCCN eligibility criteria for lung cancer screening. Bilingual screening coordinators enrolled eligible individuals, scheduled their screening exams, and organized their transportation to and from the medical center.

RESULTS

342 Korean American patients were referred to the program from 8/20/2016 through 3/8/2019. 315 patients met eligibility criteria for lung cancer screening, and 270 patients underwent baseline LDCT. 239 males (89%) and 31 females (11%) received baseline LDCT, with a mean age of 61 years (range 50-80). Median pack-years was 38.5 (range 20-165), and 69% (185) of patients were current smokers. 15% (40) of patients reported occupational exposure to one or more lung carcinogens. 85% (229) of scanned patients received a Lung-RADS score of 1 (65) or 2 (164), 9% (24) received a score of 3, 3% (9) a score of 4A, 2% a score of 4B (6), and 1% a score of 4X (2). 3 patients (1%) have been diagnosed with lung cancer to date, 2 adenocarcinomas and 1 squamous cell carcinoma. 27% (73) of scanned patients had potentially clinically significant incidental findings, including moderate-severe coronary calcifications (28), extrapulmonary masses (16), aortic aneurysm (12), severe emphysema (13), and interstitial lung disease (6).

CONCLUSION

Lung cancer screening with LDCT in an underserved Korean American population yields similar results as screening in the NLST population. However, the prevalence of potentially significant incidental findings in our population is greater than in the NLST. More follow-up time is required to determine whether the reduction in mortality demonstrated in the NLST applies to this under-studied population.

CLINICAL RELEVANCE/APPLICATION

Underserved Asian Americans may similarly benefit from LDCT lung cancer screening, with the potential added value of detecting clinically significant incidental findings.

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CH284-SD-TUA4

The Diagnostic Value of Pulmonary Embolism (PE) Using Iodine-Based Material Decomposition Images with a 16cm Wide-Detector Dual-Energy Spectral CT

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CH Community, Learning Center Station #4

Participants
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PURPOSE

The aim of this study was to investigate the clinical value of iodine-based material decomposition images to diagnose pulmonary embolism (PE) from a 16cm wide-detector dual-energy spectral CT.

METHOD AND MATERIALS

Fifty patients with suspected PE underwent CT pulmonary angiography (CTPA) with a dual-energy spectral CT. 100kVp-like CTPA images and iodine-based material decomposition images were obtained from its spectral mode. The iodine content of normal lung perfusion area, abnormal lung perfusion area, and embolic lung artery area were measured. The difference of iodine content in acute and chronic pulmonary embolism group were compared and the diagnostic performance of iodine content was evaluated.

RESULTS

14 patients of 50 with PE were diagnosed by CTPA. 9 patients of 14 with PE were diagnosed acute PE and 5 were chronic PE. 50 clots were detected including lobar (n=18), segmental (n=24) and sub-segmental (n=8). The abnormal lung perfusion area were found in 38 of 50 clots. The average iodine content of abnormal lung perfusion area and normal lung perfusion area were (7.78±1.10)μg /cm3 and (23.46±9.38)μg /cm3, respectively. Compared with normal lung perfusion area, notably lower iodine content of abnormal lung perfusion area were observed in PE ($P<0.05$). The average iodine content of abnormal lung perfusion area were (6.91±1.51)μg /cm3 in acute PE group and (7.88±0.85) μg /cm3 in chronic PE group, and embolic lung artery area were (2.61±0.94)μg /cm3 in acute PE group and (2.79±0.72)μg /cm3 in chronic PE group. There were no significant differences among the two groups (All $P>0.05$). The ROC curve analysis indicated that the cutoff of iodine content of abnormal lung perfusion area had the best diagnostic performance for PE at 8.70 μg /cm3, and the corresponding areas under curve (AUC), sensitivity, and specificity were 0.868, 81.6% and 79.3%, respectively.

CONCLUSION

The iodine-based material decomposition images generated from a 16cm wide-detector dual-energy spectral CT could be used as a feasible tool to detect the presence of PE with good diagnostic performance. The difference of iodine content in pulmonary perfusion area can not distinguish acute from chronic pulmonary embolism.

CLINICAL RELEVANCE/APPLICATION

The iodine-based material decomposition images generated from a 16cm wide-detector dual-energy spectral CT could be used as a feasible tool to detect the presence of PE with good diagnostic performance

CH285-SD-TUA5

Tumor Invasiveness and Malignant Prediction in GGO Lung Nodules Using Deep Learning Methods

Tuesday, Dec. 3 12:15PM - 12:45PM Room: CH Community, Learning Center Station #5

Participants
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PURPOSE

To investigate the application of deep learning methods in distinguishing the invasiveness and malignancy of Ground Glass Opacity (GGO) nodules.

METHOD AND MATERIALS

759 patients underwent lung CT scan between August, 2016 and December, 2018, are enrolled in a retrospective study with IRB approval and written consent waived, including 27 Atypical Adenomatous Hyperplasia (AAH), 221 Adenocarcinoma in situ (AIS), 231 Minimal Invasive Adenocarcinoma (MIA) and 280 Invasive Adenocarcinoma (IA). All nodules have been confirmed by pathology. Those patients were randomly split into training, validation and testing sets, with a ratio of 3:1:1, or 455, 152 and 152 respectively. Invasiveness are classified using deep learning into 3 classes of AAH+AIS, MIA and IA, respectively. Differentiation of benign and malignant GGO are also performed using deep learning, with AAH/AIS/MIA considered as benign, and IA as malignant. The deep learning model uses a 34-layer convolution network, with dense connected 3D convolutional Blocks in a FCN structure. The center 2x2x2 voxels of each channel from the last convolutional layer output were averaged, indicating the likelihood of each class. In the invasiveness classification task, the output channel is 3 for AAH+AIS, MIA and IA; While in malignant differentiation task, the output channel is 2 for either benign or malignant(Fig 1). Cross entropy loss is used for classification. An exponentially LR scheduler is used as the optimization function.

RESULTS

In invasiveness stratification, an accuracy of 0.649 is achieved, with mcc of 0.47, weighted F1 of 0.650, recall of 0.65 and precision of 0.65. The confusion matrix of different invasiveness level is shown in Fig 2. In the task of benign malignant differentiation, an AUC of 0.8851 is achieved, with a sensitivity of 0.82, and specificity of 0.83. The AUC curve is shown in Fig 3.

CONCLUSION

In this work, we proposed a deep learning network for classification of tumor invasiveness of GGO nodules, which achieves state of art in the invasiveness classification of GGO. The same model is also trained and tested in malignant nodule differentiations, which achieves an AUC of 0.8851.

CLINICAL RELEVANCE/APPLICATION

Besides nodule detection, deep learning is also qualified to diagnosis lung nodule malignancy and invasiveness even in the challenging GGO nodule classification.

ER161-ED-TUA6

Twenty Known and Emerging DECT Applications in Emergency Neuroradiology

Tuesday, Dec. 3 12:15PM - 12:45PM Room: ER Community, Learning Center Station #6

Participants
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Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

TEACHING POINTS

1. To highlight the applications of dual energy CT (DECT) in improving evaluation of different conditions affecting the brain, head and neck and spine. 2. To show how dual energy CT analysis works as a problem solving tool in various neurological emergencies.

TABLE OF CONTENTS/OUTLINE

DECT concepts Brain: Iodine staining vs hemorrhage, tumoral vs non tumoral hemorrhage, acute hemorrhage vs calcifications, enhancement within hematomas, SAH on CTA, metal artifact reduction in aneurysm clips, calcium subtraction to delineate aneurysm, bone subtraction to delineate extra-axial masses and collections, clot evaluation, enhancing subdural effusions Neck: calcium subtraction to delineate stenosis, soft tissue evaluation, foreign bodies/devices, vascular injuries Spine: Marrow abnormalities, vertebral fractures, arthritis including gout, epidural invasion by paraspinal tumors, disc evaluation, hardware complications Summary and future directions

ER166-ED-TUA7

Review of Non-Traumatic Renal Emergency Conditions

Tuesday, Dec. 3 12:15PM - 12:45PM Room: ER Community, Learning Center Station #7

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TEACHING POINTS

1. Review renal anatomy and retroperitoneal boundaries 2. Understand and differentiate non-traumatic emergent conditions which may or may not require immediate medical/surgical intervention 3. Discuss diagnostic pearls and common pitfalls in diagnosing non-traumatic emergent renal conditions on MDCT

TABLE OF CONTENTS/OUTLINE

Epidemiology of renal emergencies Annual health care costs of non-traumatic renal emergencies Associated comorbidities with most common non-traumatic renal emergencies Anatomy Retroperitoneal anatomy, boundaries General renal anatomy Etiologies and symptomatology of non-traumatic renal emergencies Infectious Acute/chronic pyelonephritis Emphysematous pyelonephritis vs pyelitis Renal Abscess Xanthogranulomatous Pyelonephritis Obstructive Staghorn calculi Nephrolithiasis Calyceal rupture Vascular Renal vein thrombosis Infarction Spontaneous hemorrhage Post Procedural Pseudoaneurysm Dissection Hematoma Urinoma Perinephric abscess Diagnostic pearls and pitfalls Take home points

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ER210-SD-TUA1

Optic Nerve Sheath Diameter Measurement for Predicting Raised Intracranial Pressure in Patients with Traumatic Brain Injury: A Meta-Analysis

Tuesday, Dec. 3 12:15PM - 12:45PM Room: ER Community, Learning Center Station #1

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PURPOSE

The aim of this meta-analysis was to evaluate the diagnostic feasibility of measurement of the optic nerve sheath diameter (ONSD), via brain computed tomography (CT) or ocular ultrasonography (US), for the prediction of raised intracranial pressure (ICP) in patients with traumatic brain injury (TBI).

METHOD AND MATERIALS

The PubMed and EMBASE databases were searched for studies assessing the diagnostic accuracy of brain CT or ocular US for predicting raised ICP. Bivariate and hierarchical summary receiver-operating-characteristic (HSROC) modeling were performed to evaluate the diagnostic feasibility of measuring the ONSD in patients with TBI. We examined pooled diagnostic odds ratios (DORs) and performed a subgroup analysis to evaluate the diagnostic feasibility of measuring the ONSD in patients with severe TBI. Methodologic quality was assessed using the Quality Assessment of Diagnostic Accuracy Studies-2 tool. For heterogeneity exploration, we performed meta-regression analyses.

RESULTS

Twelve studies (1190 patients) were included. The ONSD had a pooled sensitivity of 0.90, pooled specificity of 0.86, and area under the HSROC curve of 0.94 for predicting raised ICP. Pooled DORs also indicated that the ONSD was informative for evaluating raised ICP (DOR, 56). The corresponding values in patients with severe TBI were 0.87, 0.81, and 0.90, respectively. Regarding meta-regression analysis, studies with ocular US tended to have a higher sensitivity and specificity than those with brain CT.

CONCLUSION

The ONSD may be a useful method for predicting raised ICP in patients with TBI.

CLINICAL RELEVANCE/APPLICATION

We recommend measuring the ONSD using ocular US, to more accurately diagnose raised ICP.

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ER211-SD-TUA2

Choosing Wisely: Imaging Recommendations Reduce Unnecessary Radiological Exams in an Emergency Department

Tuesday, Dec. 3 12:15PM - 12:45PM Room: ER Community, Learning Center Station #2

FDA Discussions may include off-label uses.

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PURPOSE

Alignment of radiological exams indication in the emergency department according to the Choosing WiselyR campaign. To promote awareness of the risks and benefits and rational use of radiological exams to health professionals and patients.

METHOD AND MATERIALS

A longitudinal study with prospective analyses, educational intervention in the emergency sector of a private hospital that has 100 thousand users, 8,500 adult and 6,500 pediatric monthly medical attendances. Choosing Wisely recommendations were applied to promote low risk patients supported by evidence: not duplicative tests, free from harm, truly necessary, engaging patients and doctors. In 2018 the program included internists (n=56) and pediatricians (n=52). In 2018, 3100 radiographs and 500 tomography are performed monthly. The 10 mostly common indications for radiological examinations and their protocols were reviewed. Justification of exams were supervised by another multispecialist medical team. Educational personalized activity, monthly analysis of percentages of radiological examinations and medical attendances, virtual education training based on Choosing WiselyR campaign were done.

RESULTS

In 2018, there was a reduction of 11.1% in requested radiological exams per attendance in adult and pediatric emergency department compared to the past two years. The most requested radiographies were chest (41.1%); paranasal sinus (17.5%) and abdomen (5.1%). Computed tomography of brain (45.1%); abdomen (30.8%) and thorax (5.5%). A high number of exams were identified in the age group 0 to 4 years. The main clinical indications were: abdominal pain (23.3%); headache (12.8%); paranasal sinus diseases (11.2%); low back pain (9.2%); chest pain (5.6%, dyspnea (5.6%), and urinary complaints (5.3%). Ten flowcharts protocols were implemented and continual educational strategies applied.

CONCLUSION

Justification and directed training with validated protocols allowed improvement in quality and patient safety. The Choosing WiselyR Campaign can be applied in emergency sectors promoting benefits to patients, physicians and institution, using specialist medical societies and international consensus.

CLINICAL RELEVANCE/APPLICATION

Choosing Wisely recommendations applied in emergency department can improve quality and safety of patient care, promote correct diagnosis and reduce radiation exposure.

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ER212-SD-TUA3

Availability of the High-Pitch Helical Scan Using Dual-Source CT in Aortic Disease: ECG-Gated is No Longer Needed

Tuesday, Dec. 3 12:15PM - 12:45PM Room: ER Community, Learning Center Station #3

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PURPOSE

In the CTA examination aimed at aortic dissection and the like, ECG-gated scan is regarded as a golden standard.However, ECG-gated scan has the disadvantage that the scanning time is long and the exposure dose is large.In this study, we evaluate the feasibility of non-ECG-Gated scan by turbo flash scan using dual source CT.

METHOD AND MATERIALS

We compared the motion artifacts of each part with 50 patients who had turbo flash scan in the past and 50 patients who performed ECG-Gated scan.(Age55.4±16.7, BMI22.6±3.9 vs Age56.3±16.2, BMI22.1±2.9)Measurement sites were the ascending aorta, thoracic descending aorta, and abdominal descending aorta.The image quality scores were defined as 1 (excellent), 2 (good), 3 (adequate), and 4 (poor).The examination was conducted by 10 radiological technologists, 2 radiologists, and 2 cardiovascular surgeons.In addition, standard deviation (SD), and Dose-Length Product(DLP)were compared between the two groups.We also compared and studied MTF, SSPz, windmill artifacts between the two groups using a phantom.We evaluated the case where turbo flash scan was not suitable and devised the countermeasure.

RESULTS

Mean heart rate during scanning was 71.8±13.6 bpm in ECG-Gated scan and 72.2±13.2 bpm in turbo flash scan.(P=0.950)No significant differences were observed in the quality score between ECG-Gated scan and turbo flash scan.(1.16±0.15 vs 1.25±0.2 : p=0.633) DLP was significantly lower in the turbo flash group.(1730±41.3 vs 523±46.8 : p<0.0001)The MTF, SSPz and windmill artifact were not significantly different between the two groups.

CONCLUSION

Turbo flash scan showed no significant difference in image quality and diagnostic accuracy compared to ECG-Gated scan.

CLINICAL RELEVANCE/APPLICATION

With turbo flash scan, it is possible to make an equivalent diagnosis with an exposure dose of about 30% compared to ECG-Gated scan.

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ER234-SD-TUA4

Deep Learning-Based Computer Aided Diagnostic System Reduces Reading Time and Occupational Fatigue of Radiologists in Thoracic Fracture

Tuesday, Dec. 3 12:15PM - 12:45PM Room: ER Community, Learning Center Station #4

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PURPOSE

To explore the potential of deep learning-based computer aided diagnostic system (DL-CAD) in reducing reading time and occupational fatigue of radiologists.

METHOD AND MATERIALS

4 attending radiologists with more than 5 years of experience were equally divided into two groups: group A and group B to interpret chest CT images for thoracic fracture diagnosis with and without a DL-CAD system (InferRead CT Bone Research, Infervision, Beijing). All 103 cases with thoracic fractures were diagnosed by each radiologist within seven hours. occupational fatigue index of each radiologist was assessed immediately after they completed the interpreting task with the improved Swedish Occupational Fatigue Scale which consisted of 5 evaluation indictors (lack of energy, physical consumption, physical discomfort, lack of motivation and sleepiness). The mean reading time for each patient of both groups were calculated. Two-samples t-test was used to examine the differences.

RESULTS

The mean reading time for group A and group B was 4.12±0.23 min and 2.13±0.17 min with significant difference ($P<0.05$). For the occupational fatigue assessment, there was a significant difference between group A and group B for all the 5 evaluation indictors.

CONCLUSION

DL-CAD reduces reading time and occupational fatigue of radiologists.

CLINICAL RELEVANCE/APPLICATION

It is recommended to use DL-CAD to accelerate clinical workflow and reduce occupational fatigue of radiologists in thoracic emergency.

ER235-SD-TUA5

Peritoneal Infarcts: Timing of CT Scan

Tuesday, Dec. 3 12:15PM - 12:45PM Room: ER Community, Learning Center Station #5

Participants
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PURPOSE

To assess the optimum time between the beginning of clinical symptoms and appearance of CT signs for diagnosing peritoneal infarcts

METHOD AND MATERIALS

This retrospective study was done on 91 adult patients with clinical suspicion of omental infarcts who underwent serial contrast enhanced MDCT, presenting to us over consecutive period of 3 years. These CT scans were done at the day of presentation and 3 days after the onset of symptomsand were reviewed by 2 Radiologists for presence or absence of any signs of peritoneal infarction, which included focal fat stranding, thrombosed central vessel and ill defined peritoneal collections.The results were interpreted as negative, which meant no sign of infarct, equivocal which meant one of the three signs being present and positive with more than above two signs seen. The diagnostic accuracy of initial scan with serial 3 day delayed scans were assessed and compared.The equivocal cases were considered as inconclusive and negative.

RESULTS

Out of 91 patients, 47 had omental infarcts. The sensitivity of initial CT scan in diagnosis of omental infarcts at Day 1 of presentation was 12.7%,whilst the sensitivity of a delayed scan done at Day 3 of presentation was 100%.The specificity of initial CT scan at Day 1 of presentation was 89.7%,whilst the specificity of a delayed scan done at Day 3 of presentation was 100%.The Positive predictive value of initial CT scan at Day 1 of presentation was 54.5%,whilst that of a delayed scan done at Day 3 of presentation was 99%.The Negative predictive value of initial CT scan at Day 1 of presentation was 48.7%,whilst that of a delayed scan done at Day 3 of presentation was 94.1%.

CONCLUSION

Patients with suspected peritoneal infarcts should be scanned at an optimum time interval of 72 hours after the onset of symptoms as initial scans done at day of presentation may be inconclusive and falsely negative.

CLINICAL RELEVANCE/APPLICATION

Peritoneal infarction is emerging as a common cause of acute abdomen with advances in cross sectional imaging. However, appropriate and delayed timing is essential for its accurate diagnosis.

GI295-ED-TUA12

Imaging in the Evaluation of Potential Living Donor for Liver Transplantation

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #12

Participants
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TEACHING POINTS

To describe the salient multimodality (US, CT and MRI) imaging findings in liver donors which allow for the identification of normal and abnormal anatomy pathological conditions which may preclude transplantation

TABLE OF CONTENTS/OUTLINE

- Delineate the range of indications for liver transplantation. - Outline the surgical technique in harvesting the donor liver. - Describe advantages of living donor liver transplantation. - Demonstrate multimodality imaging findings in the pre-operative assessment of a potential liver donor: Ultrasound is usually the first imaging modality for evaluation of potential donors because it can identify hepatic lesions, obtain important information on the anatomy of the great vessels, such as hepatic veins and portal system, and evaluate the presence of steatosis. CT is used for precise anatomic assessment of the hepatic artery, portal and hepatic veins, to accurately calculate volume of both liver lobes, to identify focal liver lesions and diffuse liver disease (steatosis, haemochromatosis) and to identify extrahepatic incidental findings. MR cholangiography is considered the primary imaging tool for biliary anatomy evaluation in potential living liver donors. MRI is also used to accurately calculate the presence of steatosis and to identify and characterize focal lesions.

GI296-ED-TUA13

Morison's Pouch: Anatomical Background, Pathologies, and Spread of Disease on Cross Sectional Imaging

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #13

Awards
Certificate of Merit

Participants
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TEACHING POINTS

1. Demonstrate the anatomical details and boundaries of the Morison's pouch. 2. List the various disease processes related to Morison's pouch and potential route of disease spread. 3. Discuss the spectrum of common and uncommon Morison's pouch related pathological processes. 4. Describe typical and atypical imaging features of these lesions with pathologic correlation 5. Illustrate a pattern recognition approach to help reach a specific diagnosis.

TABLE OF CONTENTS/OUTLINE

- Anatomical background of Morison's pouch. - Pathological background. - Pathway of disease spread. - Common and uncommon pathologies including: fluid collection (e.g. transudate in case of cirrhosis and ascites, exudate in case of inflammatory causes, hematoma in case of trauma), soft tissue infiltrations (e.g. inflammatory haziness of the fat planes and invasion of neoplastic lesions), and metastatic (e.g. peritoneal deposits). - Current surgical and non-surgical management options of these pathological entities. - Differential diagnoses and summary.

GI297-ED-TUA11

MRI Evaluation of Pathological Complete Response of Locally Advanced Rectal Cancer after Neoadjuvant Chemoradiation Therapy: Can We Wait and What Will We Watch?

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #11

Awards
Identified for RadioGraphics

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TEACHING POINTS

1. To describe the pathological complete response (pCR) of locally advanced rectal cancer(LARC) after Neoadjuvant Chemoradiation therapy, and the "watch-and-wait" strategy. 2. To describe the challenge and utilitys of MRI in evaluation of pCR in LARC. 3. To discuss the role of MRI in prediction of pCR, the planning of surgery and therapeutic protocols. 4. To discuss the future directions of MRI accurately evaluation of pCR in LARC.

TABLE OF CONTENTS/OUTLINE

1. Why and what kind of patients with locally advanced rectal cancer should be suggested a "watch-and-wait" strategy? 2. The necessity and challenges of accurately evaluating pCR. 3. MRI predictors that may be used to evaluate pCR after neoadjuvant chemoradiation therapy. 4. MRI predictors that may be used to predict pCR, and the benefits of early predicting pCR. 5. Combining the MRI predictors demonstrated accurately evaluating and predicting pCR. 6. Comparison between using MRI and pathological methods to evaluate pCR. 7. The limitation of current MRI method and future direction.

GI298-ED-TUA15

Abdominal Complications After Lung Transplantation

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #15

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TEACHING POINTS

1. To review the gastrointestinal complications after lung transplantation: incidence, type and management. 2. To learn important findings to detect these complications with abdominal CT and when to suspect them. 3. To emphasize the importance of detecting these potential complications early.

TABLE OF CONTENTS/OUTLINE

1. Introduction of lung transplantation and its abdominal complications. 2. Incidence of each type complication. 3. Types of complication: when it occur (early postoperative vs long-term morbidity) and its severity (minor and mayor): - Acute cholecystitis - Perforation and obstruction - Colitis (ischemic and infectious) -Others: symptomatic gastro-esophageal reflux disease, gastroparesis, peptic ulcer disease, pancreatitis (acalculous and probably related to immunosuppression), diverticulitis, hepatitis, appendicitis 4. CT findings and pitfalls. 5. Management and outcome of these patients.

GI300-ED-TUA14

Single-Energy CT Subtraction and Iodine Enhancement Map: Protocol and Abdominal Applications

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #14

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TEACHING POINTS

• Describe the protocol and image manipulation to perform a single energy CT subtraction and digital iodine enhancement map.• Show how CT subtraction and iodine enhancement map can aid radiologist to detect subtle lesions, whether there is enhancement within a lesion and how it may facilitate clinician image understanding.

TABLE OF CONTENTS/OUTLINE

• CT subtraction protocol.• CT iodine enhancement map protocol.• Cased based examples on how CT subtraction and iodine enhancement map can help radiologist:- Patient with liver metastasis of colonic adenocarcinoma showing how CT subtraction and iodine enhancement map can help radiologist and clinician in a single image stack to recognize which nodules still show enhancement after treatment.- Dubious pancreatic nodule on conventional CT images, better depicted on CT subtraction and iodine enhancement map, confirmed to be a nodule in endoscopic ultrasound and a biopsy proven adenocarcinoma.- Patient with small (1 cm) renal cortical hyperattenuating formation, undetermined in conventional CT images, that when analyzed on CT subtraction and iodine enhancement added concern to be solid. MRI confirmed to be a solid nodule with enhancement.• Discuss the perspectives for CT subtraction and iodine enhancement map application in routine.

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GI337-SD-TUA1

Automated Quantification of Hepatic Steatosis Using Deep Learning in Penn Medicine BioBank Patients

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #1

Awards
Trainee Research Prize - Medical Student

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PURPOSE

Non-alcoholic fatty liver disease (NAFLD) is the most common cause of chronic liver disease affecting one-third of the U.S. adult population. However, the pathogenesis of NAFLD is not well understood and there has been little progress applying precision medicine principles in part due to unknown associations between genetic markers and imaging phenotypes. We developed a fast, fully-automated pipeline to quantify hepatic fat from 25,936 abdominal CT studies and associated it with genetic and phenotypic markers in the Penn Medicine Biobank (PMBB).

METHOD AND MATERIALS

A convolutional neural network (CNN) was trained to segment the liver and spleen using training sets of 124 and 158 abdominal CT studies respectively. DICE coefficients between automatic and manual segmentations were computed on a testing set of 20 studies. Additionally, the CNN derived mean Hounsfield (HU) values were compared to those obtained by manually selecting regions of interest (ROIs). Utilizing cloud computing, these networks generated segmentations on 25,936 studies, representing 10,472 patients. NAFLD was assessed based on the differential attenuation between spleen and liver. A Phenome-Wide association study (PheWAS) was performed to investigate related phenotypes. Additionally, a genome-wide association study (GWAS) was conducted to identify potentially pathogenic single nucleotide polymorphisms.

RESULTS

When compared to manual segmentations, the CNN derived liver and spleen segmentations had DICE coefficients of 0.95 ± 0.02 and 0.92 ± 0.07 respectively. Pearson correlation coefficients of 0.992 and 0.976 were obtained when comparing mean HU between CNN and manually derived ROIs. All 25,936 PMBB studies were processed using cloud computing in less than 48 hours. Using these results, a PheWAS of NAFLD showed the strongest association with the phenotype of chronic nonalcoholic liver disease ($p=1e-27$) (Figure 1). Other significant associations include Type 2 Diabetes ($p=5e-16$) and obesity ($p=3e-13$). A GWAS of NAFLD showed significant associations with genes PNPLA3 and SAMM50.

CONCLUSION

Deep learning when applied to an EHR cohort for retrospective analysis provides an efficient and accurate way to quantify imaging phenotypes.

CLINICAL RELEVANCE/APPLICATION

Automatic quantification of liver fat from abdominal CT may identify genetic factors that predispose to elevated liver fat and allow screening of individual risk prior to disease onset.

GI345-SD-TUA2

Diffusion-Weighted MRI of Surgically Treated Gastrointestinal Stromal Tumor: Associations with Survival and Cell Proliferation Activity

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #2

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PURPOSE

Gastrointestinal stromal tumor (GIST) is the most common mesenchymal tumor of the gastrointestinal tract. The malignant potential of GISTs is generally evaluated based on the pathological evaluation of surgical specimen. However, no preoperative biomarker for GIST has been reported yet. On the other hand, diffusion-weighted MRI (DWI) is reported to be a biomarker for various malignant tumors. The purpose of this study is to apply DWI to quantify GIST, and evaluate its biomarker value for predicting survival and proliferation activity of GIST.

METHOD AND MATERIALS

We retrospectively identified 72 patients (35 M / 37 W; median age: 64.5) with GISTs who underwent a preoperative MRI with DWI. Both mean and minimum of apparent diffusion coefficient (ADC) values of the tumor were measured. These tumor parameters were compared with disease-free survival (DFS), the risk classification of GIST (modified Fletcher classification), and Ki 67 index (proliferation marker).

RESULTS

In univariate Cox regression analysis, minimum ADC value of tumor had a significant association with DFS (P=0.004), but mean ADC value didn't. In Kaplan-Meier analysis, patients with lower minimum ADC tumors (minimum ADC < 1.01) showed a significantly worse OS (P=0.04, log-rank). Regarding risk classification, 9 patients were categorized as the high risk, and the other 34 cases were categorized as the very low, low or intermediate risk. High risk GIST showed significantly lower minimum and mean ADC value (P=0.002, 0.04, respectively). Minimum and mean ADC value of tumor showed significant negative correlations with Ki 67 index (P=0.0007, 0.03, respectively).

CONCLUSION

Preoperative tumor ADC can be a useful imaging biomarker of GIST reflecting DFS and proliferation activity.

CLINICAL RELEVANCE/APPLICATION

Currently, there is no established preoperative biomarker to evaluate malignant potential of GIST. But DWI can be a useful non-invasive preoperative biomarker of GIST reflecting survival and proliferation activity, and it would help select an optimal therapy for patients with GISTs.

GI346-SD-TUA3

Spectral CT of Pancreas: Added Value of Virtual Monoenergetic Imaging in the Patients with Pancreatic Ductal Adenocarcinoma

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #3

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PURPOSE

To evaluate the image quality and optimal energies of virtual monoenergetic images (VMI) from spectral-detector computed tomography (SDCT) in multiphasic pancreatic CT, and investigate whether low-keV VMI at the portal-venous-phase (PVP) provides sufficient tumor conspicuity and arterial depiction relative to conventional pancreatic-parenchymal-phase (PPP) images.

METHOD AND MATERIALS

Forty-eight patients with pancreatic ductal adenocarcinoma (PDCA) underwent contrast-enhanced SDCT during PPP and PVP. Conventional polyenergetic images and VMI at 40-100 keV (10-keV increments) were reconstructed at each enhancement phase. Image noise and the contrast-to-noise ratio (CNR) of the pancreas, tumors, arteries and veins were quantified. Two radiologists independently assessed tumor conspicuity, margin delineation, image noise, sharpness of pancreatic duct, and depiction of arteries and veins on a five-point scale. Size-specific dose estimate (SSDE) was calculated.

RESULTS

Image noise for VMI at 40-100 keV was significantly lower than that for convetional images ($p<0.01$). The CNR in VMI increased gradually with decreasing energy; CNRs for VMI at 40-60 keV were significantly greater than that for conventional images ($p<0.01$). All subjective VMI scores were maximized at 40 keV, followed by 50-60 keV; all of which were significantly better than of conventional images ($p<0.01$). Objective and subjective image qualities of 40-50 keV at the PVP were equivalent to or even better compared with conventional PPP images. No significant difference in SSDE was observed between phases ($p=0.10$).

CONCLUSION

SDCT-VMI improved the subjective and objective image quality in multiphasic pancreatic CT for patients with PDAC. Low-keV PVP imaging may yield diagnostically adequate tumor conspicuity and arterial assessment compared with polyenergetic PPP images, potentially allowing the early detection and local staging of incidental PDCA on routine PVP abdominal CT performed for various clinical indications.

CLINICAL RELEVANCE/APPLICATION

Low-keV VMI of the PVP provide sufficient tumor conspicuity and arterial depiction, potentially eliminating the necessity of dedicated multiphasic scanning for the detection and local staging of PDCA.

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GI347-SD-TUA4

Extracellular Contrast-Enhanced MRI with Diffusion-Weighted Imaging for HCC Diagnosis: Prospective Comparison with Gadoxetic Acid

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #4

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PURPOSE

Hepatobiliary phase (HBP) is specific to hepatobiliary agent (HBA)-MRI and is reported to improve diagnostic performance for hepatocellular carcinoma (HCC). However, HBP is not available for extracellular agent (ECA)-MRI. The aim of this study was to perform intra-individual comparison of ECA-MRI and gadoxetic acid (HBA)-MRI to determine whether introducing Diffusion-Weighted Imaging (DWI) to ECA-MRI can compensate for the lack of HBP for diagnosing HCC.

METHOD AND MATERIALS

This was a prospective intra-individual comparison study using two different types of contrast agents for liver MRI performed at a tertiary referral academic center. One hundred and forty-seven lesions in 122 patients at high risk for HCC scheduled for liver surgery were included. Sensitivity, specificity, and accuracy of imaging criteria for HCC using conventional and modified criteria of ECA- and HBA-MRI were measured and compared. Modified criteria referred to arterial phase hyperenhancement with diffusion restriction for ECA or hypointensity on TP or HBP for HBA.

RESULTS

Modified ECA-MRI had higher sensitivity and accuracy than modified HBA-MRI [91.0% (111/122) vs. 74.6% (91/122), $p < 0.0001$; and 91.2% (134/147) vs. 75.5% (111/147), $p < 0.0001$, respectively], as well as higher specificity, although the difference did not reach statistical significance [92.0% (23/25) vs. 80.0% (20/25), $p = 0.0833$]. The specificity of modified ECA-MRI was slightly lower than both conventional criteria but without a significant difference [92.0% (23/25) vs. 100% (25/25), $p = 0.1573$].

CONCLUSION

Modified criteria for ECA-MRI using diffusion restriction showed better sensitivity and accuracy than modified criteria of HBA-MRI using hypointensity on TP or HBP, without significantly compromising specificity compared with conventional EASL criteria of ECA- or HBA-MRI.

CLINICAL RELEVANCE/APPLICATION

ECA exhibited arterial phase hyperenhancement more frequently than HBA. In addition, modified criteria for ECA-MRI using diffusion restriction showed the best sensitivity and accuracy than other criteria without compromising specificity compared with conventional criteria. Diffusion restriction on ECA-MRI seems to be able to overcome the lack of HBP

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GI392-SD-TUA5

Does the Change in Volumetric Functional MR Metrics Post-TACE Predict Histopathologic Grading of Hepatocellular Carcinoma?

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #5

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PURPOSE

To evaluate whether the change in volumetric ADC (vADC) and volumetric venous enhancement (vVE) after transarterial chemoembolization (TACE) can predict the histologic grading of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

This HIPPA compliant retrospective study was approved by our institutional review board. The study population included 103 HCC patients (128 index lesions) who had MR imaging within 6 months before and 6 months after TACE and pathologic report of the HCC either by biopsy or liver transplantation/resection between 2001 and 2017. Volumetric measurements of venous enhancement (VE) and apparent diffusion coefficient (ADC) were performed on the baseline and post TACE MRI. The tumors were histologically classified into two low-grade and high-grade groups. The parameters between the two groups were compared using bivariate analysis.

RESULTS

Total of 103 patients with a median age of 61(58-67) was evaluated. 82 were male and 21 were female. Median change in vADC and vVE after TACE was higher in low-grade HCC as compared to high-grade HCC (p=0.000 and p=0.002, respectively). Setting the cutoff value of 136.9 (10 -6 mm2/s) for vADC change resulted in the highest sensitivity and specificity (of 79% and 70%, respectively) in distinguishing between the 2 groups. vVE change at the cutoff point of -19.39 could differentiate between the two groups with the sensitivity and specificity of 77% and 50%, respectively.

CONCLUSION

Changes in volumetric functional MRI metrics are more dramatic in low-grade HCCs in response to TACE as compared to high-grade HCCs.

CLINICAL RELEVANCE/APPLICATION

Using volumetric changes of functional MRI in TACE-treated HCCs can be utilized as a non-invasive alternative in predicting tumor grading and can help clinicians to better plan treatment in HCC patients.

GI393-SD-TUA6

Magnetic Resonance Imaging as a Non-Invasive Method for the Assessment of Pancreatic Fibrosis (MINIMAP): A Comprehensive Study Design from the Consortium for the Study of Chronic Pancreatitis, Diabetes, and Pancreatic Cancer

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #6

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PURPOSE

Characteristic features of chronic pancreatitis (CP) may be absent on standard imaging studies. Quantitative Magnetic Resonance Imaging (MRI) techniques such as T1 mapping, extracellular volume (ECV) fraction, diffusion-weighted imaging (DWI) with apparent diffusion coefficient map (ADC), MR elastography (MRE) and T1-weighted signal intensity ratio (SIR) have shown promise for the diagnosis and grading severity of CP. However, radiologists still use the Cambridge classification which is based on traditional ductal imaging alone. There is an urgent need to develop new diagnostic criteria that incorporate both parenchymal and ductal features of CP as illustrated by MRI/MRCP. Designed to fulfill this clinical need, we present the MINIMAP study, which was funded in September 2018 by the National Institutes of Health. We hypothesize that quantitative MR imaging combined with ductal features can serve as valuable non-invasive imaging biomarkers to detect and grade CP.

METHOD AND MATERIALS

This is a prospective quantitative MR imaging study which will be performed at 7 institutions in well-phenotyped CP patient cohorts. The study will enroll 180 patients, composed of equal numbers (n=60) of no pancreas disease controls, and patients with suspected or definite CP. We will evaluate the role of T1 relaxometry, ECV, T1-weighted gradient echo SIR, MRE, arterio-venous enhancement ratio, ADC, pancreas volume/atrophy, pancreatic fat fraction, ductal features and pancreatic exocrine output following secretin stimulation in the assessment of CP. We will attempt to generate a multi-parametric pancreatic tissue fibrosis (PTF) scoring system.

RESULTS

Will not be available until December.

CONCLUSION

Will be published at the completion of the study.

CLINICAL RELEVANCE/APPLICATION

There is an urgent need to develop new diagnostic criteria that incorporate both parenchymal and ductal features of CP as illustrated by MRI/MRCP. We anticipate that a quantitative scoring system may serve as a biomarker of pancreatic fibrosis, hence this imaging technique can be used in clinical practice as well as clinical trials to evaluate the efficacy of agents which may slow the progression or reverse measures of CP.

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GI394-SD-TUA7

Influence of Sequence Selection of MR Enterography Diagnostic Accuracy

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #7

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PURPOSE

To evaluate the impact of individual MRE sequences on diagnostic accuracy for small bowel Crohn's disease.

METHOD AND MATERIALS

The study utilised data from a prospective trial comparing the diagnostic accuracy of MRE and US for CD (either newly diagnosed or with relapsing disease) recruited across 8 hospitals. A construct reference standard (multidisciplinary panel diagnosis) was used in the trial, incorporating 6 months of patient follow up. 73 (28 new diagnosis, 45 suspected relapse) trial MREs were interpreted by one of 27 radiologists using a locked sequential read paradigm via an online viewing platform (Biotronics 3Dnet). For the first read, only T2 weighted images were reviewed. The second read added 2 b value diffusion weighted images (DWI) and the final read added contrast enhanced T1 images. After each read, radiologists recorded the presence and location of small bowel Crohn's disease. Sensitivity and specificity for small bowel disease extent (i.e. presence and correct segmental location) was compared to the trial construct reference standard by bootstrapping with replacement by patient 1,999 times, taking an average value over the bootstrapped datasets (STATA 14.2).

RESULTS

T2 weighted images alone were 63% sensitive (95%CI 51-75%) and 79% specific (57-100%) for small bowel disease extent. Addition of DWI did not significantly increase sensitivity (61% [95%CI 47-73%), difference -2% [-8 to -4]), or specificity (79% [57-100%], difference 0%). Conversely, compared to T2 weighted images alone, addition of a combination of both diffusion weighted and contrast enhanced images significant reduced sensitivity by 7% (95% CI -1 to -14).

CONCLUSION

Addition of DWI does not increased sensitivity for small bowel disease extent compared to T2 weighted images alone. Addition of T1 contrast enhanced images reduces sensitivity suggesting they may falsely reassure radiologists suspecting disease based on T2 weighted images.

CLINICAL RELEVANCE/APPLICATION

For small bowel disease detection, streamlined MRE protocols avoiding cannulation and gadolinium exposure may be sufficient.

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GI395-SD-TUA8

Prediction of Liver Fibrosis Using T1ρ and T2 Relaxations

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #8

Participants
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PURPOSE

To investigate the diagnostic performance of liver fibrosis stage using T1ρ relaxation in comparison with T2 relaxation

METHOD AND MATERIALS

Eighty-three patients (F/M = 29/54, mean age, 69.4 yrs) with liver tumor were scanned MRI including T1ρ and T2 maps before the surgery. Among 83 patients, 67 patients had a history of chronic liver disease. but other 16 patients did not. All patients were classified into five stages (F0, n=21; F1, n=12; F2, n=20; F3, n=6 and F4, n=24) referring to the pathological examination of surgically resected specimens of the liver. Averaged T1ρ and T2 values of the liver parenchyma of each patient were measured after drawing three regions of interest on both maps. The Spearman correlation coefficient was calculated between T1ρ and liver fibrosis stages, and between T2 value and liver fibrosis stages. The performances in diagnosing cirrhosis (F4 vs F0-3), advanced fibrosis (F3-4 vs F0-2), clinically significant fibrosis (F2-4 vs F0-1), and with or without fibrosis (F1-4 vs. F0) were evaluated using a receiver operating characteristic (ROC) analysis.

RESULTS

Mean T1ρ values of five stages were as follow: F0, 51.2 ms; F1, 52.0 ms; F2, 52.5 ms; F3, 61.9 ms and F4, 62.8 ms, respectively. Mean T2 values of five stages were as follow; F0, 37.2 ms; F1, 37.0 ms; F2, 37.9 ms; F3, 39.9 ms and F4, 43.3 ms, respectively. The Spearman correlation coefficients of T1ρ and T2 values were 0.55 and 0.51, respectively ($p<0.05$). ROC analysis showed the area under the curves (AUCs) of T1ρ for diagnosing cirrhosis (F4), advanced fibrosis (F3 or greater), and significant fibrosis (F2 or greater), with fibrosis (F1 or greater) were 0.82, 0.86, 0.75 and 0.69, respectively ($p<0.05$). In addition, ROC analysis showed the AUCs of T2 for diagnosing cirrhosis, advanced fibrosis, and significant fibrosis, with fibrosis were 0.82, 0.80, 0.71 and 0.64, respectively ($p<0.05$). However, there were no significant differences in AUCs between T1ρ and T2 values.

CONCLUSION

T1ρ relaxation, as well as T2 relaxation, has potential as a biomarker to predict liver fibrosis stage.

CLINICAL RELEVANCE/APPLICATION

T1ρ and T2 relaxations may help clinicians for the non-invasive prediction of liver fibrosis stage in patients with chronic liver disease.

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GI396-SD-TUA9

Comparison between ROI-Based and Volumetric Measurements of Liver Fibrosis Using MR Elastography in Quantifying Heterogeneity of Liver Stiffness

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #9

Participants
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PURPOSE

To compare ROI-based and volumetric measurements in quantifying heterogeneity of liver stiffness (LS) using MRE.

METHOD AND MATERIALS

In this retrospective, IRB approved study, 128 patients with suspected liver fibrosis and MRE were reviewed between 12/2016 and 12/2017. LS was measured using: 1) the average of 3 Regions of interest (ROI), and 2) volumetric segmentation of the entire liver parenchyma (excluding vessels) using a semi-automatic software. Mean LS (MLS) of the 2 methods was calculated for each patient. Stages of fibrosis were defined using previously tested thresholds. Each patient was assigned to one of the 5 stages of fibrosis (MLS-stage)based on their ROI-MLS. Volumetric measurement of stiffness maps was also used to calculate the full range of LS and percentage involvement of the liver with each stage of fibrosis. Accordingly, specific proportions were defined: 1) above MLS-stage: percentage of the liver that has LS at least one category higher than MLS-stage, and 2) the first and second most predominant stages of fibrosis. Heterogeneous stiffness was defined when the first and second most predominant stages were more than one category apart.

RESULTS

The mean age of patients was 54 ±15 years; 46% were female. The average of MLS was 2.72 ±1.03 kPa for ROI measurements and2.64 ±0.93 kPafor volumetric method (p=0.001).As per MLS-stage,59 (46 %), 19 (15 %), 13 (10 %), 26 (20%) and 11 (8%) patients were assigned to stages F0, F1, F2, F3, and F4.In 58 patients (45%), more than 20% of liver had stiffness at least one stage higher than MLS-stage. Among 59 patients with normal MLS-stage (F0), 31 patients (53%) had >20% of liver volume with abnormal LS (F1-F4). In all 128 patients, an average of 20% of the liver volume had stiffness at least one stage higher than each individuals' MLS-stage. By definition,18 patients (14%) were identified to have heterogeneous stiffness.

CONCLUSION

Heterogeneity of hepatic fibrosis may occur in patients with chronic liver disease. MLS may not represent the entire spectrum of hepatic fibrosis. Failure to detect heterogeneity in its early stage could cause a delay in treatment initiation and progression of fibrosis.

CLINICAL RELEVANCE/APPLICATION

Volumetric segmentation and descriptive reporting of LS can potentially improve the detection of heterogeneous fibrosis in the liver and the accuracy of LS measurement. It helps to establish a more timely and precise management plan for each patient.

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GI397-SD-TUA10

Pilot Study to Assess Feasibility of Fast Whole-Body MRI Imaging in Oncologic Screening

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GI Community, Learning Center Station #10

Participants
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PURPOSE

Assess the feasibility of whole-body MRI imaging in 30 minutes in oncologic applications.

METHOD AND MATERIALS

Our IRB approved this HIPPA-compliant prospective study. Twenty-six adult patients assessed for metastatic diseases were scanned with WB-DWI methods using a 3T MRI scanner. Axial fat-suppressed T2-weighted (T2WI), DWI, precontrast TS T1-weighted (T1WI) followed by post contrast FS T1WI in the arterial, portal venous and delayed phases were acquired (gradient time of 30 minutes). A single reader utilizing a five-point-scale recorded image quality of each WB-MRI study. Findings on whole-body MRI were recorded. The number of lesions was compared to those detected on CT or PET-CT studies, performed with 12 months of whole-body MRI if available. The WB-MRI, CT, and PET-CT were divided into standard anatomical location including chest, abdomen, and pelvis. The number of lesions within each anatomic location was compared in all three modalities.

RESULTS

Our study included 14 males and 12 females with the mean (±standard deviation) age of 55(±14) years. All whole-body MRI examinations were successfully obtained in the median time of 35 (IQR, 29-39) minutes. There were 17,21 and 8 lesions detected from chest, abdomen and pelvis, respectively in CT studies (N=19). Additionally, total of 0, 3, 2 lesions were detected in the chest, abdomen and pelvis respectively by assessing PET-CT studies (N=5). The WB-MRI detected 15 Lesions in chest, 38 Lesions in abdomen and 8 lesions in pelvis. All lesions detected on PET-CT were also detected on WB-MRI. Four lesions (16%) detected on WB-MRI in abdomen parts were missed on CT, while WB-MRI missed 2 lesions (11%) detected by CT in the chest parts; all were less than 10 mm. These two studies are comparable in detecting lesions in the pelvis. The overall image quality of whole-body MRI was 4/5.

CONCLUSION

We have demonstrated that fast multiparametric WB-MRI may be preformed in approximately 30 minutes, with relatively high image quality. Lung lesions <10mm may not be readily detected by WB-MRI.

CLINICAL RELEVANCE/APPLICATION

Whole-body MRI might be an acceptable alternative for CT or PET, in staging, assessment and monitoring of treatment response in oncologic applications.

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GU212-SD-TUA1

Does an Additional Biopsy or Targeting with Contrast-Enhanced Ultrasound Positively Influence Disease Detection or Severity in the Renal Transplant?

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To determine if renal transplant (Tx) pathologic diagnosis significantly changes when 2 biopsy sites are chosen and if CEUS has value in targeting the second site.

METHOD AND MATERIALS

40 patients undergoing US guided renal Tx biopsy within 2 years of their Tx were recruited and consented for this IRB approved, sponsor funded study; 20 'surveillance' and 20 with 'for cause' indications. After routine diagnostic ultrasound, CEUS was performed with the aim of identifying cortical regions with subjectively altered flow. One biopsy was at the location deemed 'technically preferred' (primary) by the operator regardless of CEUS findings. An additional biopsy was performed at a second location, either targeted to an area in which CEUS findings differed from the primary site (targeted) or at a random location (secondary) if there was no different area of CEUS findings. Specimens were randomly labeled A or B; the pathologist blinded to the CEUS result and location of the biopsy. Location-specific CEUS assessments were recorded (none, mild, moderate, marked). Pathology results were compared, including total BANFF scores divided into acute and chronic categories.

RESULTS

There were no location-specific pathology differences that correlated with differences in CEUS assessments. Total BANFF score for 2 biopsies was significantly higher than for the primary biopsy alone in both acute ($p=0.02$) and chronic ($p<0.01$) disease. Comparison of the two biopsies yielded tissue with a discordant basic (normal vs abnormal) pathologic conclusion in 5/20 (25%) surveillance patients, but 0/20 (0%) in for cause biopsies. In discordant biopsies, were abnormal only in the primary location and 2/5 only in the secondary site. Major bleeding complications occurred in 3/40 (7.50%) patients; the historical major bleeding complication rate in our lab (6 years) is $< 0.5\%$.

CONCLUSION

Obtaining renal Tx biopsies from two substantially different locations may provide clinically significant additional information. CEUS targeting was not useful. Major bleeding complications were much higher than typical for our institution; this may be due to the additional biopsy away from the "operator preferred" location.

CLINICAL RELEVANCE/APPLICATION

Obtaining biopsies from two substantially different locations in renal transplants may provide clinically significant additional information but should be considered with caution because it may result in higher complication rates.

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GU214-SD-TUA3

Contrast-Enhanced MRI Findings in Adnexal Torsion: A Case-Control Study Based on Qualitative and Quantitative Evaluation

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #3

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PURPOSE

To assess qualitative and quantitative findings of contrast-enhanced magnetic resonance imaging (MRI) that are useful in diagnosisg adnexal torsion.

METHOD AND MATERIALS

The case group was made up of 30 patients who were examined by contrast-enhanced MRI during April 2009 to December 2017 and for whom adnexal torsion was confirmed by surgery. The control group was made up of 31patients who were randomly selected from 353 patients who had contrast-enhanced MRI and surgery for ovarian tumors during the same period. Qualitative MRI findings reverled: characteristics of the tumor, cystic wall, characteristics of fallopian tubal swelling, T1WI and DWI high-intensity of the ovary and fallopian tube, contrast intensity of the ovary and fallipian tube, characteristics of ascites and uterine deviation. These findings were independently assessed by two radiologists. Quantitative MRI findings revealed the tumor size, cystic wall thickeness, and contrast intensity ratio of ovaries and fallopian tubes, which were measured by one radiologist.

RESULTS

Significant differences between the case and control groups were observed in the qualitative findings for nodular and twisted swelling of the fallopian tube, and weakness of the contrast enhancement of the ovary and the fallopian tube, high intensity on T1WI of the fallopian tube, in the quantitative findings for average of cystic wall thickeness, ovarian early increased ratio (EIR-o) <0.5, ovarian delayed increased ratio <0.8, and fallopian delayed increased ratio (DIR-t) <1.4.

CONCLUSION

These results identify several contrast-enhanced MRI findings that may be useful in diagnosing adnexal torsion: nodular and twisted tubal swelling, ovarian and tubal contrast enhancement weakening, high intensity on T1WI of the fallopian tube, and contrast enhancement ratio of the ovaries and fallopian tubes.

CLINICAL RELEVANCE/APPLICATION

This is a case-control study of contrast-enhanced MRI of adnexal torsion which revealed old useful knowledges and new quantitative useful findings.

GU247-SD-TUA5

Validation of the Use of Region of Interest (ROI) Measurements for Objective Assessment of Post-Contrast Enhancement of Renal Lesions on Magnetic Resonance Imaging (MRI)

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #5

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PURPOSE

The aim of this study was to validate the use of region of interest (ROI) measurements in magnetic resonance imaging (MRI) to objectively assess for enhancement in suspected solid renal masses and to determine a minimum threshold value for true enhancement.

METHOD AND MATERIALS

104 consecutive patients who had renal MRI and subsequent biopsy or partial/radical nephrectomy between January 2015-December 2017 were included. Two body imaging fellows independently measured the mean ROI values of renal masses, normal renal parenchyma, the ipsilateral psoas muscle and external air on the pre- and post-contrast sequences. Pathology-proven renal cysts were used as controls. The absolute and percentage changes in the mean ROI values were calculated. The readers were blinded to the pathology results.

RESULTS

104 patients were included in this study (mean age of 65 years; 58 males and 46 females). 74 patients (71%) had a diagnosis of renal cell carcinoma (RCC). Pathology showed clear-cell RCC in 55%, papillary RCC in 22%, and other RCC subtypes in 23%. There were 30 non-RCC renal lesions (29%), including oncocytoma, renal papillary adenoma, and renal metastasis. The minimum percentage change in ROI values in the pre- versus post-contrast images for all pathology-proven RCCs was 23% (range: 23-437%). The percentage change for normal renal parenchyma ranged from 32-317%. The maximum percentage change in ROI values for 13 pathology proven renal cysts was 13%. There was excellent inter-observer agreement between the two readers [Cohen's Kappa (k) 0.84].

CONCLUSION

The percentage change in ROI values on MRI (signal intensity index) can be a helpful tool in the objective assessment of true enhancement of renal masses and can supplement subtraction images. The minimum threshold for enhancement of solid renal lesions in our study was 23%.

CLINICAL RELEVANCE/APPLICATION

The signal intensity index is an objective tool to assess for true enhancement of renal lesions on MRI, which is particularly helpful when the subtraction images are degraded by motion artifact.

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GU248-SD-TUA6

Development and Validation of a Radiomics Nomogram for Preoperative Prediction of Extracapsular Extension in Prostate Cancer

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #6

Participants
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PURPOSE

To develop and validate a radiomics nomogram for preoperative prediction of extracapsular extension (ECE) in patients with prostate cancer (PCa).

METHOD AND MATERIALS

Preoperative magnetic resonance imaging data from 238 patients with PCa was studied. Patients enrolled were randomized in a two-to-one ratio into training (n = 165) and validation (n = 73) cohorts. Radiomics features were extracted from T2-weighted images (T2WI). A radiomics signature was built via dimension reduction, feature selection based on the least absolute shrinkage and selection operator method. Finally, a radiomics nomogram comprised of radiomics signature, MR-reported ECE status, and independent clinicopathologic risk factors (i.e., location, maximum diameter and the apparent diffusion coefficient (ADC) values of the index lesion, MR-reported prostatic volume and prostate specific antigen (PSA) level) was constructed using multivariable logistic regression. Discrimination, calibration and clinical usefulness of this radiomics nomogram were subsequently assessed. The incremental role of biopsy results added to the nomogram was also explored by the net reclassification improvement (NRI) value assessment.

RESULTS

A radiomics signature consisting 22 selected radiomics features was significantly associated with pathologic ECE status ($P < .001$ for both training and validation cohorts). The radiomics nomogram comprising radiomics signature, lesion location, PSA level, and MR-reported ECE status demonstrated excellent performance concerning discrimination and calibration, with an area under the curve (AUC) of 0.874 and 0.846 in training and validation cohort, respectively. Clinical usefulness of this nomogram was confirmed with no need to incorporate additional invasive biopsy results.

CONCLUSION

The proposed radiomics nomogram demonstrated adequate discrimination and calibration for preoperative prediction of ECE status.

CLINICAL RELEVANCE/APPLICATION

The proposed radiomics nomogram demonstrated good discrimination and calibration for prediction pathologic ECE status, and was confirmed with no need to incorporate additional biopsy findings to facilitate the preoperative prediction of ECE in a noninvasive fashion, which outperformed subjective MR-reported ECE status by radiologists. It could define patient subsets benefiting most from radical prostatectomy approach, supporting the clinical decision-making.

HP124-ED-TUA5

Benefits of a Near-Miss Peer Learning Conference Tailored for Residents

Tuesday, Dec. 3 12:15PM - 12:45PM Room: HP Community, Learning Center Station #5

Participants
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TEACHING POINTS

An emerging learning opportunity is peer learning from diagnostic error. Discussing near misses has the potential to expose systemic vulnerabilities and to create a comfortable environment in which trainees can learn from one another's experiences. To this end, we designed a peer learning curriculum tailored toward residents, in which near-miss events encountered during the daily workflow were shared. Residents analyzed each case, defined the factors that nearly led to the error, the corrective action that was taken, and any lessons learned. Surveys regarding residents' experience with near misses and reactions to the curriculum were sent before and after the conferences. An emerging learning opportunity, peer learning captures a unique spectrum of errors (such as near misses) and teaching points when compared to traditional radiology QA systems such as peer review. Normalizing the discussion of diagnostic error helps reshape residents' approach to failure by turning it into a positive learning opportunity. A resident-focused near-miss curriculum was rated positively and increased resident comfort discussing error with colleagues.

TABLE OF CONTENTS/OUTLINE

Introduction to peer learning Definition of a near miss The near-miss curriculum Example cases Pre- and post-survey results Lessons learned Future directions

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December 1–6 | McCormick Place, Chicago
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HP212-SD-TUA1

Assessment of Radiology Malpractice Claims in the United States

Tuesday, Dec. 3 12:15PM - 12:45PM Room: HP Community, Learning Center Station #1

Participants
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PURPOSE

To describe the frequency and costs associated with malpractice claims in the field of radiology, as well as the associated clinical scenarios and legal outcomes.

METHOD AND MATERIALS

A retrospective investigation of the VerdictSearch legal claims database was performed for claims occurring from 2003-2018. Allegations, case outcomes, and payouts were examined.

RESULTS

In total, 187 cases were analyzed. Mean age of plaintiffs was 48.8±18.0 years; 5.4% (10/176) were pediatric cases. Claims were most commonly associated with the outpatient setting (48.4%; 90/186) and diagnosis-related allegations (71.0%; 132/186). Trial cases lasted on average 10.2±8.5 days. Total liabilities of the 187 cases were $481,906,443 with individual awards ranging from $100,000 to $109,026,094. Median plaintiff award was $2,350,000 (interquartile range (IQR): $546,919 to $5,737,500; mean $7,927,388±$18,331,442). Median settlement amount was $1,000,000 (IQR: $562,499 to $2,375,000; mean $2,077,186±$2,589,577). In total, 51.2% (95/186) of claims ended in a payout to the claimant.

CONCLUSION

Over half of all claims against radiologists end in provider loss, with most of the claims occurring in the out-patient setting. Median payments are higher than previously reported. This is both costly to providers, as well as the healthcare system. These data may help inform providers to minimize medicolegal risk and improve the delivery of patient care.

CLINICAL RELEVANCE/APPLICATION

These data may help inform providers to minimize medicolegal risk and improve the delivery of patient care.

HP213-SD-TUA2

Do Senior Women Mentor Women More Than Men?

Tuesday, Dec. 3 12:15PM - 12:45PM Room: HP Community, Learning Center Station #2

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PURPOSE

Women continue to remain a minority in radiology. Mentorship has been identified as a key element for career advancement and having a women mentor or role model can be instrumental for career advancement and progression of women to higher academic ranks and/or leadership positions. We sought to determine if senior women mentor women more than men.

METHOD AND MATERIALS

We assessed the gender of 3,702 first and last authors listed for manuscripts published in nine high-impact American radiology journals between 2002-2017. We Plotted the gender ratio of last author and first author for each year to map out the gender combination of mentor/mentee over time. Statistical tests were employed to assess the changes over time.

RESULTS

Overall, women constituted 28.2% of first auhtors and 20.1% of senior authors of selected journals for 16 years. The contribution of women as first author grew from 26.9% to 37.4% over the 16 years, and from 15.7% to 23.9% as senior author ($P<0.0001$). 26.7 % of women first author were mentored by senior women, and 73.4% by men. Of men first auhtor, 13.7 % were mentored by semior women, and 86.3% by senior men. Although our data shows an increasing trend in the number of women as senior authors, first auhtor women were mostly mentored by men each year over all the years studied and there was no change in the number of women who were mentored by senior women.

CONCLUSION

Exposure to women leaders as role models and being mentored by them might be an influencial and important factor for the progression of women into the higher rungs of the academic career ladder. Therefore, considering strategies to increase the number of women in early stages of academic career to be mentored by senior women could be an initiative to provide a more promising future for the advancement of women in radiology.

CLINICAL RELEVANCE/APPLICATION

Increasing the exposure to women leaders as role models and being mentored by them will have a downstream effect and might help to progression of women to more senior and leadership position.

HP214-SD-TUA3

Is Hypnosis an Alternative to Pharmacologic Sedation for Claustrophobic Patients Undergoing MR Exams? A Retrospective Study

Tuesday, Dec. 3 12:15PM - 12:45PM Room: HP Community, Learning Center Station #3

Participants
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PURPOSE

Claustrophobia is a condition that prevents certain patients from completing magnetic resonance (MR) without sedation. The aim of our study is to assess the feasibility of medical hypnosis in helping claustrophobic patients to complete MR without compromising image quality.

METHOD AND MATERIALS

The ethical committee approved our retrospective study. From December 2015 to February 2019 we included 40 patients who underwent MR with medical hypnosis. Every patient had previously interrupted a MR exam due to claustrophobia. As a control group, we included 40 consecutive patients that underwent MR with sedation. Two experience radiologists assessed randomly, independently and blinded, the quality of the images of the two groups using a symmetrical Likert scale (0= non diagnostic images; 1=bad image quality; 2 = fair image quality; 3= good image quality; 4=very good image quality). Descriptive statistics was performed. We also compared additional direct costs from the health care system point of view, according to outpatient insurance reimbursement in Switzerland. Furthermore, we measured time needed for each MR exam of both groups.

RESULTS

The majority of the MR exam of both groups showed good or very good image quality (64/80 = 80% and 61/80 = 76.25% for reader 1 and reader 2, respectively). No statistically significant difference was found in image quality between the two groups. In comparison to a standard MR, medical hypnosis had additional costs of approximately 120-200 USD as opposed to approximately 370-410 USD with pharmacologic sedation. Moreover, the mean MR exam time was 44 min 30 sec. (range 14 min. 30 sec to 118 min.) and 54 min (range 16 min. to 133 min 30 sec.) for patients and for control group, respectively.

CONCLUSION

Medical hypnosis is a valid alternative to pharmacologic sedation in patients unable to undergo MR due to claustrophobia, allowing achieving good quality images, with less additional costs and without affecting workflow.

CLINICAL RELEVANCE/APPLICATION

Medical hypnosis could therefore be a valid alternative to medical sedation in claustrophobic patients undergoing MR.

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HP233-SD-TUA4

Assessment of Modality-Specific Strengths and Weaknesses of Non-Enhanced and Contrast-Enhanced Postmortem Computed Tomography

Tuesday, Dec. 3 12:15PM - 12:45PM Room: HP Community, Learning Center Station #4

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PURPOSE

Cadaver-specific post mortem computed tomography (PMCT) has become an integral part in gross anatomy teaching at several universities. Recently, also the feasibility of contrast-enhanced PMCT has been demonstrated in the framework of the medical curriculum. The purpose of this study was to identify particular strengths and weaknesses of both non-enhanced and contrast-enhanced PMCT compared to conventional cadaver dissection.

METHOD AND MATERIALS

N=320 first-year medical students followed the universities gross anatomy curriculum (2018-19) which included conventional cadaver dissection (CCD), non-enhanced (NE-) PMCT, and contrast-enhanced (CE-) PMCT. After completion of the anatomy course, n=257 (80.3%) medical students answered a 34-item questionnaire in order to evaluate the three teaching modalities. The questionnaire covered all anatomy course modules on a region- and system-based categorization with a 5-point Likert scale. Results were compared using the non-parametric Friedman test.

RESULTS

PMCT has been evaluated superior to CCD in 18/34 categories. In 12 out of these 18 categories, significant differences were due to increased learning benefits at CEPMCT, especially in the field of vascular anatomy (e.g. carotid internal artery: CCD=2.71±1.04, NEPMCT=2.63±1.22, CEPMCT=4.10±0.97, $p<0.01$) and head and neck anatomy (e.g. skull base foramina: CCD=3.07±1.22, NEPMCT=3.28±1.15, CEPMCT=3.51±1.20, $p<0.01$). CCD has been found superior to PMCT in 16/34 categories and particularly helpful in learning musculoskeletal anatomy, such as the muscles of the forearm/hand (CCD: 4.44±0.81, NEPMCT: 2.69±1.19, CEPMCT: 2.64±1.17, $p<0.01$).

CONCLUSION

PMCT is particularly powerful to reveal structures that cannot easily be seen in their topographical arrangement by CCD. However, PMCT should be regarded as a perfect complement to CCD rather than a substitute. CEPMCT yields additional gains in vascular anatomy and head and neck anatomy. Therefore, this work contributes to furthering our understanding of the value of post mortem computed tomography in anatomy teaching.

CLINICAL RELEVANCE/APPLICATION

Radiologic imaging techniques are increasingly applied in the anatomy laboratory. Hereby, radiologists play a central role in teaching undergraduate students in cross-sectional anatomy and image data interpretation. These approaches anticipate clinical cases and facilitate a smooth transition into the clinical work.

IN019-EC-TUA

Using the Open Health Imaging Foundation (OHIF) Framework to Build Web-Based Imaging Applications

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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TEACHING POINTS

The purpose of this exhibit is to: Explain how radiologists can build their own imaging tools and applications using the open source Open Health Imaging Foundation (OHIF) framework to address their custom use cases. Discuss the components of a full fledged zero-footprint web-based imaging application and how they interact using various APIs (e.g. DICOMweb). Explain how advanced functionality, such as 3D visualization and segmentation, can be incorporated in these applications. Demonstrate how this type of system can be deployed both securely and cost effectively.

TABLE OF CONTENTS/OUTLINE

Open source resources for radiology and AI applications Relationships between components in web imaging applications Building custom measurement tools Incorporating advanced visualization and segmentation tools Deploying scalable secure web imaging applications locally or using cloud resources Future directions

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IN029-EC-TUA

The Quantitative Image Feature Pipeline (QIFP): Automated Computation of Quantitative Image Features for Prediction of Clinical Characteristics (e.g., Malignancy, Response to Therapy, Overall Survival) in Subject Cohorts

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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Conclusion

The Stanford QIFP facilitates the development, evaluation and comparison of quantitative imaging biomarkers by allowing component algorithms to be written and implemented in any programming environment, and processing pipelines to be configured and run on cohorts containing imaging and clinical data.

Background

Quantitative image features (a.k.a. radiomics) computed from medical images can be used to establish biomarkers of cancer subtypes that can be used for deriving relationships to cancer genomics, treatment selection, assessing response to treatment, and for predicting clinical outcome. The Stanford Quantitative Imaging Feature Pipeline (QIFP), an open source and cloud-based software system, allows researchers to characterize images of tumors and surrounding tissues, and facilitates discovery of the best quantitative imaging features and predictive modeling algorithms for each cohort, disease type and imaging modality. The QIFP also allows researchers to add their own algorithms, written in any language for any platform and deployed in Docker containers for their own studies and for the benefit of the quantitative imaging community.

Evaluation

We tested the ability of the QIFP to integrate algorithms built in Docker containers contributed by researchers in the NCI's Quantitative Imaging Network to segment lung nodules on chest CT scans, to characterize them with radiomic features, and to a train and test predictive models for malignancy. The figure shows two pipelines that were configured on the QIFP, each with a resulting ROC curve for malignancy that was generated by these pipelines. Harvard contributed a lung nodule segmentation algorithm and a radiomics package ('pyradiomics'), Stanford contributed a radiomics package ('QIFE') and a sparse regression module ('LASSO'), and Moffitt Cancer Center contributed a radiomics package ('Moffitt-radiomics' not shown).

Discussion

The QIFP embodies many key attributes and functionality for the advancement and use of quantitative imaging, including a web-based, graphical user interface, support algorithms written in a variety of languages via Docker containers, resident machine learning algorithms, and over 30 prebuilt and user-configurable workflows.

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IN030-EC-TUA

Interactively-Trained Segmentation Tool Leveraging Machine Learning and Geodesic Distance

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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Conclusion

The tool offers a fast, easy to use and consistent way to segment medical images, while leveraging real-time ML training.

Background

Machine-learning-based segmentation tools usually suffer from two critical limitations: requirement for large and diverse training data, and failing on new unseen data that deviate from the training set. We present an interactive segmentation algorithm leveraging information from multi-modal medical images to perform multi-class iterative semi-automatic segmentation. A patient-specific training set is interactively produced by a user, briefly drawing over different areas of the structure or lesion of interest and over background tissue. A machine learning (ML) algorithm is then trained in real-time and produces segmentation labels. Subsequent iterations allow the user to refine these labels for misclassified tissues. Here we evaluate this method in terms of consistency and speed.

Evaluation

A clinical expert was asked to interactively perform 4-class segmentation for MRI glioblastoma images of 20 subjects using our approach and the results were compared with the expert's own manual segmentations. The average Dice score (%) was 86.6 for whole tumor segmentation, 71.9 for non-enhancing tumor, 79.0 for enhancing tumor and 78.7 for peritumoral edema/invasion. The expert was allowed a maximum of 20 minutes per subject. The active user interaction time was on average 8 minutes for the first iteration and 2 minutes per further iteration. The expert never did more than 3 iterations and didn't receive any special training, apart from a brief explanation of how the algorithm works and a 6-minute video showcasing the tool.

Discussion

We present an interactive algorithm and software tool for multi-label tumor segmentation, utilizing real-time ML training and inference, along with geodesic distance constraints to reduce false positives. The user can dynamically decide the trade-off between time and segmentation accuracy by limiting the number of iterations of drawing and retraining. Algorithmic evaluation occurred in very heterogeneous tumors. Future work will include pre-trained models that help achieve better generalization of the user's input for areas that are distant.

IN031-EC-TUA

Virtual Dynamic Contrast-enhanced CT (vDCE-CT): A Novel Method for Quantification of Tissue Perfusion and Reconstruction of DCE-CT Image at Any Temporal Window Using Routine Abdominal DCE-CT Protocol

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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Conclusion

vDCE-CT can be feasible as less-invasive CT perfusion imaging and better diagnostic imaging method that realizes one-stop imaging.

Background

Quantification of tissue perfusion using CT perfusion imaging is useful for tissue characterization. However, the problem is its complicated imaging protocols and additional radiation exposure in conventional CT perfusion imaging that prohibits wide clinical application. The purpose of our presentation is to demonstrate feasibility of our proposed method using routine 3-phasic DCE-CT protocol; virtual dynamic contrast-enhanced CT (vDCE-CT) based on compartment model analysis and estimation of arterial/portal venous input functions (EIF) using observed individual data and population database, in abdominal imaging.

Evaluation

Twenty-one consecutive patients who underwent CT perfusion study using 10-phasic DCE-CT protocol (temporal window: 0, 22, 28, 34, 40, 46, 52, 58, 90, 210 s) were included in this study. The reproducibility of obtained perfusion parameters and reconstructed time-density curve (TDC) was evaluated using 3-phasic DCE-CT data set (temporal window: 0, 40, 90 s) that was extracted from original 10-phasic DCE-CT data set in the same patient. Significant correlation between perfusion parameters obtained from vDCE-CT and 10-phasic perfusion CT was observed in arterial inflow velocity constant of the spleen ($r=0.92$, $p<0.0001$) and the liver ($r=0.77$, $p<0.0001$), and in arterial flow fraction of the liver ($r=0.60$, $p=0.004$). The mean absolute error in reconstructed TDC of the spleen/liver between 3-phasic and 10-phasic protocol was significantly small with EIF (vDCE-CT: 7.6/4.9 HU per phase) compared to without EIF (conventional 3-phasic perfusion CT: 16.3/9.2 HU per phase). The simulated total volume CT dose index was significantly low in 3-phasic protocol (44.6 mGy) compared to 10-phasic protocol (128.5 mGy).

Discussion

vDCE-CT enables quantification of tissue perfusion with smaller radiation dose. The capability of generating virtual reconstructed DCE-CT images at any temporal window will be useful when temporal window was not appropriate for diagnosis due to patient's irregular circulation.

IN144-ED-TUA7

Platform for Development and Deployment of Computer-Assisted Reporting & Decision Support at the Radiologist Point-of-Care: What Radiologists Should Know

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Station #7

Awards
Certificate of Merit

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TEACHING POINTS

Clinical decision support (CDS) at the radiologists' point-of-care (POC) can be delivered using the open computer-assisted reporting and decision support (CAR/DS) framework. CAR/DS has been shown to increase report standardization, guideline adherence, and compliance with report recommendations, thus increasing the value of radiology reports and likely improving patient care. Since 2013, forty-five of these CDS modules for specific clinical scenarios have been developed, and/or implemented in our institution. Such experience allowed for designing an end-to-end pipeline for development and curation of CAR/DS modules in which radiologists are the end users. This exhibit aims to: review the steps of this pipeline focusing on what is relevant for the practicing radiologists, and provide guidance on how to use CAR/DS tool at the POC.

TABLE OF CONTENTS/OUTLINE

Description of CAR/DS modules pipeline: 1. Identification of a clinical scenario; 2. Assignment of a clinical team; 3. Content definition; 4. Development; 5. Deployment and usage; 6. Quality control & updates. Components of each step will be detailed explored with explanations and schematic illustrations of CAR/DS capabilities, content, coding, usage, and curation. CAR/DS modules for adrenal masses, lung cancer, and adnexal cysts will be utilized as use-cases to illustrate the CAR/DS pipeline.

IN212-SD-TUA1

AI Radiomics in a Monogenic Autoimmune Disease: Deep Learning of Routine Radiologist Annotations Correlated with Pathologically Verified Lung Findings

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Station #1

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CONCLUSION

Our pilot study addresses the major missing 'link' needed for supervised deep learning: expert labeling of pathology correlated abnormal lung findings on CT by radiologists, providing the 'supervision' for deep learning models in reports. Routinely annotated and pathologically verified imaging findings should greatly augment deep learning radiomic models.

Background

We address the missing 'link' of minimally available expertly labeled image data for deep learning by connecting routine radiologist annotations directly to their reports as hypertext. We apply an in-house deep learning model guided by radiologist annotations of chest CT pulmonary manifestations in patients with autoimmune polyendocrinopathy candidiasis ectodermal dystrophy (APECED). These patients have mutations in the autoimmune regulator (AIRE) gene, sometimes leading to life-threatening end-organ tissue damage such as pneumonitis, with unique pathologic findings that correlate with CT features.

Evaluation

As a proof of concept, we exported DICOM data from 57 regions in 30 chest CTs with lung findings annotated by radiologists and matched to hypertext within radiology reports in our PACS (Vue Reporting v12.1 Carestream Health, Rochester, NY). Radiologists annotated ground glass opacity (GGO), consolidation (CO) and cavity (CA) with ovals, arrows or 2D measurements, linking them to textual descriptions in reports. Assisted by hyperlink-directed bounding boxes, these findings acted as the testing dataset used to evaluate our pre-trained deep learning algorithm. Dice coefficients were 48%, 56%, 58% and 50% for normal, GGO, CO and CA, respectively, with an average overall accuracy of 53%.

Discussion

Radiologists at our institution routinely connect annotated abnormal findings on imaging with their associated descriptions as hypertext in advanced interactive reporting that can act as 'supervision' for deep learning training without additional labeling. We demonstrate feasibility in connecting radiologist hypertexts to their image annotations, directing deep learning algorithm training and eventual automated detection/classification.

IN214-SD-TUA4

Fully Automated Open-Source Critical Findings Notification System

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Station #4

Participants
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CONCLUSION

The entire closed-loop critical finding communication is feasible using an automated system in the majority of cases. Nevertheless, there is home for improvement regarding individual institution and user needs.

Background

Several automatic systems have been proposed to streamline critical findings communication, with mixed outcomes. Although, there is no conclusive model for critical results notification, and its implementation varies across the industry. This study proposes a new model for optimizing the information flow between radiologist and referral physician, reducing the burden of communication and improving time-response.

Evaluation

An effortless closed-loop critical finding notification system was developed for a multi-site radiology practice, composed of the following steps:When signing the report, the radiologist identifies the study as critical.The study status is stored in a SQL database;A script is responsible for a two-way communication with a messaging app bot which notifies selectively each institution's group, using an inline button for instant confirmation and promptly gives access to the images and report;Confirmation information is received and stored in our database.The system was implemented as an optional and complementary path for communicating critical results in four hospitals, monitored by a real-time business intelligence dashboard.The vast majority of critical findings were on CTs (84,7%), followed by CTA (6,5%) and X-rays (4,8%). Average confirmation time was 6 hours and message confirmation rate was between 34% and 100%.

Discussion

Adoption of the system was heterogeneous and facultative between institutions, depending on their internal policies and processes. This could explain the slow referral physician time-response and striking confirmation rate difference between them. Tracking data confirmation time allow instant feedback for future improvements.

IN232-SD-TUA5

CT Attenuation Characteristics of 3D Printed Materials

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
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CONCLUSION

Accurate 3D printing of anthropomorphic simulators and phantoms requires precise distribution of a reliable variably radiopaque material in three dimensions. Whilst no commercially available printing material can span the full range of tissue properties, especially in the softest range, cataloguing known imaging features can facilitate a diverse range of radiological projects.

Background

3D printing has exploded in popularity in recent years. In Radiology, many of its uses are related to anatomical exploration and surgical planning, but a parallel body of literature uses printing/casting for anthropomorphic simulation and phantom creation. With the proliferation of different printing technologies, the expanse of available printable materials can be overwhelming. These include thermoplastics, laser cured resins, photopolymers, and resin-bonded powders. Many of their physical properties are readily available, however, no manufacturer lists the expected radiographic properties, critical for realistic image-guided procedural phantoms. In order to provide a comprehensive library of properties for printable materials suitable for a given project, we assembled and measured the Hounsfield units (HU) from 75 of the most commonly available commercial and domestic products.

Evaluation

All scans were performed on a Siemens SOMATOM Definition AS+ scanner (Siemens, Germany) with a detector configuration of 128 x 0.6mm (flying focal spot, nominal radiation beam width of 38.4 mm) and a standard spiral head CT technique. Axial images reconstructed using a J30s kernel at a display field of view of 27.6 cm and image thickness of 5mm. Images were acquired at 80, 100, 120, and 140kV, using a 0.5 pitch and an effective mAs of 250. Circular regions of interest were used in adjacent 0.625mm sections as a means of calculating HU values with standard deviations.

Discussion

The is the largest library of the CT radiodensity of 3D printable materials. We identified multiple materials that lie within the expected HU range of human tissue, including visceral organs, bone, fat and lung. These materials can be used to create radiographically-realistic CT/X-ray/Fluoroscopic phantoms or simulators.

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IN236-SD-TUA2

Artificial Intelligence in Radiology Literature: Trends in Publication from 2008-2017

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Station #2

Participants
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PURPOSE

From detecting stroke to optimizing patient wait times, AI is rapidly gaining prominence in the field of Radiology. Using journal analysis, we seek to assess if increasing applications of AI in Radiology practice resulted in a greater representation in Radiology literature. We evaluated the trends in publication of articles related to AI in the top 20 Radiology journals from 2008-2017.

METHOD AND MATERIALS

The top 20 radiology journals were selected based on their impact factor (IF), scimagojr.com ranking, and SCOPUS 2017 Cite-Score. Journals with article data from 2008-2017 available on SCOPUS were included. All articles published by the respective journals from 2008-2017 were selected. Article information and citation statistics were collected from SCOPUS. Articles with titles, MeSH terms, or keywords that included the phrases "Artificial Intelligence", "Deep Learning", "Machine Learning", or "Neural Network" were included for analysis. These terms were analyzed in Google Trends and compared to the collective radiology journal's average yearly AI articles to assess interest over time.

RESULTS

Of the 48,260 articles published in the selected journals from 2008-2017, 280 articles met the criteria for inclusion (0.58%). The average number of AI articles per journal per year was 1.55. Academic Radiology published the most AI literature over the 10-year period with a total of 85 articles. Journal of Vascular and Interventional Radiology and Journal of Neuroradiology published the least with 0. AI articles received more citations on average, 16.7 (0-40.3), than the average overall citations of articles published by the selected journals 14.1 (5.18-30.12), but this difference was not significant (p=0.49). There was not a clear correlation in interest over time in the radiology journals (R^2 =0.0071), however interest over time showed a positive correlation in Google Trends (R^2=0.65).

CONCLUSION

AI publications among top radiology journals have not increased over time despite burgeoning developments and public interest in the application of AI in Radiology.

CLINICAL RELEVANCE/APPLICATION

Knowledge of publication trends, citation statistics, and public interest regarding the application of AI is valuable to researchers and journal publishers across all subspecialties in Radiology.

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IN240-SD-TUA6

Sustainability of an Automated CT Protocol Selection System Based on Machine Learning and Natural Language Processing

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Station #6

Participants
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PURPOSE

Radiologists may be affected by fatigue and distraction when protocolling a large number of imaging requests. The purpose was to develop an automated CT protocolling system based on natural language processing (NLP) and machine learning to support the protocolling task and evaluate the robustness against temporal variation of imaging requests over the years.

METHOD AND MATERIALS

: With REB approval, 27,281 historical imaging requests (from 2014-2018) for abdominal CT were extracted from the RIS database containing the executed imaging protocols and 16 associated patient information valuables (e.g, indication, primary diagnosis, free text comment). We extracted 258 keywords with characteristic information to identify protocols using TF-IDF (short term frequency - inverse document frequency) and created the bag of keywords features from the free text. Categorical features (one hot vectors) were extracted, and numerical features from 15 other variables were merged as input into the classification model. The classification model was trained by Multinomial Naive Bayes to classify the 9 most frequent protocols. Recursive Feature Elimination (RFE) was applied to determine the best feature set with high model accuracy and low variance. To evaluate robustness, the model was trained using the year 2014 data set and evaluated for accuracy, average precision and average recall using year 2015, 2016, 2017 and 2018 datasets.

RESULTS

For the years 2015, 2016, 2017, 2018, the accuracy of the model trained by year 2014 data was 0.75, 0.76, 0.77, 0.77, the average precision was 0.75, 0.76, 0.78, 0.78, and the average recall was 0.75, 0.76, 0.77, 0.77, respectively.

CONCLUSION

The results shows that the performance of the model built by year 2014 data set is maintained in 2015-2018 data sets. We can eliminate the noise from the free text field by TF-IDF and create the robust model against the variation of imaging requests over time.

CLINICAL RELEVANCE/APPLICATION

An automated CT protocolling system may be valuable for the radiologist by recommending appropriate protocols in abdominal CT.

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IN251-SD-TUA3

An Automated Informatics-Based Repeat/Reject Rate Algorithm for CT

Tuesday, Dec. 3 12:15PM - 12:45PM Room: IN Community, Learning Center Station #3

Participants
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Ben Viggiano, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Timothy P. Szczykutowicz, PhD, Madison, WI (*Abstract Co-Author*) Equipment support, General Electric Company; License agreement, General Electric Company; Founder, Protocolshare.org LLC; Medical Advisory Board, medInt Holdings, LLC; Consultant, General Electric Company; Consultant, Takeda Pharmaceutical Company Limited

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PURPOSE

Repeat/reject rate analysis is federally mandated in mammography and recommended by multiple organizations in radiography. Here we propose and validate an informatics based (i.e. no human interaction required) algorithm that quantifies repeated or off protocol events in CT.

METHOD AND MATERIALS

The algorithm uses dose monitoring data to identify repeats due to motion, technologist mistakes, etc. The algorithm does not require manual specification of protocols. A pattern recognition method identifies a site's gold standard exams. Repeats are identified via comparison of individual exams to these gold standards. The algorithm estimated repeat/reject rates for CT scanners from two sites using data collected over 3 years (n = 50,277 exams). Sites A and B represent a rural and academic hospital, respectively. The sensitivity of the algorithm was estimated using technologist-recorded repeats from the two sites. CT protocols were separated into three tiers based on the frequency with which they were performed. The positive predictive value (PPV) for identifying and correctly classifying repeat-containing exams (e.g. repeated overlapping helical, repeated localizers, repeated bolus tacking, etc.) in each tier was determined by manually interrogating the PACS and scanner log files record (n=2,222 exams).

RESULTS

The overall sensitivity of the algorithm to repeats performed under prevalent protocols (>20 exams over 3 years) was 95% (95% CI [95%, 99%]) and 90% (95% CI [82%, 95%]) at sites A and B, respectively. Among frequent protocols (>2% of total scan volume), the median PPV among investigated repeat types was 94.5% (range [87%, 99%]). Among common protocols (<2% and >0.5% of total scan volume) the median PPV was 96% (range [80%, 99%]), and among infrequent protocols (<0.5% of total scan volume) the median PPV was 97.5% (range [70%, 100%]).

CONCLUSION

We were able to successfully measure repeat rates for CT. Historically, this has been challenging due to the complex nature of CT ordering sets, which frequently involve multiple irradiation events and fulfilling multiple orders in a single exam. Monitoring repeats have motivated our practice to intervene for individual technologists and protocols.

CLINICAL RELEVANCE/APPLICATION

Repeats in CT burden healthcare with longer exam times (reduced patient satisfaction and revenue) and increased x-ray and contrast dose. Now our community has a method to monitor these events.

MI006-EB-TUA

Next Generation Sequencing for the Practicing Radiologist

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MI Community, Learning Center Hardcopy Backboard

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS

Next Generation Sequencing (NGS) is a technique of reading the entire genome or screening few relevant genes for aberrations. NGS sequences DNA parallelly thus resulting in reduced price and high speed of genome sequencing. For Onco-Radiologists: NGS, can detect inherited or sporadic germline mutations or acquired changes i.e. somatic mutations on tumour tissues. Identification of germline mutations helps in confirming the diagnosis, better management of diseases, prognosis and suggest preventive and surveillance measures for at risk unaffected relatives. Few radiological outcomes are spot diagnosis for a few cancer genetics syndrome. Somatic analysis of tumour biopsy helps in predicting the response of targeted therapy, prognostication and pharmacogenomics. For Ultrasonologists - For prenatal cases with abnormal USG findings, Non - Invasive Prenatal Techniques (NIPT), is a test that detects small amounts of cell free fetal DNA in the maternal bloodstream, allowing prenatal genetic diagnosis through maternal blood.

TABLE OF CONTENTS/OUTLINE

What is next generation sequencing? Germline vs somatic mutation detection Germline - applications in clinical care Somatic mutations - large gene panels - what is their use? NIPT - how can radiologists use it Imaging + genomics - the future?

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MI208-SD-TUA1

Performance of 18F Cerenkov Luminescence Detection on General Optical Imaging Devices

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MI Community, Learning Center Station #1

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PURPOSE

We aimed to examine the quantitative performance of general optical imaging devices for detecting Cerenkov luminescence.

METHOD AND MATERIALS

STF-8300M (Santa Barbara Instrument Group) and PENTAX KP (RICOH Imaging Company) cameras were used for Cerenkov luminescence imaging. RIA tubes (6 mL) were filled with 18F solution of 0.01-340 MBq/mL and placed in a light-tight box. Data acquisition was performed for 10, 30, 60, 180, and 360 seconds using the STF-8300M with binning 1 × 1, 15 × 15, and 30 × 30 and lens to tube distance of 25 cm, while that using the PENTAX KP (ISO sensitivity 819200) was similar without binning. The images were acquired to evaluate the relationship between gray value and radioactivity concentration.

RESULTS

Minimum detectable radioactivity concentration was 0.22 MBq/mL with the STF-8300M (binning 15 × 15) and 13 MBq/mL with the PENTAX KP. A relationship between radioactivity and gray value was observed in both imaging devices. Gray value closely correlated with radioactivity with STF-8300M binning 1 × 1, 15 × 15 ($R2 = 0.98$) and PENTAX KP ($R2 = 0.99$) while it did not with STF-8300M binning 30 × 30. Better quantification of performance was observed at the higher radioactivity concentration and when using longer acquisition times.

CONCLUSION

A linear relationship between radioactivity concentration and gray value was observed on general optical imaging devices, while sensitivity of Cerenkov luminescence detection was not considered to be sufficient for clinical use.

CLINICAL RELEVANCE/APPLICATION

Cerenkov luminescence imaging(CLI) is expected to make up the poor special resolution of PET and SPECT images. In addition, optical imaging devices are relatively inexpensive. CLI will be promising technique for detecting tumors.

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MI209-SD-TUA2

Simultaneously Calculation of Concentration of Contrast Media, Relaxivity, and Oxygen Extraction Fraction Using Quantitative Parameter Mapping

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MI Community, Learning Center Station #2

Participants
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PURPOSE

Our aim was to quantitatively map the concentration of contrast media (CM), relaxivity (r1), and oxygen extraction fraction (OEF) for detecting changes in tissue environment in brain diseases.

METHOD AND MATERIALS

In this study, quantitative parameter mapping (QPM), which can simultaneously create quantitative maps of T1, T2, proton density (PD), and quantitative susceptibility mapping (QSM) of brain diseases treated with or without radiation therapy (n = 6), was performed on a 3T MRI system (Hitachi, Ltd.). R1 (reciprocal of T1 map) and QSM, before and after injection, were calculated (Gd-BTDO3A; Gadovist ®). CM map of Gd-BTDO3A and subtracted map of R1 (R1sub) were calculated from QSM and R1 map before and after injection. Moreover, r1 of brain diseases was calculated from CM and R1sub (r1 = R1sub/CM). Additionally, OEF of areas surrounding the affected brain area was estimated using QSM before injection. After obtaining these quantitative maps, linear and non-linear regression analyses were performed for CM, r1, and OEF. Finally, the statistical significance of differences in the patients was calculated to compare whether changes in CM, r1, and OEF were dependent on brain diseases (P-value < 0.05).

RESULTS

The comparison between CM and R1sub maps of brain metastasis with radiotherapy is shown, demonstrating a strong correlation (R = 0.83). The non-linear regression analysis of r1 and OEF, including brain metastasis, with and without radiotherapy, showed good correlation (R2 = 0.55). The differences in CM, r1, and OEF in patients who did and did not undergo radiotherapy were statistically significant (P<0.001).

CONCLUSION

In conclusion, CM, r1, and OEF maps can measure changes in tissue environment in diseases.

CLINICAL RELEVANCE/APPLICATION

Our methods may independently evaluate CM, r1, and OEF. Moreover, QPM can not only calculate CM, r1, and OEF but also can calculate conventional weighed images such as T1w, T2w, T2* FLAIR before and after injection.

MI219-SD-TUA3

Facile Preparation of Near-Infrared Fluorescence and Magnetic Resonance Dual-Modality Imaging Probes Based on Mesoporous Organosilica Nanoparticles

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MI Community, Learning Center Station #3

Participants
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PURPOSE

Facile prepared near-infrared fluorescence and magnetic resonance dual-modality imaging probes based on mesoporous organosilica nanoparticles.

METHOD AND MATERIALS

Firstly, mesoporous organosilica nanoparticle was prepared via a surfactantassembly sol-gel process in a Stöber solution. Then, the functional molecules with fluorescence and magnetic resonance effects are connected via click reaction.

RESULTS

Fourier transform infrared (FT-IR) spectra, zeta potentials, UV-vis spectra, and energy dispersive X-ray (EDX) spectrum confirm the successful modifications of the functional molecules on the MONs. The prepared MON-Gd-Cy5.5-RGD probes shows excellent NIRF and MR imaging properties, and the relaxivity rate (r1) is measured up to 2.85 mM1 s 1. In addition, the MON-Gd-Cy5.5-RGD probes show excellent in vitro and in vivo biocompatibility. Confocal laser scanning microscopy and flow cytometry reveal that the internalization of MON-Gd-Cy5.5-RGD is significantly higher than the others. The ex vivo tumor NIRF images show stronger fluorescence intensity in the probe group, and the fluorescence intensity is significantly stronger. The tumor region exhibits a stronger signal after injection of the probe in vivo MR imaging, and a relatively greater increase in brightness than the other groups.

CONCLUSION

In this work, near-infrared fluorescence (NIRF) and magnetic resonance (MR) dual-modality imaging probes are prepared on thioetherbridged mesoporous organosilica nanoparticles (MONs) via click reaction. It shows excellent in vitro and in vivo biocompatibility. Confocal laser scanning microscopy and flow cytometry demonstrate that the MON-GdCy5.5-RGD can efficiently target to MDA-MB-231 tumor cells. Additionally, ex vivo NIFR and in vivo MR imaging demonstrate that the MON-Gd-Cy5.5-RGD probes can accumulate in tumor and improve the signals of tumor.

CLINICAL RELEVANCE/APPLICATION

We rapid prepared a near-infrared fluorescence and magnetic resonance dual-modality imaging probe by using MONs which are molecularly incorporated with thioether groups in the frameworks, bring unusual properties such as chemical stability, easily modification via organic reaction, and excellent biocompatibility.

MI220-SD-TUA4

In Vivo Multimodal Imaging and Phototherapy of Triple-Negative Breast Cancer Using a Cathepsin B-Activated Probe

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MI Community, Learning Center Station #4

Participants
Yanshu Wang, Shanghai, China (*Presenter*) Nothing to Disclose
Defan Yao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Triple-negative breast cancer (TNBC) is considered incurable with currently available treatments. In light of upregulated cathepsin-B (CTSB) in TNBC, a targeted near-infrared activatable MRI/fluorescent /photoacoustic (MRI/NIR FL/PA) probe (Pep-SQ@USPIO) is synthesized for the selective detection of TNBC-derived CTSB and followed with photothermal/photodynamic therapy (PTT/PDT).

METHOD AND MATERIALS

Pep-SQ@USPIO based on USPIO core modified with Pep-SQ. The sequence of Pep-SQ consisted of two moieties: the first moiety is TNBC targeted peptide (Pep) which labelled with a green fluorescent group, naphthalimide; the sencond moiety is an NIR fluorescent dye (SQ), of which it's essential properties of NIR FL/PA imaging and PTT/PDT. The two moieties linked via a CTSB-activated peptide. Transmission electron microscopy images, hydrodynamic size profiles, and absorption spectra of Pep-SQ@USPIO were acquired before and after addition of CTSB at different periods of time. After incubation with probe, MDA-MB-231 and MCF-7 cells fluorescence images were obtained with a confocal microscope. Test Pep-SQ@USPIO toxicity with or without laser irradiation by CCK-8 assay and singlet oxygen generation. The in vivo imaging application and antitumor efficacy are evaluate by injecting Pep-SQ@USPIO into tumor bearing mice.

RESULTS

T1 and T2 relaxivity values of Pep-SQ@USPIO were measured to be 9.49 and 39.11 mM-1.s-1, respectively. Pep-SQ@USPIO itself can produce ROS as a PDT agent. After undergoing CTSB-triggered degradation, the activated probes recover the quenched NIR FL signal with response, and their self-assemble in situ significantly enhances PTT efficacy. Pep-SQ@USPIO against the CTSB-high MDA-MB-231 cells with a lower IC50 compared to CTSB-low MCF-7 cells ($p<0.05$). Pep-SQ@USPIO was also successfully applied to the in vivo imaging and phototherapy of tumors.

CONCLUSION

Pep-SQ@USPIO can act as MRI and PDT agent. Triggered by CTSB, the probe can recover the quenched NIR FL signal and provide an enhanced photothermal conversion behavior, which enables NIR FL/PA imaging of CTSB activtity and aggregation enhanced PTT of TNBC.

CLINICAL RELEVANCE/APPLICATION

This tumor-specific theranostic probes can precisely diagnose and exerts further selective treatment, which may address challenges faced by traditional medicine of TNBC.

MK315-ED-TUA8

Patell-It Like It Is: A Multimodality Image-Based Guide of Patellofemoral Disorders for Radiologists

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #8

Participants
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TEACHING POINTS

1. Review the anatomy of the patellofemoral articulation including its tendinous and ligamentous stabilizers 2. Review the clinical presentation of the spectrum of patellofemoral disorders 3. Discuss the causes of patellofemoral pathology including biomechanical, degenerative, and miscellaneous etiologies 4. Multimodality imaging overview of patellofemoral disorders including common measurements 5. Overview of orthopedic management of biomechanical pathologies

TABLE OF CONTENTS/OUTLINE

Background Patellofemoral image-based anatomy review Clinical presentation of patellofemoral pathology Spectrum of pathology Biomechanical/Traumatic Degenerative Neoplastic/Variant anatomy Pertinent measurements Insall-Salvati ratio TT-TG distance Trochlear depth Q angle Management Physical therapy MPFL reconstruction Trochleoplasty Medialization of tibial tuberosity Medial capsular plication

MK316-ED-TUA9

Clinical Applications of Dual Energy Computed Tomography in Musculoskeletal Imaging: Detection of Gout, Bone Marrow Edema, and Application in Skeletal Surveys

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #9

Participants
Meaghan Woo, MD, Winnipeg, MB (*Presenter*) Nothing to Disclose
Laurence D. Stillwater, MD , Winnipeg, MB (*Abstract Co-Author*) Nothing to Disclose
James K. Koenig, MD, FRCPC, West St Paul, MB (*Abstract Co-Author*) Nothing to Disclose
Iain D. Kirkpatrick, MD, Winnipeg, MB (*Abstract Co-Author*) Speaker, Siemens AG

TEACHING POINTS

The purpose of this exhibit is to: 1. Briefly review the principles and acquisition methods of dual energy computed tomography (DECT). 2. Describe the clinical utility of DECT in the identification of urate deposition in gout. 3. Review how bone marrow analysis in DECT can increase the sensitivity for detecting fractures. 4. Outline the advantages of using DECT to identify focal bone lesions in skeletal surveys.

TABLE OF CONTENTS/OUTLINE

1. Introduction to DECT 2. Describe the utility and advantages of DECT with regards to: 2 (a) Arthritis - Gout and detecting urate deposition 2 (b) Trauma - Bone marrow analysis to detect edema at fracture sites 2 (c) Skeletal survey - Detection of focal bone lesions 3. Sample cases with multimodality comparison 3 (a) Arthritis 3 (b) Trauma 3 (c) Skeletal Surveys 4. Summary

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MK317-ED-TUA10

Ultrasound (US) Imaging of Rectus Abdominis Muscles Diastasis: Methodology, Findings, and Practical Role

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #10

Participants
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Antonio Nunziata, MD, Naples, Italy (*Presenter*) Nothing to Disclose
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TEACHING POINTS

The educational focus of this exhibit is threefold. To illustrate how to perform an appropriate US assessment of rectus abdominis muscles diastasis. To explain the abnormal findings. To highlight the role of US in the practical patient management and in the pre-surgical assessment.

TABLE OF CONTENTS/OUTLINE

. Patient is placed supine, with the head slightly extended, the upper limbs along the trunk, and the knees slightly flexed. US is performed with high-frequency, linear transducers. Trapezoid field-of-view and extended field-of-view option are useful to measure high degrees of diastasis. The thickness and structure of the rectus muscles is initially evaluated. Then, the distance (margin to margin) between the muscles is measured at rest, both 2 cm above the navel and 3 cm below. The entire midline is finally checked, both at rest and during the Valsalva maneuver, to rule out any hernia. US can show the normal thickness or the thinning of the rectus muscles, can demonstrate and measure accurately an abnormal (>2 cm) midline diastasis of the muscles (above the navel, below the navel, or both), and can detect median hernias. US assessment is useful for the patient, to have a confirmation of the abnormality and to be aware of what exercises to do and what to avoid. US is also valuable for the surgeon to plan the abdominoplasty.

MK318-ED-TUA11

Dual-Energy CT for Bone Marrow Imaging: "How To Do It"

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #11

Participants
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Aleksander Kosmala, Wurzburg, Germany (*Abstract Co-Author*) Research Cooperation, Siemens AG ; Research Consultant, Siemens AG
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TEACHING POINTS

To review the indications, contraindications and limitations of dual-energy computed tomography (DECT) in bone marrow imaging. To learn about the basic physical principles of DECT imaging with emphasis on bone marrow applications. To interpret dual-energy bone marrow CT scans of healthy subjects, patients with acute fractures or malignant bone marrow infiltration. To highlight the potential benefits of a dual-energy investigation as a comprehensive examination of osseous morphology and additional bone marrow information.

TABLE OF CONTENTS/OUTLINE

A. Basic principles of dual-energy computed tomography. B. Technical differences in data acquisition: Single-Source (Dual-layer detector; Twin-Beam) vs. Dual-Source scanners (differences between 1st-3rd generation dual-source scanners). C. Post-processing: Material-decomposition algorithm, creation of VNCa ('virtual non-calcium') images. D. Data acquisition: Parameter settings for dual-energy CT. E. Current applications of DECT for the detection of acute fractures: examples in the spine, pelvis and extremities. F. Current applications of DECT for the detection of malignant bone marrow infiltrations (e.g. in multiple myeloma): examples in the spine, pelvis and extremities. G. Pitfalls of dual-energy bone marrow imaging; limitations of DECT; alternative imaging modalities.

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MK361-SD-TUA1

Increased Bone Marrow Density on Unenhanced CT in Patients with Acute Myeloid Leukemia

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #1

Participants
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PURPOSE

Although the diagnosis of leukemia is usually made by peripheral blood and bone marrow blasts, CT examination is occasionally performed due to non-specific symptoms, such as malaise and fever. While it has been reported that increased bone marrow CT attenuation due to bone marrow reconversion can be detected before peripheral blood abnormality in patients with AML, the actual threshold of the CT attenuation value (AV) to suspect it has not been reported. The purpose of this study was to determine whether unenhanced CT AV of bone marrow could be used for suspecting AML.

METHOD AND MATERIALS

We retrospectively reviewed patients with AML from 2010 to 2018 who underwent pretreatment unenhanced CT in our hospital. The inclusion criteria were: >20 years old, unenhanced CT of the body was performed before treatment, and final diagnosis of AML was made by bone marrow biopsy. As a control group, patients without any hematologic disease were randomly selected. CT AVs were measured in both iliac bones with circular region-of-interest on unenhanced CT (5mm thickness). Receiver operating characteristic (ROC) curve analysis was performed, and Student's t test and Steel-Dwass' test were also used for a statistical analysis.

RESULTS

A total of 15 AML patients consisted of 10 patients diagnosed before CT (diagnosed AML group) and five patients diagnosed after CT (undiagnosed AML group) met criteria. The mean AV of iliac bone of diagnosed AML group (155.0 +/- 51.8 HU) and that of undiagnosed AML group (137.3 +/- 9.6) were significantly higher than that of control group (16.8 +/- 41.5, $p < 0.01$). The mean AV did not differ between the diagnosed and undiagnosed AML groups. The sensitivity and specificity for the diagnosis of AML were 100% and 93% at threshold value of 86 HU.

CONCLUSION

CT AV of iliac bone was elevated in patients with AML, and should be checked even when AML is not specifically suspected.

CLINICAL RELEVANCE/APPLICATION

CT attenuation value of iliac bone is valuable information in the diagnosis of AML.

MK362-SD-TUA2

The Efficacy of Ultrasound-Guided Suprascapular Nerve Radiofrequency Ablation in the Treatment of Chronic Shoulder Pain

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #2

Participants
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PURPOSE

Ultrasound guided radiofrequency ablation (RFA) of suprascapular nerve is an alternative to surgery for treatment of chronic shoulder pain. The aim of this study is to evaluate the efficacy of this procedure in relieving the pain in patients affected by chronic shoulder pain.

METHOD AND MATERIALS

This is a retrospective study for all ultrasound guided suprascapular nerve radiofrequency ablations performed at our institution between April 2013 and April 2018. The standard criteria for patients to be considered for RFA in our institution is to have chronic shoulder pain, which is not settling with pain relief optimisation, and show a favourable response to diagnostic suprascapular nerve block. All the ultrasound guided RFA were performed by MSK Radiologists as an outpatient procedure under local anaesthetic. The patients were issued with a pain diary, using a pain score system, to complete over the subsequent two weeks. The efficacy of RFA was evaluated by identifying the proportion of patients who had significant reduction in pain after RFA, the mean pain score reduction after the procedure and the mean time interval between consecutive ablations.

RESULTS

139 ultrasound guided RFA procedures were performed. A significant pain reduction was observed in 86% of the radiofrequency ablations. The mean pain score reduction after the procedure was 7.7 and the mean time interval between consecutive ablations was11 months.

CONCLUSION

Ultrasound guided radiofrequency ablation of the suprascapular nerve is an effective treatment in patients affected by chronic shoulder pain and it provides a relatively long period of pain relief.

CLINICAL RELEVANCE/APPLICATION

Ultrasound guided suprascapular nerve radiofrequency ablation is an effective method in the treatment of chronic shoulder pain.

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MK363-SD-TUA3

Diagnostic Value of Dual-Energy CT Virtual Non-Calcification for Occult Fracture of Knee Joint

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #3

FDA Discussions may include off-label uses.

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PURPOSE

To evaluate the diagnostic value of dual energy CT(DECT) virtual non-calcification (VNCa) in occult knee fractures.

METHOD AND MATERIALS

Thirty patients with a definite history of trauma and knee movement disorder who were clinically diagnosed as occult knee fractures were prospectively collected and sequentially underwent DECT and MRI of the knee.Each knee were divided into 12 zones(distal femoral and proximal tibia were divided into 6 zones respectively), two independent readers evaluated conventional CT and VNCa images for the present of bone marrow injury.The knee joint was detected on the coronal image, VNCa CT value of normal and injured bone marrow were performed, and the difference between the two CT values was calculated.MR images were used as the reference standard to evaluate the ability of subjective evaluation and CT difference to detect occult fractures of the knee joint.The sensitivity and specificity of the above two methods for bone marrow injury of knee joint were observed by ROC curve.Kappa values were used to test the consistency of diagnosis of bone marrow injury by two radiologists.

RESULTS

There were 360 zones in 30 knee joints.MRI showed that 11 cases of distal femur(54/132) area in the bone marrow damage, 22 cases of proximal tibia (136/264) damage area in bone marrow and marrow damage area on T1WI sequences showed irregular shape, low signal of the linear fuzzy shadow,while PDWI FS sequence was slightly higher or high signal.The virtual non-calcification diagram showed bone marrow damage in 11 cases of distal femur (58/132) and 22 cases of proximal tibia (138/264). The VNCa diagram showed flak-like high-density shadows with unclear boundaries in the black background.VNCa difference revealed bone marrow damage in 11 cases of distal femur (53/123) and 22 cases of proximal tibia (137/264).The subjective evaluation and CT values in VNCa images were consistent with MRI imaging respectively (the Kappa values were 0.829 and 0.867, respectively).The AUC, sensitivity, specificity and accuracy of subjective evaluation and CT difference evaluation were 0.876 and 0.885, 92.1% and 90.3%, 89.3% and 92.4%, 87.6% and 93.1%, respectively.

CONCLUSION

VNCa dual-energy imaging has excellent diagnostic performance for evaluating occult knee fractures with a high consistency of MRI imaging.

CLINICAL RELEVANCE/APPLICATION

VNCa dual-energy imaging provides a reference for clinical diagnosis of occult fractures.

MK396-SD-TUA4

High Resolution Ultrasound in Sub-clinical Diabetic Neuropathy: A Potential Screening Tool

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #4

Participants
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Siddharth Maheshwari, Delhi, India (*Abstract Co-Author*) Nothing to Disclose
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Shiva Narang, Delhi , India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In recent years research has shifted to early detection of diabetic neuropathy. Various screening methods include tuning forks, monofilaments testing and nerve conduction studies (NCS).High resolution sonography (HRUS) has emerged as a promising technique for evaluation of peripheral nerves.The aim of this study was to assess the utility of HRUS in screening diabetic patients for subclinical neuropathy.

METHOD AND MATERIALS

29 Type II diabetic patients without clinical features of neuropathy and with normal NCS were recruited along with 30 healthy controls. Institutional ethical committee approval and informed consent were obtained.Nerve sonography was performed by two MSK radiologists independently who were blinded to the group status of the subjects.Nerves studied were median (at elbow and wrist), ulnar (cubital tunnel & guyon's canal), common peroneal (fibular head) and posterior tibial nerve (at medial malleolus).The size [cross sectional area (CSA) in mm2], shape, echogenicity and morphology of each nerve was assessed and compared between the two groups using relevant statistical tests.

RESULTS

A significantly higher CSA was present in diabetics compared to controls at all sites examined. Mean for median nerve was 8.4 vs.5.2 and for ulnar was 4.8 vs 3.1 at elbow (p value < 0.001 for both). For common peroneal CSA was 7.7 vs 3.7 and for posterior tibial 4.9 vs 3.0 (p <0.001). The nerves in diabetics were more rounded (68.9% vs 50% for median, 58.6% vs 36.6% for ulnar), more hypoechoic (24.1% vs 20% for common peroneal) and revealed an altered morphology in higher percentage of cases (51.7% vs 33.3% for median nerve at elbow). ROC curves revealed high area under curve for all nerves (0.942 for ulnar and 0.962 for common peroneal); common peroneal nerve with a cut off CSA of 5.5mm2 had the highest sensitivity (80%) and specificity (96%) for detecting nerve changes. Interobserver agreement was excellent. (ICC >= 0.9:all nerves)

CONCLUSION

HRUS detected nerve changes in asymptomatic diabetics with good accuracy and had an excellent Interobserver agreement. It, thus, can be a potential screening tool for detection of neuropathy in subclinical stage.

CLINICAL RELEVANCE/APPLICATION

Sonographic nerve changes in asymptomatic diabetics depict that morphological alterations in nerves precede clinical symptoms. Detection of subclinical neuropathy can aid in timely intervention and dedicated care to reduce disease progression and morbidity.

MK397-SD-TUA5

Quantitative MRI Detects Muscle Recovery?

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #5

Participants
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PURPOSE

Determine time course changes in Diffusion Tensor Imaging (DTI) parameters in injured hamstring muscles.

METHOD AND MATERIALS

20 injured athletes (18 males, 2 females, average age 27.8±7) underwent MRI examination within 1 week after their hamstring injury, 2 weeks after time point 1 and at return to play (RTP). RTP means full training at pre-injury level. MRI datasets were acquired with a 3T Philips Ingenia MRI scanner. DTI: spin echo- echo planar imaging sequence, multiple b-values for Intra Voxel Incoherent Motion (IVIM) correction, duration: 11.08 min. DTI data was processed using DTITools for Wolfram Mathematica and manual segmentation of the injured muscle was performed in ITK-snap. ROI's consisted of 7 slices (35mm) overlaying the origin of the injury. The DTI parameters, Mean Diffusivity (MD) and Radial Diffusivity (RD), were calculated for each subject at each time point. A linear mixed model was used to determine differences in RD and MD between time points. Statistical significance level was set to $p<0.025$. Subsequently, post-hoc analysis was performed to determine which time points caused the differences.

RESULTS

The following hamstring muscles were injured: 8 left and 10 right biceps femoris long head muscle, 1 left and 1 right semimembranosus muscle. Six subjects were measured at 3 time points, 14 subjects were measured at 2 time points. 8 of the 14 subjects with 2 time points were loss to follow up for the RTP time point. The other 6 subjects already reached RTP by time point 2, or reached RTP within 10 days of time point 2. Both DTI parameters declined during the recovery period. A significant overall time effect was found for both MD ($P<0.01$) and RD (P:0.01). MD declined significantly between time points 1 and 2 ($P<0.01$), between time points 1 and 3 (P:0.01) but not between time point 2 and 3 (P:0.32). RD declined significantly between time points 1 and 2 ($P<0.01$), but not between time points 1 and 3 (P:0.05) and time point 2 and 3 (P:0.41). The small number of subjects with 3 time points is likely the cause of the non-significant results between time points 2 and 3.

CONCLUSION

DTI is able to detect time course changes in injured hamstring muscles, potentially reflecting recovery.

CLINICAL RELEVANCE/APPLICATION

Research has shown that conventional T2-weighted MR sequences fail in assessing muscle recovery. DTI seems more sensitive to microstructural changes and could change how we assess muscle injuries.

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MK398-SD-TUA6

Lateral Femoral Condyle Insufficiency Fractures: Associated Morphological Findings

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #6

Participants
Terence P. Farrell, MBBCh,FFR(RCSI), Philadelphia, PA (*Presenter*) Nothing to Disclose
Diane M. Deely, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Medial femoral condyle insufficiency fractures (MFCIF) are strongly associated with medial meniscal tears and medial compartment chondrosis. Lateral femoral condyle insufficiency fractures (LFCIF) are less frequent and have not been systematically reviewed. We hypothesise that LFCIF are less frequently associated with meniscal tears and chondrosis in the lateral compartment. The purpose of this study is to evaluate the MRI characteristics of LFCIF and their associated morphological findings.

METHOD AND MATERIALS

A retrospective review of consecutive patients with LFCIF on MRI was performed after excluding post-traumatic and pathological fractures. Morphological findings including lesion size/location, presence of bone marrow and soft tissue edema, chondrosis grade and associated meniscal pathology were classified by two musculoskeletal radiologists. Previous MRIs and available DEXA scans were reviewed.

RESULTS

105 consecutive patients (56 female, 49 male) with LFCIF were included (age range 17-86 yrs, median 59 yrs), representing the largest reported population. Central weight bearing (61%) and lateral (55%) locations for LFCIF were most prevalent. Most patients had an associated meniscal tear/s (65%) with medial tears (48%) more prevalent than lateral tears (41%, p=0.4). High grade chondrosis (grade 3/4) was present in 63% with no difference in prevalence between compartments. Bone marrow edema was present in all cases and soft tissue edema was present in 83%. 29% of cases progressed to osteonecrosis with increasing age a significant risk factor for progression (p=0.04). 11 subjects with LFCIF previously had a MFCIF at MRI (shifting bone marrow edema). Osteopenia was present in 2/3 of patients.

CONCLUSION

Meniscal tears and high grade chondrosis are highly prevalent findings with LFCIF. Unlike MFCIF these occur in similar prevalence both medially and laterally suggesting that LFCIF occur in the presence of more global knee pathology potentially resulting in increased stress applied to the normally less weight bearing lateral compartment. 2/3 of patients were osteopenic highlighting the role of weakened bone in the pathogenesis of LFCIF.

CLINICAL RELEVANCE/APPLICATION

This is the largest reported series of LFCIF and demonstrates different morphology to MFCIF which suggests that LFCIF develop in the presence of more global knee pathology with altered biomechanics.

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MK399-SD-TUA7

Differentiation of Benign and Malignant Vertebral Fracture on MR Using ResNet Deep Learning Compared to Radiologist's Reading

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MK Community, Learning Center Station #7

Awards
Trainee Research Prize - Medical Student

Participants
Yang Zhang, Irvine, CA (*Presenter*) Nothing to Disclose
Lee-Ren Yeh, MD, Kaohsiung, Taiwan (*Abstract Co-Author*) Nothing to Disclose
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Ning Lang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate the diagnostic performance of deep learning in differentiation of benign and malignant vertebral fracture on MR, compared to the reading of an experienced radiologist.

METHOD AND MATERIALS

A dataset of 137 benign and 53 malignant vertebral fracture from one hospital was used as the training dataset. The abnormal region on T2W sagittal images was marked as the ROI, and the smallest square bounding box containing the entire affected vertebra was used as input for deep learning, using ResNet50. The box was mapped to T1W, and the input included both T1W and T2W of the slice combined with its two neighboring slices. The performance was evaluated using 10-fold cross-validation. After obtaining the malignancy probability for each slice, the highest probability among all slices of one patient was used as the probability for that patient. An experienced radiologist performed reading, and gave the score of 0 or 1 for 20 features, as well as a final diagnostic impression. The developed model using ResNet50 was applied to a second independent dataset of 94 benign and 105 malignant patients from another hospital for testing.

RESULTS

The radiologist's diagnostic accuracy=0.96. When using the scores of 20 features to build a logistic regression model, the accuracy=0.92. In deep learning using ResNet50, the per-slice accuracy=0.83, and per-patient accuracy=0.92. For the testing in the second independent dataset, the matrix size of image was found to have a great influence on the performance. When using images of the same 512x512 matrix as in the training set, the accuracy was 0.81 for per-slice diagnosis and 0.77 for per-patient diagnosis. But, when the matrix size was changed to 384x384, the per-patient accuracy became much lower to 0.68. When including one additional convolutional layer for adaptive pre-processing, the pre-patient accuracy was improved to 0.75.

CONCLUSION

Deep learning using ResNet50 achieved a good diagnostic accuracy for differentiating benign from malignant fracture using T1W and T2W MRI. The image matrix size or spatial resolution needs to be considered in designing algorithms to improve the robustness of the diagnostic model.

CLINICAL RELEVANCE/APPLICATION

Deep learning using ResNet architecture by considering T1W and T2W of the abnormal slice with adjacent neighboring slices yielded a high accuracy in diagnosis of benign and malignant fracture on MR.

MS225-ED-TUA1

The Power of Affirmation: A Radiologist's Primer on Gender Affirmation Surgeries and Complications

Tuesday, Dec. 3 12:15PM - 12:45PM Room: MS Community, Learning Center Station #1

Participants
Florence X. Doo, MD, New York, NY (*Presenter*) Nothing to Disclose
Azita S. Khorsandi, MD, Manhattan, NY (*Abstract Co-Author*) Nothing to Disclose
Bella Avanessian, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Marci Bowers, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mark A. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Venkata S. Katabathina, MD, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Alexander S. Somwaru, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

We display multimodality imaging findings of the major components of gender affirmation surgeries: genital reconstruction, body contouring, and maxillofacial contouring. We highlight key imaging findings of gender affirmation surgeries to familiarize radiologists with post-surgical anatomy and unique complications to ensure accurate interpretations and guide pre- and post-operative management.

TABLE OF CONTENTS/OUTLINE

The revision of International Classification of Diseases (ICD-11) defines gender incongruence as 'a marked and persistent incongruence between an individual's experienced gender and the assigned sex.' Gender affirmation surgery is a treatment option that can be tailored to match the gender identity to the patient. Radiologists must be able to recognize post-surgical anatomy and unique complications of these surgeries. We use multidisciplinary cases with multiple imaging modalities to illustrate the major areas of gender affirmation surgeries: genital reconstruction (vaginoplasty; metoidoplasty/phalloplasty); body contouring; maxillofacial contouring (frontal sinus and maxillofacial osteotomies, thyroid cartilage modification, mentoplasty). Key anatomy, select complications, and management are discussed. The authors include Plastics and Uroynecological surgeons with gender affirmation surgical expertise.

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NM131-ED-TUA6

Histiocytoses and Neoplasms of the Macrophage-Dendritic Cell Lineages: Multimodality Imaging with PET/CT Emphasis

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NM Community, Learning Center Station #6

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Kenneth N. Huynh, BS, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1.To present the revised classification of histiocytoses and neoplasms of macrophage-dendritic cell lineage with five main groups: Group L: Langerhans cell histiocytosis (LCH) and Erdheim-Chester disease, Group C: Non-LCH of skin and mucosa, Group R: Rosai-Dorfman disease, Group M: Malignant histiocytoses, and Group H: hemophagocytic lymphohistiocytosis. 2.To review the anatomic and functional imaging of these five groups with emphasis on PET/CT impact of staging and post-therapeutic surveillance.

TABLE OF CONTENTS/OUTLINE

The histiocytoses are rare disorders characterized by the accumulation of cells thought to be derived from dendritic cells or macrophages. The first classification of histiocytosis consisted of 3 categories: Langerhans cell (LC) or non-LC-related groups, and malignant histiocytoses. The revised classification has 5 groups mentioned above. The educational exhibit has two components: (1) introduction and discussion of the revised classification with the related physiopathology of the 5 main groups, and (2) the multi-imaging of each of these five categories of lesions on cross-sectional imaging and PET/CT. All the common and unusual sites of the lesions are reviewed and discussed.

NM132-ED-TUA7

Spectrum of Incidental Vascular Findings on 18F-FDG PET/CT Imaging

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NM Community, Learning Center Station #7

Awards
Identified for RadioGraphics

Participants
Gaurav V. Watane, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose
Hyewon Hyun, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Robertson, MD, Cambridge, MA (*Abstract Co-Author*) Stockholder, CRISPR Therapeutics; Stockholder, Gossamer Bio, Inc

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TEACHING POINTS

1. To become familiar with various emergent and non-emergent vascular findings observed on oncologic and non-oncologic PET/CT scans 2. To gain awareness of the current role and limitations of PET/CT in vascular imaging.

TABLE OF CONTENTS/OUTLINE

1. Case based review of the spectrum of clinically relevant incidental vascular findings detected on PET/CT; including drug induced vasculitis, large vessel vasculitis, pulmonary infarction, thrombophlebitis, post-surgical complications related to graft repair and inadvertent vascular injury. 2. Current status of the PET/CT in vascular imaging with emphasis on inflammatory vasculitis 3. Limitations of the PET/CT in vascular imaging.

NM212-SD-TUA1

Relationship between Decreased Cerebral Blood Flow in 123I-IMP SPECT and the Severity of Postoperative Memory Impairment of Anterior Communicating Artery Aneurysm: A Pilot Study

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NM Community, Learning Center Station #1

Participants
Shunji Mugikura, MD, PhD, Sendai, Japan (*Presenter*) Nothing to Disclose
Naoko Mori, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Kei Takase, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent MR imaging studies have suggested that the occlusion of the subcallosal artery, a largest unpaired artery from the anterior communicating artery (ACoA) could cause memory impairment following ACoA aneurysmal surgery. The purpose of this study is to examine whether decreased regional cerebral blood flow (rCBF) in the territory of subcallosal artery related to the severity of postoperative memory impairment.

METHOD AND MATERIALS

10 consecutive patients diagnosed with postoperative memory impairment by the formal neuropsychological tests underwent 123I-IMP-SPECT in a median of 4 months after the ACoA aneurysmal surgery. The rCBF map was imaged and regional voxel data analyzed by three-dimensional stereotactic surface projection were compared between the 10 patients and 13 age-matched normal subjects. The severity of decreased rCBF was calculated as average Z-value of the coordinates with a Z-value exceeding the threshold (Z-value=2). The cerebral lobes with rCBF representing Z value >2 in all patients were identified. Then in such lobes, the Z-values of the detailed gyri were compared with the memory quotients (MQs) by Wechsler Memory Scale -Revised. $P<0.01$ was considered significant.

RESULTS

In the right subcallosal gyrus, there was a significant negative correlation between the Z-value and visual MQ ($\rho=-0.88$, $p=0.0007$) or general MQ ($\rho=-0.85$, $p=0.0017$). In the right anterior cingulate gyrus, there was a significant negative correlation between the Z-value and verbal MQ ($\rho=-0.76$, $p=0.0092$) . In the right rectal gyrus, there was a significant negative correlation between the Z-value and general MQ ($\rho=-0.81$, $p=0.0044$). No significant correlation was found between Z-value in other brain region and verbal, visual or general MQ.

CONCLUSION

Our preliminary results showed that the severity of decreased rCBF in the subcallosal gyrus and anterior cingulate gyrus perfused by the subcallosal artery and that in the rectal gyrus in the right hemisphere are related to the severity of postoperative memory impairment of ACoA aneurysmal surgery.

CLINICAL RELEVANCE/APPLICATION

The decreased rCBF in the subcallosal gyrus, anterior cingulate gyrus and rectal gyrus in the right by 123I-IMP-SPECT suggested severe memory impairment following ACoA aneurysmal surgery

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NM213-SD-TUA2

The Utility of FDG-PET/CT in the Staging and Restaging of Orbital Malignancies

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NM Community, Learning Center Station #2

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
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PURPOSE

Over the past decade, we have performed FDG-PET/CT imaging on patients referred by the Ocular Oncology Department of our associated Ophthalmology Hospital. Our goal was to evaluate the role of FDG-PET/CT in the initial staging and restaging of the various ocular/orbital neoplasms, as well as its role in the response to therapy.

METHOD AND MATERIALS

Our study is the both retrospective and prospective. From 2008 through 2018, a total of 56 patients with varying orbital malignancies underwent FDG-PET/CT imaging for either initial staging prior to surgery, or for follow-up after excision and treatment. Follow-up was obtained in all but one patient (who was lost to follow-up) via review of medical records and attendance at tumor boards.

RESULTS

In all 55 patients, FDG accumulated in the primary tumor, with a sensitivity of 100%. These included lacrimal duct cancers, invasive squamous cell tumors, lymphoma, uveal melanoma, basal cell cancers, uveal schwannoma, high-grade sebaceous gland tumors, plasmacytoma, ethesioneuroblastoma, poorly-differentiated adenocarcinoma, undifferentiated adenocarcinoma, and neuroendocrine tumors. PET/CT was requested for initial staging, restaging of recurrent disease, and response to therapy. In 5 patients, PET/CT detected metastases that were not identified or unappreciated on CT. In addition, in 3 patients, PET/CT localized additional metastases outside of the field of view of CT and MRI, thereby upstaging the tumors.

CONCLUSION

In our series of 55 patients, FDG-PET/CT is 100% sensitive in detection of orbital malignancies, and is an excellent tool for the detection of metastases. Moreover, PET/CT can be potentially more sensitive than anatomical cross-sectional imaging in disease staging.

CLINICAL RELEVANCE/APPLICATION

FDG-PET/CT is a highly reliable imaging modality in the staging and restaging of orbital neoplasms, and plays a key role in monitoring treatment response, all of which impacts patient management.

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NM214-SD-TUA3

Correlation between 99m Tc-PYP Cardiac Accumulation Using SPECT/CT PYP Cardiac Accumulation and Cardiac Disturbance in Familial Amyloid Polyneuropathy Patients with Cardiac Amyloidosis

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NM Community, Learning Center Station #3

Participants
Kouji Ogasawara, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Shinya Shiraishi, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
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Osamu Ikeda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

The usefulness of 99m Tc-PYP for the diagnosis of ATTR-type cardiac amyloidosis is widely recognized. In cases with advanced amyloidosis, it is reported the degree of 99m Tc-PYP accumulation to the myocardium does not accurately reflect the disease state. However, in familial amyloid polyneuropathy (FAP) patients, there is no report evaluating the correlation between 99m Tc-PYP accumulation and cardiac disturbance. The purpose of this study is to clarify the association between the degree of correlation between 99m Tc-PYP cardiac accumulation using SPECT/CT PYP cardiac accumulation and cardiac disturbance in FAP patients with cardiac amyloidosis.

METHOD AND MATERIALS

The subjects consisted of 63 FAP patients who underwent 99mTc-PYP scintigraphy and SPECT/CT. We assessed the degree of 99mTc-PYP myocardial accumulation in both planar and SPECT / CT images using visual and quantitative indicators. Quantitative indicators for planar images used the heart-to-contralateral chest ratio (H / CL ratio), and the indicators for the SPECT / CT, images were the maximum LV wall thickness-to- LV lumen ratio (LVW / LVL ratio). The left ventricular ejection fraction, left ventricular septum thickness, left ventricular posterior wall thickness, and age were used as indicators of the degree of cardiac dysfunction.

RESULTS

The indices of each 99mTc-PYP scintigraphy were correlated with the left ventricular ejection fraction, left ventricular septum thickness, left ventricular posterior wall thickness and age. (in visual analyses using planar images: LVEF, correlation coefficient (r)=-0.353, p=0.004; IVST, r=0.710, p<0.001; PLVW, r=0.675, p<0.001, age, r=0.550, p<0.001, in quantitative analyses using planar images: LVEF, r=-0.271, p=0.032; IVST, r=0.656, p<0.001; PLVW, r=0.637, p<0.001; age, r=0.503, p<;0.001; in visual analyses using SPECT/CT images: LVEF, r=-0.366, p=0.003; IVST, r=0.689, p<0.001; PLVW, r=0.716, p<0.001; age, r=0.535, p<0.001; in quantitative analyses using SPECT/CT images: LVEF, r=-0.323, IVST, r=0.723, p<0.001; PLVW, r=0.742, p<0.001; age, r=0.504, p<0.001)

CONCLUSION

Our findings suggested that 99mTc-PYP cardiac accumulation is related to the cardiac dysfunction in FAP patients with cardiac amyloidosis. Also, the SPECT / CT indices were more sensitive than the planar image indexes.

CLINICAL RELEVANCE/APPLICATION

99m Tc-PYP may de noticed ATTR cardiac amyloidosis before developing heart failure. This would have clinical relevance.

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NM240-SD-TUA4

Impact of PET/CT on Clinical Management in Patients with Cancer of Unknown Primary

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NM Community, Learning Center Station #4

Participants
Christian P. Reinert, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
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Christian La Fougere, Tubingen , Germany (*Abstract Co-Author*) Nothing to Disclose
Christina Pfannenberg, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate the impact of PET/CT on clinical management decisions in patients with Cancer of Unknown Primary (CUP).

METHOD AND MATERIALS

A cohort of patients with CUP undergoing clinically indicated PET/CT was prospectively enrolled in a local PET/CT registry study between 01/2013 to 06/2018. Questionnaire data from referring physicians on intended patient management before and after PET/CT were recorded. The questionnaire included items on PET/CT indication (primary staging, re-staging, lesion characterization), intended diagnostic procedures (biopsy, additional imaging), and intended treatment concept (no treatment plan, curative treatment, palliative treatment, watchful waiting). Changes in management before and after PET/CT were analyzed. Patient outcome was measured as overall survival from initial diagnosis and drawn from available patient records.

RESULTS

155 patients (53 female; 63.4±12.1y) with CUP were included. PET/CT detected the primary in 36 patients (23.7%). Intended treatment concepts were changed in 74 patients (47.7%) on the basis of PET/CT results. The treatment plan changed from 'curative' or 'no treatment plan' before PET/CT to 'palliative' in 28 patients (18.1%) and from 'no treatment plan' to a 'curative' concept in 15 patients (9.7%). Minor therapy adjustments without change of treatment goal were documented in 30 patients (19.4%). Additional invasive procedures and imaging (CT, MRI) were intended in 40 (25.8%) and 98 (63.2%) patients before PET/CT and in 21 (13.5%) and 10 (6.5%) patients after PET/CT. Overall patient survival was significantly longer in patients with one CUP manifestation (4.6±0.4y) compared to patients with 2-3 (2.8±0.4y) or more than 3 manifestations (2.4±.4y)(p=.001). Patients with cervical CUP manifestations showed a significantly longer survival (4.3±0.3y) than patients with extracervical manifestations (3.5±0.5y)(p=.01), as well as patients with intended curative (4.0±3.6y) compared to palliative treatment (2.7±0.6y) after PET/CT (p=.001).

CONCLUSION

PET/CT significantly influences clinical management in patients with CUP. It helps referring physicians to select a more appropriate and individualized treatment and to avoid unnecessary additional diagnostics.

CLINICAL RELEVANCE/APPLICATION

PET/CT has a high impact on clinical management of CUP patients due to its potential as a method for detection of the primary and distant metastases that directly influences overall patient survival.

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NM241-SD-TUA5

FDG PET/MRI Analysis in Neurodegenerative Disorders: How Strong is the Correlation between Volumetric Analysis and Hypometabolism?

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NM Community, Learning Center Station #5

Participants
Kiyon Naser-Tavakolian, MD, Nesconset, NY (*Presenter*) Nothing to Disclose
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Robert Hutnik, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Neurodegenerative disorders demonstrate typical lobar and regional patterns of volume loss with corresponding decreased glucose metabolism. In this retrospective study, we aim to correlate volumetric changes utilizing Neuroquant morphometric analysis with decreased FDG uptake as per age-matched calculated Z-scores utilizing [F18] FDG PET-MR neuroimaging.

METHOD AND MATERIALS

70 patients (mean age 70) with neurodegenerative disorders underwent PET-MR brain imaging. Patients were categorized by dementia subtype as follows: Alzheimer's disease (AD), Frontotemporal dementia (FTD), Lewy Body Dementia (LBD). NeuroQuant software was used for assessment of intracranial volumetric information compared to normal age-matched controls. MIM software was utilized to provide semi-quantitative Z-score analysis of abnormal areas of hypometabolism. Volumetric data was graded by severity into none/mild volume loss (MVL) (>=1 standard deviation below the mean) and severe volume loss (SVL) (2 standard deviations or more below the mean). A two-tailed T-test was used for analysis.

RESULTS

In the 26 patients with suspected AD (mean age 70), parietal lobe SVL had an average Z score of -2.74 compared to -1.31 in MVL ($p = 0.08$). Patients with temporal lobe SVL had an average Z score of -1.55 compared to -0.26 in MVL ($p = 0.08$). In 31 patients with FTD (mean age 72), patients with SVL had a frontal lobe Z score of -1.15 compared to -0.66 in MVL ($p = 0.07$). Patients with temporal lobe SVL had an average Z score of -0.39 compared to -0.59 in MVL ($p = 0.63$). In the 13 patients with LBD (mean age 66), SVL patients had an average occipital lobe Z score of -2.5 compared to -2.98 in MVL ($p = 0.26$). Patients with parietal lobe SVL had an average Z score of -3.8 compared to -1.7 in MVL ($p < 0.05$).

CONCLUSION

Our semi-quantitative approach to lobar specific volume loss and brain hypometabolism on PET-MRI imaging demonstrate a strong trend towards statistical significance in several regions including the parietal/temporal lobe with AD, frontal lobe in FTD and statistical significance within the parietal lobe in suspected LBD. Increasing sample size may provide further clarification of the strength of this correlation.

CLINICAL RELEVANCE/APPLICATION

Correlating lobar-specific volumetric percentiles with FDG Z-score values may add diagnostic confidence in the differential diagnosis of neurodegenerative disease in clinical practice.

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NR343-ED-TUA10

WHO 2016 Classification of CNS Tumors: The Beginning of the Molecular Era

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #10

Participants
Maria Emilia Paday Formenti, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Review the updates of WHO classification of CNS tumors, highlighting the differences with previous classifications. Describe key imaging characteristics of the different entities on this group. Illustrate with cases from our institution, enhancing radio-pathologic and molecular correlation.

TABLE OF CONTENTS/OUTLINE

Major changes WHO 2016 classification: -Nomenclature -New and removed entities Astrocytic and oligodendroglial tumors: -Diffuse gliomas classification scheme based on IDH mutations and 1p/19q status -Glioblastoma: IDH mutant and IDH wild type -Epitheloid glioblastoma -Diffuse midline glioma, H3 K27M-mutant -Anaplastic xantoastrocitoma Embryonal tumors: -Medulloblastomas: WNT, SHH, group 3 and group 4 -Embryonal tumor with multilayered rosettes, C19MC-altered Neuronal and mixed glioneuronal lesions: -Diffuse leptomeningeal glioneuronal tumor (DLGT) -Multinodular vacuolar neuronal tumor (MVNT) Ependymal tumors: -Ependymoma, RELA fusion-positive Solitary fibrous tumor and hemangiopericitoma Atypical meningiomas with brain invasion Conclusion

NR344-ED-TUA11

Diagnosing Intracranial Vasculitides and Vasculopathies: Conventional MRI and Vessel Wall Imaging-based Diagnosis

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #11

Awards
Certificate of Merit

Participants
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Amit K. Agarwal, MD, MBBS, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Diego J. Oliveira, MD, Salvador, Brazil (*Abstract Co-Author*) Nothing to Disclose
Toshio Moritani, MD,PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Suyash Mohan, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, NovoCure Ltd Grant, Galileo CDS, Inc
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TEACHING POINTS

Understand the difference between vasculitides and vasculopathies, and use this designation accurately. Identify the appropriate imaging exam for the diagnosis of vessel related pathology, particularly the MRI sequences most helpful in aiding the diagnosis of vasculitides and vasculopathies. Utilize Vessel wall Imaging (VWI) to aid in the differentiation between vasculitidies/vasculopathies and other vascular pathology.

TABLE OF CONTENTS/OUTLINE

Overview of Diagnostic Classification: Vasculopathy vs Vasculitis Role of Imaging in Diagnosis: Invasive imaging, CT, MRI, VWI Vessel Wall Imaging: differentiating vascular pathologies Outline of Cases CNS Vasculitis Cases 'Large' Vessel 'Medium' Vessel 'Small' Vessel 'Variable Size' Infectious, Drug Induced, and Vasculitides associated with Systemic Disease CNS Vasculopathy Cases Degenerative Metabolic Inflammatory Coagulative Functional Unknown Etiology Conclusions

NR345-ED-TUA12

Contemporary MRI Imaging in Parkinson's Disease

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #12

Participants
Cristina Berastegi Santamaria, MD, Bilbao, Spain (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Parkinson's disease is the second most common neurodegenerative disorder. The disease is characterized by death of dopaminergic neurons in the pars compacta of the substantia nigra (SNc) due to intraneuronal (lewy bodies) and intra neuritic (Lewy neurites) presynaptic aggregation of a-synuclein. It is responsible for the cardinal motor features of the disease after a substantial denervation of substantia nigra. The Learning objectives are: 1) To review the clinical features of the disease, enhancing the less known non motor symptoms which may precede the motor symptoms in over a decade 2) To discuss the neuropathology findings, both in dopaminergic and non dopaminergic systems 3) To understand the imaging findings in advanced structural and functional imaging, including, Brain Volumetry, Susceptibility Weighted Imaging (SWI), Quantitative Susceptibility Mapping QSM) , Neuromelanine Sensitive Magnetic Resonance Imaging (NM-MRI), Diffusion Tensor Imaging (DTI) and Resting State Functional MRI (RSfMRI).

TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Neuropathologic findings 3) Epidemiology and clinical features of the disease 4) Physical basis of advanced MRI techniques 5) Imaging findings in individual cases and in group analysis 6) Conclusions and take home messages

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NR376-SD-TUA1

Detection of Left Atrial Appendage Thrombus in Acute Stroke Patients by Adding Cardiac CT in Stroke Protocol

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #1

Participants
Angelique Bernard, Dijon , France (*Presenter*) Nothing to Disclose
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PURPOSE

Cardioembolic factors are responsible for 20-30% of ischemic strokes, especially atrial fibrillation and thrombus in the left atrial appendage (LAA). The reccurrence rate of events in the first year after an acute stroke is estimated to be 7 to 13 %. Therefore, the cause of ischemic stroke needs to be investigated to treat and prevent a second stroke. The aim of the present study was to detect LAA thrombi in a suspicion of stroke by adding a cardiac CT during the initial imaging in order to prescribe anticoagulation promptly.

METHOD AND MATERIALS

From November 2018 to April 2019, 479 consecutive patients admitted with stroke like symptoms in the emergency department of our institution were analysed. All patients underwent a stroke CT protocol including a non-enhanced CT, a brain perfusion if necessary, a carotid CTA, a cardiac CT and a post-contrast brain CT. The cardiac CT was performed with a prospectively ECG gated volume acquisition. All left appendage hypodensity were analysed and classified as either thrombus or circulatory stasis.

RESULTS

158 acute stroke were diagnosed by brain imaging. 19 LAA thrombi were detected and one left intra ventruclar thrombus. 2 patients with LAA thrombus suffered a recurrence of an acute stroke within 6 days. All patients with LAA thrombus suffered an acute stroke except one patient. The mean DLP of cardiac was 128.9 ± 56 mGy.cm.

CONCLUSION

Cardiac CT added to acute stroke protocol allows detection of 4% LAA thrombi in case of a stroke suspicion and 12% in a confirmed acute stroke. Anticoagulation can be started earlier to reduce the risk of reccurrence of cardioembolic stroke.

CLINICAL RELEVANCE/APPLICATION

Adding cardiac CT in an acute stroke CT protocol improves directly left atrial appendage thrombus diagnosis and help to provide better patient care.

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NR377-SD-TUA2

Wall Shear Stress Assessment Using Vector Flow Imaging Discriminates Between Subjects with and without Carotid Atherosclerosis in the Carotid Bifurcation

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #2

Participants
Manlio Guazzaroni, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Several studies demonstrated a relationship between low values of Wall Shear Stress (WSS) and a greater propensity to develop atherosclerotic plaques in sites with disturbed hemodynamic flow. The aim of this study was to assess WSS 'in vivo' in the carotid bifurcation using Vector Flow Imaging (VFI), an innovative, angle- and operator-independent ultrasound (US) module with a high frequency of frames, which provides accurate WSS measures at variance with conventional US systems.

METHOD AND MATERIALS

This study, combining conventional US and high frame rate VFI, was performed between November 2018 and January 2019 on 118 subjects. Depenging on the presence or absence of atherosclerotic lesions at the carotid artery level, they were divided into 2 groups: pathological patients affected by carotid atherosclerosis (n=95) and control subjects without lesions (n=23). WSS was calculated in three points along the posterior-lateral wall of the carotid sinus.

RESULTS

Patients with carotid atherosclerosis showed significantly lower WSS values than control subjects (0.60 ± 0.23 Pa versus 1.60 ± 0.34 Pa, age-adjusted p-value < 0.0001). There was no overlap between the two groups, with all measures lower than 1 and tending to 0 in pathological patients and all values higher than 1 in control subjects.

CONCLUSION

This preliminary study proved that WSS values tending to zero accurately identify those subjects presenting a carotid hemodynamic pattern related to the development of atherosclerosis.

CLINICAL RELEVANCE/APPLICATION

These data support WSS assessment by applying V-Flow module in the carotid bifurcation for diagnostic purposes and risk stratification. VFI allows a more intuitive and quantitative imaging of vortex formation, which is not clearly distinguishable in Color-Doppler images, thus providing an accurate evaluation of blood flow rates in all directions and at any angle.

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NR378-SD-TUA3

Detailed Visualization of Streamline Flow Patterns in a Neurovascular Phantom Using a 1000 Frames-Per-Second, High-Speed Photon-Counting Detector (PCD)

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #3

Participants
Allison Shields, Buffalo, NY (*Presenter*) Research Grant, Canon Medical Systems Corporation
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Daniel Bednarek, PhD, Buffalo, NY (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Stephen Rudin, PhD, Buffalo, NY (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation

PURPOSE

The use of high-speed x-ray detection in an interventional setting offers the ability to extract new information about blood flow in and around vascular pathologies. This may assist with diagnosis, tracking the development of pathologies, treatment planning, and evaluating treatment outcomes.

METHOD AND MATERIALS

High speed angiography was performed at 1000 fps using the Actaeon photon counting detector from XCounter. The PCD was used with a C-arm unit to image iodinated contrast injections in a patient-specific saccular aneurysm phantom. The technique parameters were 70 kVp, 100 mA, and 1 ms frame acquisition time. Image sequences were taken with a 2.8 Fr catheter at various locations relative to the aneurysm. Arterial blood flow through the vessel was simulated with a pulsatile pump (Harvard Apparatus, model #1423), with settings typical for flow seen in intracranial vasculature. Various injection volumes and flow rates of contrast were investigated.

RESULTS

Several different streamline patterns outlining flow dynamics were visible within the vessel and aneurysm, dependent on the phase of the cardiac cycle. Streamline patterns are visualized during the systolic portion of the pump cycle that is captured by the detector. Previously unseen detailed vortex filling patterns within the aneurysm are visible over a duration of less than 50 ms. Flow diversion outside the aneurysm, due to the geometry of the phantom, occurs simultaneously with the decay of vortex streamlines inside the aneurysm, and additional flow changes are produced as the streamlines collide with the vessel wall.

CONCLUSION

Detailed flow-pattern visualization made possible with the high-speed imager can provide a means to evaluate abnormal vascular flow patterns, and information on streamline patterns may be useful in the evaluation of vascular pathology and treatment assessment.

CLINICAL RELEVANCE/APPLICATION

The use of high-speed imaging in an interventional setting may provide new detailed flow information to aid in the evaluation of neurovascular disease states.

NR419-SD-TUA5

Comparison Among Conventional MRI Sequences for the Detection of Diffuse Axonal Injury in Patients with Traumatic Brain Injury

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #5

Participants
Masahiro Fujiwara, MD, Suita , Japan (*Presenter*) Nothing to Disclose
Yoshiyuki Watanabe, MD, PhD, Suita, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation; Research Grant, Dai Nippon Printing Co, Ltd; Speakers Bureau, General Electric Company
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PURPOSE

The utility of susceptibility weighted image (SWI) in the detection of diffuse axonal injury (DAI) has been widely reported but there are only few reports comparing each lesion in various MR sequences. This study aimed to evaluate MRI images of DAI and compare the difference among conventional MRI sequences and determine the optimal MRI sequences for the detection of DAI.

METHOD AND MATERIALS

Retrospective visual assessment of 40 consecutive patients (32 male, mean age 40) who underwent MRI scan for evaluation of traumatic brain injury and were diagnosed with DAI by MRI images. MRI scan was performed 22 hours to 121 days (mean, 12 days) after traumatic brain injury. The MRI sequence for evaluation contained fluid-attenuated inversion recovery (FLAIR), diffusion weighted image (DWI), T2 star weighted image (T2*), and susceptibility weighted image (SWI). SWI was post-processed and minimal intensity projection (mIP) image with the same slice thickness as the other sequences was generated. Two radiologists independently evaluated the MRI images and identified lesions considered to be DAI and compared on all sequences. Final agreement was made by consensus.

RESULTS

1641 lesions were identified by combining all sequences. FLAIR, DWI, T2*, and SWI could detect 480, 213, 697, and 1371 lesions, respectively. 650 lesions were detected only by SWI. SWI detected the largest number of lesions but 270 lesions were SWI negative. Most of the SWI negative lesions were FLAIR positive or DWI positive.

CONCLUSION

SWI was the most sensitive sequence for the detection of DAI but some lesions were detected only by FLAIR or DWI.

CLINICAL RELEVANCE/APPLICATION

This study may help determine the optimal MRI scan protocol (at least FLAIR and SWI) for the evaluation of DAI.

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NR420-SD-TUA6

Does the Carotid Artery Geometry Play a Role for the Stroke?

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #6

Participants
Giuseppe Corrias, MD, Cagliari, Italy (*Abstract Co-Author*) Nothing to Disclose
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Luca Saba, MD, Cagliari, Italy (*Presenter*) Nothing to Disclose

PURPOSE

To explore the association between carotid artery geometry parameters such as length, tortuosity, and the occurrence of stroke.

METHOD AND MATERIALS

In this retrospective study, IRB approved, 411 consecutive patients (males: 245; median age: 56±12 years, age range: 21-93 years) with ischemic stroke were included. Only patients that underwent CTA within 7 days were considered and stroke caused by cardiac embolism and thoracic aorta embolism were excluded.

RESULTS

In the final analysis, 166 patients (males: 72; median age: 54±12 years, age range: 24-89 years) with ischemic stroke that were admitted to our hospital between February 2008 and December 2013 were included. The results showed a good concordance for the length of the vessels with a mean variation of 0.7% and 0.5% for CCA-ICA and ICA length respectively with 95% CI of CCA-ICA length of 10.5% and -9.1% and 95% CI of ICA length of 10.9% and -9.9%. The concordance was very good for the index of tortuosity with a mean variation of 0.2% and -0.4% for CCA-ICA and ICA Tortuosity index respectively with 95% CI of CCA-ICA Tortuosity index of 4.3% and -4% and 95% CI of ICA Tortuosity index of 3.4% and -4.3%. Regression model indicated that the tortuosity index of ICA was the only independent variables associated with stroke, whereas other variables did not demonstrate a significant statistical association with cerebrovascular symptoms.

CONCLUSION

Results of this preliminary study suggest that a high tortuosity index is associated with the presence of stroke whereas the length of the carotid arteries does not play a significant role.

CLINICAL RELEVANCE/APPLICATION

Results of this preliminary study suggest that a high tortuosity index should be considered as a risk factor for the occurence of stroke.

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NR421-SD-TUA7

Progression of Plaque Burden on Middle Cerebral Artery Associated with Recurrent Stroke: A Follow-Up Study by High-Resolution Magnetic Resonance Imaging

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #7

Participants
Zhang Shi, Shanghai, China (*Presenter*) Nothing to Disclose
Xuefeng Zhang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

This study aimed to investigate the association between the progression of plaque on middle cerebral artery (MCA) and recurrent cerebrovascular events using high-resolution magnetic resonance imaging (HR-MRI).

METHOD AND MATERIALS

Sixty-seven symptomatic patients with MCA stenosis underwent vessel wall HR-MRI for intracranial artery at baseline and >=6 months after the first scan between September 2013 and September 2016, respectively. All the patients had clinical follow-up after the second magnetic resonance scan for <=35 months until the onset of recurrent transient ischemic attack (TIA) or stroke. Atherosclerosis plaques from MCA were extracted as the region of interest (ROI) for quantitative evaluation. The stenosis value, plaque area/burden, lumen area and contrast enhancement ratio were extracted and calculated. The progression of plaque burden between the first and second magnetic resonance scans was measured. Univariate and multivariate Cox regression was used to calculate the hazard ratio (HR) and corresponding 95% confidence interval (95% CI) of intracranial plaque features in discriminating recurrent events. P-values <0.05 were considered as statistical significant.

RESULTS

Sixty-seven patients (mean age: 57.3±11.3 years old; 50 males) were eligible for final statistics analysis. During a mean follow-up duration of 268.9±238.1 days, 24.6% of patients (n=16) experienced ipsilateral recurrent transient ischemic attack/stroke. Acute symptom (P=0.043), the mensal progression of intracranial wall volume (P=0.027) and the mensal progression of plaque burden (P=0.018) were significantly associated with recurrent events in the univariate analysis (Figure-1). The multivariate Cox regression indicated that only the progression of plaque burden (HR, 3.335; 95% CI, 1.154-9.639; P=0.026) was the independent risk factor to predict the recurrence of transient ischemia attack/stroke.

CONCLUSION

This follow-up analysis of intracranial artery plaque on HR-MRI accurately predicted the symptomatic patients who would have a recurrent TIA or stroke. The mensal progression of plaque burden is independently associated with recurrent ischemic cerebrovascular events, and this measurement has added value in predicting future events.

CLINICAL RELEVANCE/APPLICATION

High-resolution magnetic resonance imaging can assess intracranial atherosclerotic plaque, which is complex and requires subjective assessment of plaque components.

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NR423-SD-TUA9

Frontoparietal Cortical Thinning in Impaired Executive Control in Young-Adult Multiple Sclerosis

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NR Community, Learning Center Station #9

Participants
Sindhuja Tirumalai Govindarajan, MS, Stony Brook, NY (*Presenter*) Nothing to Disclose
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PURPOSE

Cortical thinning is a hallmark of multiple sclerosis (MS) disease progression and has been associated with worsening cognitive impairment. The goal of this study was to identify areas of cortical gray-matter (GM) atrophy associated with impaired executive control in pediatric and young-adult onset MS patients.

METHOD AND MATERIALS

3D-T1-weighted MPRAGE images were acquired at 3T in 21 relapsing remitting (RRMS) patients (9M/12F, age=26±6years, age of onset=13-36years). All participants were administered the test for executive control (EXE) from Attention Network Test-I (ANTI) battery. CAT12 toolbox for SPM12 was used to map thickness across the cortical ribbon in the left (LH) and right (RH) hemispheres. Vertex-wise correlations were performed with EXE scores with corrections for age. Desikan-Killiany atlas was used to label GM regions.

RESULTS

Average cortical thickness in patients was 2.73±0.1 mm in LH and 2.72±0.1 mm in RH. Whole brain average cortical thickness correlated negatively with EXE scores ($R = -0.54$, $p < 0.05$). Vertex-wise correlations revealed significantly negative correlations ($p<0.001$) between EXE scores and cortical thickness in bilateral frontal regions (pars opercularis, superior and rostral middle frontal and precentral gyri) and parietal regions (postcentral, superior parietal, supramarginal gyri and precuneus) consistent with the frontoparietal attention network. Additionally, the cuneus and lateral occipital regions that are part of the visual system also had significant cortical thinning associated with impaired EXE.

CONCLUSION

In our pediatric and young-adult onset MS cohort, poorer performance on tests of executive control were significantly correlated with cortical atrophy, more specifically in cortical regions associated within the frontoparietal attention network.

CLINICAL RELEVANCE/APPLICATION

Characterization of GM damage associated with cognitive deficits in MS facilitates improved understanding of MS pathophysiology and aids in devising evaluation and treatment strategies.

OB179-ED-TUA1

Fetal Facial Mass and Mass-like Lesions

Tuesday, Dec. 3 12:15PM - 12:45PM Room: OB Community, Learning Center Station #1

Awards
Certificate of Merit

Participants
Roya Sohaey, MD, Portland, OR (*Presenter*) Nothing to Disclose
Karen Y. Oh, MD, Portland, OR (*Abstract Co-Author*) Research Consultant, FUJIFILM Holdings Corporation
Neel Patel, MD , Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Emily Edwards, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Petra Vajtai, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Fetal facial masses may be true tumors or anomalies that mimic tumors. Key differentiating features between similar appearing diagnoses will be stressed. 2. 3D ultrasound, multiplanar imaging, and fetal MR can help determine origin of mass, key to making an accurate diagnosis. 3. Fetal MR is best for assessing airway involvement and extent of true masses. Careful delivery planning is important for many of the diagnoses covered in this poster. 4. Prognosis, associations, post-natal pediatric considerations, and treatment will be discussed for specific diagnoses.

TABLE OF CONTENTS/OUTLINE

1. How to assess the fetal face with US and MR including cine-T2 imaging 2. Review of mass and mass-like lesions affecting the oral cavity stressing diagnosis based on anatomic locationt 3. Mass and mass-like anomalies affecting the fetal eyes 4. Masses involving the upper anterior neck 5. Mass and mass-like anomalies affecting fetal nose and midface 6. Congenital facial and neck skin tags. 7. Etiology, prognosis, treatment, and associations discussed for key diagnoses

OB180-ED-TUA2

Uterine Arteriovenous Malformations or Enhanced Myometrial Vascularity: The Distinction is Critical to Management - A Clinical and Imaging Review

Tuesday, Dec. 3 12:15PM - 12:45PM Room: OB Community, Learning Center Station #2

Participants
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TEACHING POINTS

Uterine arteriovenous malformation (AVM) and enhanced myometrial vascularity (EMV) share similar diagnostic findings and are commonly mistaken for the same entity, although EMV is usually seen postpartum and AVM is seen after uterine trauma (e.g. Cesarean section, dilatation and curretage). Recent literature suggests that these two entities are different in etiology; and management, from observation to endovascular/surgical intervention, depends on the correct diagnosis. The purpose of this exhibit is: 1. To review an unfamiliar diagnosis: enhanced myometrial vascularity (EMV) 2. To differentiate arteriovenous malformations (AVMs) from EMV, in terms of both etiology and imaging presentation 3. To briefly review management options for AVMs and EMV based on a comprehensive literature review

TABLE OF CONTENTS/OUTLINE

Pathophysiology of AVM and EVM AVM vs EVM: How to Differentiate? Case-Based Review of Clinical and Imaging Findings/Follow-Up - Ultrasound - MRA - CTA - Conventional Angiography Controversy and Future Directions References

PD177-ED-TUA6

Subpial Hemorrhage in Neonates: What Radiologists Need to Know

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PD Community, Learning Center Station #6

Awards
Certificate of Merit

Participants
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Ania Dabrowski, MD,PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. Subpial space is a potential space rarely involved with hemorrhage in adults, however implicated in neonatal intracranial hemorrhages, more common up to 6 months. 2. Given the tight space, SpH promotes damage to the underlying cortex and subcortical white matter. Subpial hemorrhage is typically accompanied by cortical infarction, and in some cases subcortical white matter hemorrhagic infarctions. 3. SpH can be unifocal or multifocal, with variable sizes. 4. Although discussed in the context of abusive head trauma, can be seen in the setting of multiple different clinical scenarios, hence not a specific finding of abusive head trauma. 5. Accurate diagnosis is critical for management, counseling and prognostication, as implications for neurodevelopment are worse compared to other extra-axial hemorrhages.

TABLE OF CONTENTS/OUTLINE

Anatomy, pathophysiology and history of SpH as it relates to neuroimaging findings. Diagnostic criteria for SpH with US, CT and MRI: technique and limitations Characteristic MR imaging features as diagnosis improves significantly with MRI: value of T1W and T2W images, DWI/ADC, SWI and TOF MRA. Neuroimaging characteristics and differential diagnosis will be presented in neonates with asphyxia, coagulopathy, shunted hydrocephalus, infection, trauma accompanied by relevant history and clinical presentation.

PD178-ED-TUA7

Dual-Energy CT Applications in the Pediatric Cardiothoracic Imaging

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PD Community, Learning Center Station #7

FDA Discussions may include off-label uses.

Participants
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Demetrios A. Raptis, MD, Frontenac, MO (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Marilyn J. Siegel, MD, Saint Louis, MO (*Abstract Co-Author*) Speakers Bureau, Siemens AG Spouse, Consultant, General Electric Company

TEACHING POINTS

* Dual energy with multiple post processing and reconstruction technique is an efficient method in pediatric cardiothoracic imaging. * Dual energy CT can be performed to better delineate both vascular and parenchymal abnormalities in the pediatric patient and highlight otherwise subtle abnormalities. * Dual-energy CT post-processing techniques that offer the most diagnostic information are the material-specific perfused lung blood volume, lung vessel, and automated bone removal images. * An understanding of the potential pitfalls of dual energy CT with respect to cardiothoracic imaging can help aid in accurate interpretation of dual energy CT examinations.

TABLE OF CONTENTS/OUTLINE

Review basic principles of dual energy CT 3D material-specific reconstructions: CTA bone removal for direct CT angiography. Blood volume perfusion map, Iodine vessel map. Discuss the application of dual energy CT with respect to its use in pediatric cardiothoracic imaging: Pulmonary embolism, Congenital heart disease, Pulmonary atresia/stenosis, Hypoplastic right heart, Arteriovenous malformations, Pulmonary hypertension, Coarctation and aortic abnormalities, Lung hypoplasia due to diaphragmatic hernia. Review the potential pitfalls and artifacts of dual energy CT in cardiothoracic imaging: Beam-hardening artifacts, Diaphragmatic motion, Cardiac motion

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PD214-SD-TUA3

Neonatal Chest Radiograph: A Comparison of Dose Imaging and Radiographic Technique Protocols - A Multi-Institutional Study

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PD Community, Learning Center Station #3

Participants
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Catherine Gunn, MBA,RT, Halifax, NS (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The International focus on pediatric radiation dose reduction supports the need to reevaluate pediatric imaging protocols, particularly the neonatal population where chest radiographs are frequently requested to assess respiratory illness and line placement. The aim of this study is to assess the impact of neonatal chest radiographic protocols on patient dose in four hospitals around the world.

METHOD AND MATERIALS

Exposure parameters, collimation, focus to source distance (FSD) and radiation dose from 200 neonatal chest radiographs were collected prospectively. Inclusion criteria consisted of both premature and full-term neonates weighing between 1000 and 5000 grams. Only images that met diagnostic criteria were included and any images with post-processing collimation were excluded. Radiation dose was assessed using dose area product (DAP).

RESULTS

The lowest DAP value (4.58 mGy·cm2) was recorded in the Norwegian hospital, employing a high kV, low mAs protocol using a DR system. The Canadian hospital recorded the highest DAP (9.48), using lower kV and higher mAs with a CR system, including the addition of a lateral projection. The difference in the mean DAP, weight, field of view (FOV) and kVp between the hospitals is statistically significant. ($p<0.001$).

CONCLUSION

Use of non-standardized imaging protocols in neonatal chest radiography has an impact on patient dose across hospitals included in the study. Using higher kVp, lower mAs and reducing the number of lateral projections to clinically relevant indications contribute to reduced radiation dose. Further studies to examine image quality based on exposure factors, along with the addition of copper filtration are recommended.

CLINICAL RELEVANCE/APPLICATION

The study has highlighted a number of areas for potential standardization of exposure parameters and recommendations for modifications to exposure parameters to a higher kV and lower mAs as well as reduced field of view for dose reduction. The centres evaluated in Canada, South Africa, and Portugal have significantly higher DAP when compared to the Norwegian centre. Neonatal chest radiograph protocols, in particular the non-standardized exposure parameters and collimation, seem to have impact on patient dose and exposure variation across the four different hospitals worldwide. Further studies examining the impact of exposure factors and image the addition of copper filtration on image quality are recommended.

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PD244-SD-TUA4

Intussusception Reduction Techniques in Children: What Do Radiologists Do in the Developing World? National Survey Findings from Pakistan

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PD Community, Learning Center Station #4

FDA Discussions may include off-label uses.

Participants
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PURPOSE

The purpose of this study is to identify the knowledge and variations in practices for intussusception reduction among pediatric radiologists in developing world.

METHOD AND MATERIALS

A cross-sectional survey was conducted among 142 practicing radiologists in Pakistan. A pre-validated survey form was adopted from a similar study conducted amongst members of Society for Pediatric Radiology. The survey collected demographic information, presence of parents/surgeon during procedure, patient selection/ preparation, use of sedation, preferred methods of reduction and technical details, approach to unsuccessful reduction, and self-reported incidence of success/perforation.

RESULTS

Of the 142 respondents 121(85.2%) had performed the procedure. Of these, 60.6% use fluoroscopy and 24.6% use ultrasound guidance. 28.2% use air and 57% use liquid; 76.8% require intravenous access; 64.8% expect a surgeon to be present in hospital; 55.6% do not sedate. Although inflating a rectal balloon is controversial, 50% do so. Sixty-two percent attempt reductions three times in the same position. In case of unsuccessful reductions, 31.7% wait and re-attempt later, 4.9% apply manual pressure, and 9.9% try again in left decubitus position and about 34.5% refer the patient for surgery.

CONCLUSION

There is wide variation regarding the methods used for intussusception reduction in Pakistan. Further studies are needed to compare the success and complication rates of various methods and thus to develop unified guidelines regarding the optimal method to be used for intussusception reduction.

CLINICAL RELEVANCE/APPLICATION

To develop a consensus guidelines regarding methods of reduction of intussusception at regional as well as at international level.

PH133-ED-TUA8

Impact of 4D- Ultra-Short Echo Time MR Angiography on Neuroimaging

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PH Community, Learning Center Station #8

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TEACHING POINTS

-To know basic principles and differences of ultra-short echo time (UTE) MR Angiography on 3D and 4D. -To know its current usefulness in clinical neuroimaging. -To know the pitfall of UTE-MRA based on a its principle.

TABLE OF CONTENTS/OUTLINE

- A technical review of UTE imaging and recent application for MRA. - Our experience in applying the UTE-MRA in patients with cerebral aneurysms (pre, post coil embolization, and post clipping), dissecting cerebral aneurysms, Moyamoya disease, intracranial carotid occlusion and carotid-cavernous sinus fistula. Principally, images are compared with conventional time-of-flight (TOF)-MRA. - Impact and certainty of 4D-MRA with UTE against recently developed neuro-IVR with mass metal (Flow diverter stent, carotid stent) are displayed. -Discussion is made of regarding important factors, including differences towards TOF-MRA, further application for clinical practices, pitfalls for interpretation.

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PH210-SD-TUA1

Assessment of the Performance of a Multifrequency Doppler Spectral Analysis (MFDSA) Algorithm in the Screening of Cardiovascular Disease

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PH Community, Learning Center Station #1

Participants
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PURPOSE

Current methods for diagnosis of cardiovascular disease (CVD) rely on detecting the obstruction of an artery through the use of Doppler ultrasound and digital subtraction angiography, when the disease is already well established. The purpose of this work was to design and assess an early diagnostic ultrasound screening technique for CVD using fluid dynamics prior to arterial obstruction.

METHOD AND MATERIALS

A potential early biomechanical marker of CVD susceptibility is wall shear stress (WSS), which is related to arterial wall stiffening. Assessment of WSS requires the accurate mapping of blood velocity close to the arterial wall, which is challenging for current imaging modalities. Multifrequency Doppler spectral analysis (MFDSA) allows for more precise velocity quantification by capturing additional spectral information in a transmitted pulse through 2-dimensional Fourier analysis. In addition utilising UltraFast acquisitions allows for complete vessel velocity quantification in a single insonation. A series of anatomically realistic walled arterial flow phantoms were constructed exhibiting a range of vessel stiffness values (60 kPa, 110kPa, & 320 kPa) corresponding to different stages of arterial disease. Flow data was collected on Aixplorer (Supersonic Imagine, France) ultrasound scanner using traditional pulsed wave (PW) Doppler as well as UltraFast Doppler. The data was analysed using three WSS assessment techniques: unaltered PW Doppler, an approximation based on the Hagen-Poiseuille equation, and the MFDSA algorithm. The outputs from each technique underwent a series of paired t-tests to determine whether they could detect a difference in WSS between the phantoms.

RESULTS

All techniques tested were capable of detecting a significant difference between the high and low stiffness phantoms ($p=0.041$, $p=0.044$, $p=0.032$). Only the MFDSA technique could detect a significant difference between the low and intermediate stiffness phantoms ($p=0.045$).

CONCLUSION

The MFDSA algorithm provides a clear advantage in WSS quantification over traditional ultrasound methods and, when used in conjunction with UltraFast acquisition times, it allows for complete velocity quantification in a region of interest in a single insonation, strengthening the case for the technique further.

CLINICAL RELEVANCE/APPLICATION

MFDSA can provide a significant improvement in the assessment of WSS, potentially providing a robust screening diagnostic for CVD

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PH248-SD-TUA3

Distinction between Benign and Malignant Breast Masses at Breast Mammography Using Deep-Learning Method with Mask-R Convolutional Neural Network

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PH Community, Learning Center Station #3

Participants
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PURPOSE

We aimed to use deep learning with Mask-R convolutional neural network (Mask-R-CNN) to discriminate between benign and malignant breast mass images from mammography.

METHOD AND MATERIALS

In total, 2000 patients (1196 benign masses and 804 malignant masses) were randomly divided into the training cohort (1600 patients) and the two validation cohorts (200 patients for each cohort). Deep learning model was constructed using Mask-R-CNN architecture in two views (craniocaudal, CC and mediolateral oblique, MLO). The performance of the trained neural network was tested with this one validation cohort. Four radiologists (2 senior and 2 junior) interpreted the test data set. In a second step, the neural network was re-trained with all cases and then was tested with another validation cohort. Sensitivity, specificity, accuracy, positive predictive value (PPV), negative predictive value(NPV)and area under the receiver operating characteristic curve (AUC) were compared between readers and the neural network.

RESULTS

For initially constructed Mask-R-CNN model, the Sensitivity, specificity, accuracy, PPV, NPV and AUC in CC view and MLO view were 92.30% Vs. 96.20%, 85.40% Vs. 81.30%, 89% Vs. 89%, 85.70% Vs. 87.40%, 91.90% Vs. 95.10%, 0.845 Vs. 0.858, respectively. The proposed model achieved better classification performance than the junior radiologists and inferior to that of senior radiologists ($P < 0.05$). With the re-trained Mask-R-CNN model, the Sensitivity, specificity, accuracy, PPV, NPV and AUC in CC view and MLO view were 96.10% Vs. 96.10%, 95.90% Vs. 91.80%, 96% Vs. 94%, 96.10% Vs. 92.50%, 95.90% Vs. 95.70%, 0.949 Vs. 0.908, respectively. There was no significant difference in classification performance between AI model and senior radiologists ($P < 0.05$).

CONCLUSION

The results obtained demonstrate that the proposed Mask-R convolutional neural network is performant and can indeed be used to predict if the mass lesions are benign or malignant.

CLINICAL RELEVANCE/APPLICATION

The study demonstrates that deep learning with Mask-R-CNN have higher performance in classifying mammography mass lesions.

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PH249-SD-TUA4

Detector Sampling and Dose Reduction in Whole-Body Photon Counting Computed Tomography

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PH Community, Learning Center Station #4

Participants
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PURPOSE

To evaluate the dose-normalized contrast-to-noise ratio (CNRD=CNR/sqrt(D)) of data acquired using the high-resolution mode of a photon counting (PC) whole-body computed tomography (CT) scanner, reconstructed at the spatial resolution of conventional energy-integrating CT acquisitions.

METHOD AND MATERIALS

To avoid pulse pileup PC-CT uses small detector pixels. In many cases the high spatial resolution achievable with such pixels is not of interest and the data are rather reconstructed at a similar spatial resolution as today's energy integrating (EI) systems achieve. From [Med. Phys. 32(5):1321-1334, 2005] it is known that reconstructing images below the system's resolution limit results in image noise reduction and thus improved CNRD compared to measurements with a system with larger pixels. We quantify this effect using measured data from a PC and from an EI detector. An anthropomorphic abdominal phantom, extendable with fat rings, in three sizes (S = 20×30 cm, M = 25×35 cm, L = 30×40 cm) equipped with iodine inserts, animal cadavers, and human corpses were measured at different tube voltages (80 to 140 kV). The images were acquired with the EI detector (0.6 mm pixel size in isocenter) and the PC detector operating in Macro mode (0.5 mm pixel size) and UHR mode (0.25 mm pixel size). Both detectors are components of the same dual source system (SOMATOM CounT, Siemens Healthineers, Germany). During image reconstruction the MTF was matched to the one of the EI detector. CNRD values are evaluated as a figure of merit.

RESULTS

Images acquired in UHR mode achieve higher CNRD values compared to EI at the same spatial resolution. E.g., for 120 kV, the CNRD improves up to 23.5%, corresponding to a possible dose reduction of 34.5% in comparison with conventional CT imaging. Compared to Macro mode, UHR mode shows a CNRD improvement of up to 12.2% at the same EI-matched resolution. These findings are valid for all tube voltages and phantom sizes.

CONCLUSION

Reconstruction of UHR data with an MTF below the system's resolution limit reduces image noise for all phantom sizes and tube voltages compared to standard acquisitions. Thus, a clinically relevant dose reduction is possible while maintaining image quality.

CLINICAL RELEVANCE/APPLICATION

The small pixel effect can be used to either improve image quality or to reduce the administered radiation dose and is applicable to most clinical CT exams.

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PH250-SD-TUA5

Differentiating between Low-Grade and High-Grade Clear Cell Renal Cell Carcinoma Using CT Image Texture Analysis

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PH Community, Learning Center Station #5

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PURPOSE

To evaluate the efficiency of differentiating between low-grade and high-grade clear cell renal cell carcinoma (ccRCC) using CT image texture analysis (TA).

METHOD AND MATERIALS

This retrospective study included 113 patients with ccRCC. Renal carcinoma was regraded according to 2016 WHO/ISUP criteria into low-grade (n=81, Grade I and II)) and high-grade (n=32, Grade III and IV). Images in cortical phase were put into ITK-SNAP software, and 3D-ROIs of total tumor were drawn manually to extract 42 different TA features (Histogram and grey level co-occurrence Matrix) from each tumor. LASSO regression was used to reduce data dimensionality, TA was constructed to identify risk scores of ccRCC of different grades. The pathological result was taken as the response variable, and the TA and clinical data with statistically significant differences between the two groups were included in the binary logistics regression multifactor analysis. A ROC was drawn to evaluate the diagnostic efficacy of each parameter. Decision curves analysis (DCA) was used to analyze TA and clinical data, and the patient's net benefit from their combination.

RESULTS

The tumor size, capsule, venous involvement and enlargement of locoregional LNs were statistically different between the two groups (all $p<0.01$). The TA risk score build in the low- and high-grade ccRCC was -1.30±0.70 and -0.40±0.77, respectively. The TA risk scores and enlargement of locoregional LNs were independent risk factors in identifying low-grade or high-grade ccRCC with odds ratio of 4.45 and 5.01, and AUC of 0.81 and 0.75, respectively. The combined AUC was 0.85. Based on Delong analysis, the combined AUC was higher than using the enlargement of locoregional LNs ($p<0.001$), but was statistically the same as using the TA risk scores ($p=0.09$). DCA showed that the decision curve of combined diagnosis was higher than the results of TA risk scores in the range of 0.21-0.77 probability threshold, which could improve the patients' net benefit.

CONCLUSION

TA risk score combined with enlargement of locoregional LNs is more effective in simplified WHO/ISUP classification of ccRCC. It improves the net benefit of patients.

CLINICAL RELEVANCE/APPLICATION

Texture analysis risk score combined with enlargement of locoregional LNs can provide a reference for evaluating the prognosis of patients with ccRCC.

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PH251-SD-TUA6

The Value of Advanced Reconstruction Algorithms in Improving Upper Abdominal CT Image Quality

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PH Community, Learning Center Station #6

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PURPOSE

To explore the value of new generation model based iterative reconstruction (MBIR), adaptive statistical iterative reconstruction (ASIR) in improving the upper abdominal CT image quality.

METHOD AND MATERIALS

20 upper abdominal patients underwent three-phase contrast-enhanced scans on a Discovery CT750HD were included. The scan protocol was: tube voltage 120kVp, automatic tube current modulation for noise index of 20HU at 0.625mm thickness, pitch 1.375:1, rotating speed 0.6s/r. Images of the delay phase were reconstructed at 0.625mm thickness with FBP, 40%ASIR and MBIR with a standard setting (MBIRstnd). The CT values and standard deviation values of the liver, spleen, pancreas, renal parenchyma and subcutaneous fat at the same imaging level were measured to calculate the signal to noise ratio and contrast to noise ratio of each measured organ. The reduction rate of SD and the improvement rate of SNR and CNR using 40%ASIR and MBIRstnd compared with FBP were also calculated. Single factor analysis of variance was used to analyze the difference of SD, SNR and CNR among the three reconstruction groups with $p< 0.05$ being statistically significant. The subjective image scores of the three groups were assessed blindly by two experienced physicians using a 5-point system and the score consistency was compared by the Kappa test.

RESULTS

The subjective scores of the three groups with FBP, 40%ASIR and MBIRstnd were 3.12±1.03, 4.08±1.14 and 4.82±1.25, respectively with significant difference among them ($p<0.05$) and there was good consistency between reviewers. The SD values (in HU) of the liver, spleen, pancreas and kidney using MBIRstnd were 10.96±0.73, 10.76±1.01, 12.35±1.67 and 12.54±1.78, statistically lower than those with 40%ASIR and FBP ($p<0.05$). The SNR values of liver, spleen, pancreas and renal parenchyma with MBIRstnd were 6.84±0.95, 6.81±0.88, 4.96±0.76 and 9.09±1.27, respectively while their respective CNR values were 14.58±3.94, 14.40±3.75, 13.31±3.69 and 17.83±4.35, both sets were statistically higher than those of 40%ASIR and FBP ($p<0.05$) (See Table 1).

CONCLUSION

Comparing with FBP, the new generation MBIR) and ASIR algorithms can significantly reduce image noise and improve image quality in upper abdominal CT imaging.

CLINICAL RELEVANCE/APPLICATION

Advanced reconstruction algorithms such as MBIR, can significantly reduce image noise and improve image quality in upper abdominal CT imaging, which provides a basis for reducing the radiation dose.

PH252-SD-TUA7

Fast MRI Connectomics with the Dual-Echo Turbo Spin Echo (DE-TSE) Pulse Sequence and White Matter Fibrography

Tuesday, Dec. 3 12:15PM - 12:45PM Room: PH Community, Learning Center Station #7

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CONCLUSION

A fast connectome rendering technique using the DE-TSE pulse sequence has been developed, which improves image acquisition efficiency by 30% as compared to tri-TSE; hence WMF could be widely implemented across MRI platforms using commercial MRI scanners. 1. Fatouros PP et al. Magnetic Resonance in Medicine. 1991; 17(2):402-13.

Background

White matter fibrography (WMF) is a recently developed MRI technique for in vivo brain connectomics. In the original implementation WMF used images generated with the triple turbo spin echo pulse (Tri-TSE) to generate qMRI maps of PD, T1=1/R1 and T2, and connectome renditions via R1-weighted Synthetic-MRI. Owing to the previously published relationship between PD and R1 that is applicable to white matter and gray matter (1/PD= A*R1 + B, where A, B are phenomenological constants (Ref.1)), the question arises as to whether WMF connectomes could be rendered from images generated by the faster and simpler dual-echo (DE-) TSE pulse sequence. The purpose of this work was to develop computer algorithms for mapping *pseudo*R1= (1/PD-B)/A, and use these maps for WMF.

Evaluation

All images used for this study were obtained with IRB approval. The directly-acquired images of the DE-TSE acquisition were used to create maps of the relaxation times (T2, and pseudo-R1), and of normalized proton density (qPD). *Pseudo*R1 heavily-weighted images of the intracranium were generated with a synthetic MRI engine based on the equation: SynthMR = PD·exp[-R1w/R1]. Algorithms were coded in Python 3.5, using the Canopy integrated development environment (Enthought, Austin, TX). These pseudo-R1-weighted synthetic images were further processed with ImageJ (https://imagej.nih.gov/ij/) leading to 3D-to-2D projections depicting the full brain connectome.

Discussion

Using the DE-TSE pulse sequence and *pseudo*R1 qMRI is advantageous because all images, and therefore maps, are self-coregistered, and the scan time is approximately 30% shorter than tri-TSE. Furthermore, the DE-TSE pulse sequence is available across vendors. This work could have implications for in vivo connectomics in routine MRI and for the generation of very high and isotropic spatial resolution connectomes with commercial scanners.

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QI003-EB-TUA

Implementation of Guideline-Appropriate Follow-Up Recommendations in Radiology Reports for Incidentally Discovered Abdominal Aortic Aneurysms on Routine CT

Tuesday, Dec. 3 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

Ruptured abdominal aortic aneurysms (AAA) are a significant public health concern resulting in approximately 4500 deaths per year in the United States. Monitoring of incidentally discovered AAAs on routine abdominal CTs can decrease mortality from rupture as one study has shown a death rate of 7.6 events per 100-person years for unfollowed AAAs. Our objective was to determine the effect of including appropriate follow-up guidelines in abdominal CT reports when AAAs are incidentally discovered in our health system.

METHODS

A multidisciplinary team of radiologists and vascular surgeons from our main teaching hospital and community practice iteratively created and approved a standardized reporting language for AAA on routine abdominal CT examinations. The language was embedded into all routine abdominal CT templates and included explicit specialty society guideline-appropriate management recommendations based on size, gender, and relevant imaging features. Radiology trainees and abdominal imaging staff radiologists at our main teaching hospital and community practice were educated on use of the macro and AAA measurement during January 2019. A manual review of all routine abdominal CT exams was performed during baseline (October - December 2016) to identify all patients with reported AAA. Our primary outcome was the presence of guideline appropriate follow-up AAA recommendations within the report and our secondary outcome was documentation of an AAA in the electronic medical record and relevant follow-up (i.e. repeat imaging, surgery) within two years. Patients who died within 2 years of the index routine abdominal CT, who had a known malignancy, or significant comorbidities precluding repair were excluded.

RESULTS

At baseline the frequency of AAAs was 0.4% (out of 12150 routine abdominal CTs) after exclusion. Mean patient age of AAAs was 74 years (range 53-94) and mean AAA size was 3.9 cm (range 3.0 cm - 6.1 cm). A single report (1/52, 1.9%) included guideline-appropriate follow-up recommendations. Only a third of patients (15/52, 28.8%) were followed: 80% (12/15) with repeat imaging, and 47% (7/15) with surgery of which 3 proceeded directly to surgery without imaging. Aneurysm size was associated with follow-up; mean size of AAAs with no follow-up was 3.6 cm compared to 4.6 cm with follow-up ($p < 0.001$). The frequency of AAAs in the first two months following the intervention (February-March 2019) was 0.5% (42 / 8046). Mean patient age was 75 years (range 57-96) and mean AAA size was 3.8 cm (range 3.0 cm - 5.6 cm). All 42 reports (100%) included guideline-appropriate follow-up recommendations.

CONCLUSION

Although AAA on routine abdominal CT exams are rare, only 30% of patients with AAA receive follow-up when no guideline-appropriate management recommendations are issued within radiology reports. Embedding specialty society guideline-appropriate management in report templates improves compliance with explicit recommendations by AAA size. Further data is needed to see if inclusion of guideline-appropriate management recommendations is associated with higher rates of guideline-appropriate follow-up.

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QI011-EB-TUA

Tele-Ultrasound: A New Tool For Quality Control and Medical Support in Large and Public Radiology Practice

Tuesday, Dec. 3 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

Diagnostic ultrasound is an imaging method which was consolidated over the years as an essential tool in medicine. It is closely related to the physician who performs it, and hence, in many cases, requires a second medical opinion or support. The mission to improve the quality of a large-scale radiology practice is extremely challenging, yet necessary, particularly within our institution, where the volume of examinations performed is very high, and both patients' profile and deteriorated work conditions make the execution of this service extremely difficult. Tele-ultrasound has allowed effective remote performance of diagnosis, and the aim of our work is to demonstrate how tele-ultrasound serves as a useful and innovative tool not only to improve ways to remotely support physicians during ultrasound examinations, but also to improve the quality of medical reports and results performed in large and public radiology practice.

METHODS

Our quality improvement project started in March 2016 and nowadays covers 13 hospital unities, and monitors a total of 32 ultrasound examination rooms. Expert physicians are physically present at an Ultrasound Support room, where they monitor the execution of both examination and its medical report, remotely performed by local physicians in the health units. The applied technology follows both an analogue and digital standard, and the resources deployed to capture data transmission include the use of ultrasound equipment and specific systems. Through a DVR device installed in the US equipment and PC monitors, the exams and the medical reports are transmitted in real time from the local health unity to the practitioners based at the Support room. The contact between local and remote physicians is done by live chat, at any time and in real time. The expert physician based at the Support room must fill an evaluation form during the examination. This form was carefully and objectively designed by experienced ultrasound practitioners with solid academic background, and it was developed for each kind of ultrasound examination. According to each question marked in the evaluation form, the system provides an automated score, which classifies the examination into 5 categories: 1) Excellent, 2) Appropriate, 3) Satisfactory, 4) Unsatisfactory, 5) Unacceptable. The data generate both quantitative and qualitative information, as well as performance indicators that are used for quality control purposes and decision-making on training and further medical education.

RESULTS

The main data collected from the evaluations, transformed into analytic graphs, include, for example, the evolution of results (figure 1), volume of examinations and quality indicators in general and per health unit (figures 2 and 3), the main errors generally observed and distribution of errors by physician (figure 4), and the mapping of physicians' performance vs. the quality goal we established for our institution, which is 80% of satisfactory exams (figure 5). Since the beginning of the project, our institution performed over 1.2 million ultrasound examinations, of which more than 32.000 were monitored by the Ultrasound Support room (over 2.6% of total volume). At the outset (first 3 months), the overall percentage of unsatisfactory exams was 41%, with a number of 9 monitored examination rooms and 2.635 evaluated exams. Today, after 3 years of the project start, the percentage of unsatisfactory exams is 23% in a total of 32 monitored rooms, with 195 evaluated physicians, within a universe of 280 physicians. In one of the units we monitor, the number of satisfactory exams was lower than the 80% desired during the first year of our project's implementation. Some factors that could contribute to this result were identified and discussed, from the technical deficiencies of the professionals involved to flaws in the physical structure of the unity. After medical education actions on specific themes that we identified from the most frequent errors performed, added to improvements in the physical environment, this unit went from 60% of excellent and satisfactory exams to 86% in the third month after the actions.

CONCLUSION

The experience from our project demonstrates that tele-ultrasound is an innovative tool in remote assessment of ultrasound examinations in real time, providing constant support to the practitioners, assisting and improving the quality of the examination at all stages, and providing a solid base for the creation of health policies, education and further medical support actions.

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QI030-EB-TUA

Augmenting Patient - Radiologist Communication Through Government Mandate: Initial Results from an Implementation to Address the Patient Test Result Information Act

Tuesday, Dec. 3 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

While electronic patient access to diagnostic testing was part of the ARRA stimulus for meaningful use, providing a means for patients to better understand when the results of an imaging test are important to their continued care has never been part of the requirements. Last Fall, the Pennsylvania State Legislature passed the Patient Test Result Information Act 112 (PA112). This law was the first of its kind that requires radiology practices to inform patients when a clinically significant finding exists on their imaging study that a reasonably prudent person would need to follow up within 90 days. The purpose of this project is to describe how our health system implemented a solution within the 60 day window mandated by this new law using existing off-the-shelf IT solutions, provide preliminary results of the frequency of alert triggers derived from a large corpus of reports, and relate lessons learned and enhancements for the upcoming year.

METHODS

Our mandate was to implement a workable solution for patient notification within 60 days when no existing commercial solution existed. While PA112 does not stipulate sending the actual report or the pertinent results, it does require that a communication be sent directly to the patient within 20 days after finalizing the report. Notification is limited to outpatient studies only. Radiography, obstetrical ultrasound and mammography are excluded from the requirements. Our solution consisted of a "belt and suspenders" approach using both a commercially available natural language processing (NLP) engine and a follow-up management and workflow application to meet the specific requirements of the law. Pre-built manual macros were also created that a radiologist could voluntarily insert into a report that would also trigger generation of a patient letter. The goal was to principally rely on the NLP engine to automatically identify criteria that met the government mandate (e.g. a follow up exam within 90 days) but also provide the latitude for the radiologist to make the decision through use of a macro. Either the NLP ("belt") or the manual macro ("suspenders") would queue a custom letter for the patient. PA112 stipulates that patients can be informed in person, by mail, FAX or direct messaging through a PHR. Conventional mail was chosen as the primary communication method that would accommodate to the heterogeneity of our clinical practice. One to two daily scheduled mailings occur each day from a pre-populated print queue based upon the logic built into the NLP.

RESULTS

This new program began on schedule with 61,783 reports passing through the system in the first three months of operation. The majority of the reports (43,132, 69.8%) were not relevant to the PA112 inclusion criteria (e.g. inpatient/ED, radiographs, OB ultrasound, mammography). Of the 18,651 potential reports that fell into inclusion criteria, only 3,123 (5%) actually contained a recommendation of some type in the text. When stratified, only 372 (12%) of these met criteria for PA112 with 2751 excluded. Review of the 372 that met criteria included 9 false positives and 2 false negatives. Interestingly, 690 patient letters were triggered during this period. Therefore, 318 letters were manually triggered by the radiologist whether or not the findings actually fell within the PA112 criteria. Manual trigger of patient letters were not evenly distributed across the practice, with some radiologists using this new communication process more liberally than others. In the first three months only three complaints were logged; one for incorrect contact information, two for false positive triggered letters. Modifications were made to mitigate against any similar issues.

CONCLUSION

Despite initial concerns, the inclusion of this new process into the radiologist workflow was not particularly onerous or time-consuming. Reservations about needlessly alarming patients and inundating ordering providers with patient phone calls were unfounded. Moreover, calls to the radiology department requesting reports and clarification were minimal and appropriate. Initial trends would suggest that radiologists overwhelmingly prefer to trigger a patient communication when they judge it may be beneficial to the patient beyond the PA112 requirements. This suggests that the criteria for the legislation is too restrictive and from a practical standpoint should be expanded to all imaging and all recommendations regardless of time limitation. This simple first step is fostering an environment for improved radiologist-patient interaction. We anticipate that other states may adopt similar legislation and other healthcare systems may also voluntarily replicate a similar workflow. We hope that our experience will inform other healthcare delivery systems on best practices.

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QI114-ED-TUA1

Evaluation of an Audiovisual Report to Enhance Traditional Radiology Reports of Musculoskeletal Urgent Cases

Tuesday, Dec. 3 12:15PM - 12:45PM Room: QR Community, Learning Center Station #1

Participants
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PURPOSE

Traditional radiology reports are narratives texts including description of imaging findings. Recent implementation of advanced reporting software allows the incorporation of annotated key images and hyperlinks into text reports, but these tools usually do not substitute the in-person consultations with the radiologists, especially in challenging cases. The use of on-demand audio/visual reports using screen capture software is an emerging technology, providing a more engaged imaging service. Our study evaluates a video reporting tool that utilizes PACS integrated screen capture software for musculoskeletal imaging studies in the emergency department. Our hypothesis are that referring orthopedic surgeons would find that recorded audio/video reports add value to traditional text reports, may increase engagement with the radiology staff and also facilitates the understanding the imaging findings of urgent musculoskeletal cases.

METHODS

In this study, we analyze 47 cases of magnetic resonance and tomography imaging of the musculoskeletal system, requested in the urgency departments of orthopedics and traumatology areas of our institution between December 2018 and January 2019. Video reports were recorded by 7 radiologists and were sent by the ordering physicians. In addition to the audio description, all image findings were also included in the traditional text version. After having received the video report, 9 ordering physicians answered an electronic questionnaire (Google Form) and gave their opinion about the material they watched. The questions included in the questionnaire were: 1. Did the audiovisual report answer the clinical suspicion?; 2. What is the complexity of this case?; 3. Did the audiovisual report make the alterations more understandable than the traditional report? 4. Would you like to receive reports in audiovisual format again? 5. In comparison to the traditional one, was the evaluation time of the audiovisual report faster, similar, indifferent or slower? 6. Would you forward this audio-visual report to the patient and family members?

RESULTS

Over half of the cases were considered of low complexity (32 responses, 50.8%), 8 were normal (12.7%) and 23 were highly complex (36.5%). In all cases assessed, physicians fully agreed that the audiovisual report confirmed the clinical suspicion. Regarding to making the changes more comprehensible compared to the traditional report, in most cases the physician fully agreed (52 observations, 82.5%), in 10 cases the physician partially agreed (15.9%) and in one case considered it indifferent (1.59%). This understanding was similar in cases of high and low complexity (86.96% of total agreement in cases of high complexity, versus 84.4% in cases of low complexity). Considering the 8 cases of normal exams (without changes), in 6 there was full agreement regarding improvement of comprehension and in 2 of them the agreement was partial. There was no association between improved understanding of the alterations and the complexity of the case ($p = 0.668$). Regarding receiving reports in audiovisual format again, in 60 cases (95.2%) doctors replied that they would certainly like to receive them in this format. Considering the total of 9 physicians, 6 of them answered 'certainly', two physicians who evaluated only 1 case responded that they would probably like it (4.8%) and one doctor who evaluated 4 cases answered 'certainly' in three of them and 'probably' in one case. About the time of evaluation in this type of report compared to the traditional one, 48 considered it faster (76.2%) and 15 considered it indifferent or similar (23.8%). In 95.8% of the cases considered to be 'high complexity' they believed that the audiovisual report had a faster evaluation time than the traditional one. In cases considered 'normal', this percentage fell to 87.5%; while cases considered 'low complexity' had a faster evaluation time in only 59.4% of cases and indifferent or similar in 40.6%. This time, therefore, varies according to the complexity of the case and is more optimized in cases of high complexity. This association was statistically confirmed by Fisher's exact test ($p = 0.002$).

CONCLUSION

The use of audiovisual reports in emergency musculoskeletal cases is a new approach to evaluate possible challenging cases. These results suggest the potential of this technology to re-establish the radiologist's role as an essential member of patient care and also provide more engaging, precise and personalized reports. Further studies are could streamline these methods in order to minimize work redundancy with traditional text reporting or even evaluate the acceptance of using only audiovisual radiology reports. Additionally, a widespread adoption would require integration with the entire radiology workflow including non-urgent cases and other medical specialties.

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QI116-ED-TUA3

Reclaiming Hands-on Ultrasound for Radiology

Tuesday, Dec. 3 12:15PM - 12:45PM Room: QR Community, Learning Center Station #3

Participants
Krista E. Weiss, MD , Chestnut Hill, MA (*Presenter*) Nothing to Disclose
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PURPOSE

Hands-on ultrasound training is included in the curriculum of many medical specialties, including emergency medicine and obstetrics/gynecology, and is increasingly incorporated into medical school curricula. Despite published curricula for ultrasound training in these training programs, there remains a dearth of such programs for radiology residency programs. At our institution, there has been a perceived decline in ultrasound scanning comfort and skill in trainees. The purpose of this project was to assess the utility and efficacy of a hands-on simulation-based ultrasound course for radiology residents in their first year of training.

METHODS

First year radiology residents were enrolled in a two-week simulation-based course for the instruction of hands-on ultrasound training. After assessing various simulation devices, a user-friendly, customizable commercial simulation software platform was selected, providing modules covering many radiologic subspecialties (including GI/GU, obstetrics, small parts, etc). As the course provides a comprehensive introduction to ultrasound anatomy, pathology and technique for those with no or little prior exposure, first year residents were chosen. The ultrasound course consisted of 19 didactic modules, 16 virtual simulations, and 10 phantom scans over a two week rotation. A dedicated simulation center with scanning models and computer-based software was provided to all residents. The didactic modules provided an introduction to the organ or organ system. Instructive simulation scanning allowed for hands-on practice with assigned tasks to assess competency. Self-assessments and assignments provided benchmarks of performance. Residents were provided protected time during the clinical day to complete the simulation component of the course, and were instructed to complete the self-study component at home, if necessary. Attendings and senior residents were in close proximity to the simulation center in case the residents needed assistance. At course completion, a portfolio was created for each resident to document progress, exam scores, and overall time spent. All radiology residents were surveyed at the start of the academic year to assess prior experience and comfort with ultrasound scanning. First year residents were surveyed a second time upon completion of the two-week scanning course. The total cost of instituting the course is estimated at $50,000, which includes the cost of the phantoms, course software, and physical space for the simulation lab. Funding was provided by two separate intra-departmental grants.

RESULTS

Initial survey results of all resident years (fig 4) showed a high percentage of residents feeling unprepared to technically assist a sonographer should a problem arise (45%) or to independently complete an ultrasound exam (90%). All residents agreed that ultrasound training and technique are important for radiology residency training. According to survey results of first year residents after completing the course, first year residents felt that both the course modules and simulation cases were helpful for their level of training. Perceived knowledge of sonographic anatomy and technique improved following the course. The course did not affect the residents' feeling of being able to assist a sonographer who encounters a problem during an exam. Comments provided by residents suggested that the most helpful components of the course were the instructional videos paired with virtual simulations, course quizzes, instruction on ultrasound basics and artifacts, and clinical cases. Least helpful components of the course were time provided for scanning practice (without tasks assigned) and areas of repetition.

CONCLUSION

Pre- and post-survey responses suggest that participation in the two-week ultrasound scanning course contributed to an improvement in perceived scanning knowledge and comfort for participating residents. Our study has several limitations. First, we do not have a true control group for our study. In order to benefit as many residents as possible, all first year residents were enrolled in the course. A second limitation of our study is the lack of long-term follow up. Additional surveys of the residents who have completed the course will help us to assess long-term outcomes. While residents did not always have an attending immediately present to answer questions as they arose, the ability of the course to stand on its own allows for improved resident education without being excessively burdensome to attending physicians. Based on our initial experience, the scanning curriculum presented here provides a comprehensive introductory course for first year radiology residents both for ultrasound anatomy and for scanning technique.

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QI117-ED-TUA4

Transforming Healthcare and Outcomes Using Medical Imaging as The Driver for Change (TOHETI): Transformation Program in a Central London NHS Trust

Tuesday, Dec. 3 12:15PM - 12:45PM Room: QR Community, Learning Center Station #4

FDA Discussions may include off-label uses.

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PURPOSE

The Transforming Outcomes and Health Economics Through Imaging (TOHETI) programme comprises a research initiative aimed at improving clinical pathways using value based healthcare and health economics principles. It is recognized that by deploying imaging resources at the right time, right place in a pathway, we can bring efficiency at the point of care. Hence, the purpose of the programme is to provide a platform of improvement for clinical pathways that relies on the new or novel use of medical imaging as the driver for change. The three key transformational components of this programme were: (i) to improve accessibility to imaging and streamlining diagnostic pathways; (ii) keeping at the forefront of technology; and (iii) transforming our ways of working. The programme's vision is to make evidence based changes to service provision.

METHODS

The TOHETI programme is a research and service transformation initiative conducted at a central London NHS Trust funded by a local charity. The programme has run in three phases: First phase focused on identifying key challenge areas for the hospital and NHS as a whole, including colon cancer, lung cancer, scaphoid injury, chronic headache, acute chest pain and fibroids. Each pathway has specific research question that need to be answered. Second phase focused on designing research studies, obtaining ethics approval and recruitment of patients into research studies. Third phase focused on data analysis, publication of results and rolling out of pathways in clinical services. Two studies and a service improvement project are summarized in this abstract, a randomized clinical trial a prospective observational study and a service improvement project that involved patient led initiative to create a patient information video for patients referred for fibroid treatment.

RESULTS

The results of two innovative models of care are summarily presented in the interest of space. If selected, a detailed results section will be presented. First, a pragmatic, randomized, single-center controlled trial evaluated the use of Magnetic Resonance (MRI) in the Emergency Department (ED) in the management of suspected scaphoid fractures compared to standard of care based on radiographs only in the ED. The intervention is associated with improved clinical, particularly diagnostic accuracy in the diagnosis of any bone fracture (98.5% vs 84.6%), and economic outcomes as the MRI intervention dominated the conventional model with an average 6-month cost difference per participant of £266 ($p=0.047$). Second, a pragmatic, prospective single-center study compared the two clinical pathways used in the management of chronic headache following referral from GPs that differed in the first appointment, either a Neurology appointment or a MRI brain scan. The MRI group improved access to care (39.2 and 70.4 days from referral to MRI scan and report, respectively) compared to the Neurology group (110 days) ($p<0.001$). TOHETI alongside clinical staff across gynecology and interventional radiology facilitated a joint clinical approach for patient assessment, referrals and follow-up across the two services for patients who are referred for fibroid treatment . This piece of work is now embedded in delivery of care and leads an example of patients' led change. The charity funded TOHETI programme is unique in its conception due to i) complete engagement from primary and tertiary clinicians who are involved in the patient pathway ii) research led initiatives with appropriate study design iii) value based healthcare and health economic principles. In addition, all work streams included patient engagement to understand value to patients.

CONCLUSION

The findings from scaphoid study led to the development of a new pathway that incorporates immediate MRI as part of the management of all patients with suspected scaphoid fracture and the increase in the workload of chronic headache patients being referred to a direct brain MRI scan. Ultimately, the TOHETI programme contributed to improving clinical outcomes at patient level whilst supporting the NHS financial sustainability agenda. Patient engagement during the fibroid work highlights that there is a potential to improve how and what we communicate to patients, in terms of treatment options, and they would prefer to be offered all options so that they can make an informed choice. The programme introduced a culture of change and further funding has been secured to campaign change that is based upon empirical evidence, across the whole organisation. Shrinking budgets in the NHS implies that organisations need to invest in scientific methodology to bring change and this programme has demonstrated just that.

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RO206-SD-TUA1

MiRNA Expression Patterns as Potential Biomarkers in Predicting Response to Neoadjuvant Chemoradiotherapy in Rectal Cancer

Tuesday, Dec. 3 12:15PM - 12:45PM Room: RO Community, Learning Center Station #1

Participants
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PURPOSE

Neoadjuvant chemoradiotherapy (nCRT) is used in the treatment of locally advanced rectal cancer to reduce tumour burden prior to surgical resection. Response to treatment varies greatly among patients, spanning the spectrum from no response, to complete pathological response (pCR). The lack of reliable predictive biomarkers to guide the selection of patients suitable for nCRT remains a significant clinical challenge. Dysregulated miRNA expression has a functional role in colorectal carcinogenesis and disease progression, prompting investigations into whether altered miRNA expression patterns could be used to predict response to nCRT in rectal cancer patients.

METHOD AND MATERIALS

Samples of pre-treatment tumour tissue were obtained from a cohort of 20 consenting rectal cancer patients undergoing nCRT, and 11 age-matched non-cancer controls. Matching pre-treatment blood samples were also collected from all participants (n=31) and an additional 9 controls. RNA was extracted from all 71 samples, reverse-transcribed and quantified by real-time (RQ)-PCR. Expression variability was determined from normalised RQ-PCR data generated using qBase software. MiRNA expression profiles were subsequently correlated with clinicopathological variables including Mandard regression score.

RESULTS

Significant differences in the expression of miR-21 (p value tissue, P value blood), miR-143 (p value tissue, P value blood) and miR-153 (p value tissue, P value blood) were observed between both rectal tumour and normal tissue, and between rectal cancer patients and normal controls. Expression of miR-29c (p value) and miR-590-5p (p value) were significantly increased in rectal tumour tissue compared to normal tissue (p value). When correlated with Mandard regression scores (response to nCRT), levels of miR-21 (p=0.043) and miR-590-5p (p=0.05) were significantly higher in the circulation and tissue respectively of patients with poor response to treatment (TRG5).

CONCLUSION

Our results indicate that the expression of miR-21 and miR-590-5p were elevated in rectal cancer patients and correlated with poor response to treatment with nCRT, highlighting their potential as predictive biomarkers in the treatment of rectal cancer.

CLINICAL RELEVANCE/APPLICATION

Dysregulated miRNA expression has a functional role in colorectal carcinogenesis and disease progression, Altered miRNA expression patterns could be used to predict response to nCRT in rectal cancer patients.

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RO207-SD-TUA2

Prognostic Value of Whole-Body Low-Dose CT (WBLDCT) in the Staging and Restaging of Patients with Multiple Myeloma (MM): A Long Period Follow-Up

Tuesday, Dec. 3 12:15PM - 12:45PM Room: RO Community, Learning Center Station #2

Participants
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PURPOSE

To determine the diagnostic value of whole-body low-dose CT(WBLDCT) imaging in evaluation of the prognostic features of bone marrow involvement according to different infiltration patterns in patients with multiple myeloma (MM) during long follow-up period.

METHOD AND MATERIALS

A total of 103 patients with known clinical diagnosis of MM that underwent unenhanced WBLDCT scan followed during a long period ranging from 3 to 7 years were enrolled for this study.Unenhanced WBLDCT was performed on 256-slice scanner, with tube voltage 120kV, tube current time product 40mAs.Whole skeleton was divided in five anatomic districts(skull,spine,sternum and ribs,pelvis,upper and lower limbs) and evaluated in terms of infiltration pattern(focal,diffused and combined) and distribution of disease.Moreover the osteolytic bone lesions were also categorized according to maximum axial diameter,having 10 mm as cut-off value.

RESULTS

At WBLDCT 63% of the patients presented focal pattern, 22% of the patients had the diffuse pattern and 15% the combined pattern. During follow-up, when considering the cut-off value>10 mm in maximum axial diameter, 86 (82%)out of 105 analysed lytic lesions remained dimensionally unchanged during the follow-up,11% of the lesions showed a dimensional increase and 7% a dimensional decrease. Fifty-nine patients with lytic/combined pattern presented multifocal lytic lesions with a maximum axial diameter <10 mm and among them 88% of the patients presented a dimensional stability of the lytic lesions, 2% of the patients showed a dimensional decrease of their lesions and only 10% had a minimal dimensional increase (average of 5,5 mm) of the lytic lesions. In those cases, with diffuse bone involvement (38%), neither modifications of pattern of disease nor development of focal lytic lesions occurred along the follow-up. The overall dose delivered to each patient was 4.2 mSv.

CONCLUSION

WBLDCT represents a reliable imaging-based tool for a proper management of MM patients,useful to define the behavior of different bone involvement, showing that diffuse form or small lytic lesions (< 10 mm) deserve of less frequent follow-up.

CLINICAL RELEVANCE/APPLICATION

WBLDCT represents a useful imaging based tool to correctly define management of MM patients along the course of follow-up, allowing a significant reduction of the radiation dose exposure.

UR184-ED-TUA7

Bosniak Classification v.2019: Pictorial Review and Update Summary

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #7

Participants
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TEACHING POINTS

After viewing the exhibit, the learner will: 1. Understand the limitations of the current Bosniak Classification of cystic renal masses. 2. Understand the rationale for the Bosniak Classification v.2019 (in press [RADIOLOGY]). 3. Apply a more quantitative approach to characterization of cystic renal masses with CT and MRI. 4. Understand the need for future validation of the Bosniak Classification v.2019.

TABLE OF CONTENTS/OUTLINE

1) Background Discuss changes to management of cystic renal masses in clinical practice, including the expanded role of surveillance and emphasis on survival rather than pathological cancer diagnosis. Discuss limitations of the current Bosniak classification of cystic renal masses. 2) Bosniak v.2019 Objectives To 1) address data indicating renal cell carcinoma with predominant cystic change is overdiagnosed and overtreated, 2) reduce inter-reader variability, 3) improve precision of reported malignancy rates within each Bosniak class, and 4) minimize the number of benign masses undergoing unnecessary treatment by improving specificity (reducing procedural morbidity, loss of renal function, and cost). 3) Pictorial Review of Bosniak v.2019 Proposed updates and changes to the Bosniak classification will be presented with schematic and illustrative examples at CT and MRI.

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UR185-ED-TUA8

The Construction of Structured Reporting Template for Renal Cancer

Tuesday, Dec. 3 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #8

FDA Discussions may include off-label uses.

Participants
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Huihui Xie, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1.The application of CT examination to make a definite diagnosis before operation is of importance for patients' prognosis. 2. Structured reports(SR) were intended to provide standardized and complete structure for lesion description which were of great significance to the selection of surgical methods and prognosis evaluation. 3. To develope and implement a SR template to determine the grading of tumor and to accurately evaluate renal function for RCC patients.

TABLE OF CONTENTS/OUTLINE

1. The basic clinical evaluation and technical evaluation. 2. Image findings were comprised of 5 subsections. a) Design a framework for lesion evaluation; b) Evaluate tumor invasion concretely; c) Estimate renal vessels and show in key image screenshots; d) Assess lymph node and bone metastasis; e) Other significant imaging signs. 3. Automatically generated a reasonable imaging performance and diagnostic impression simultaneously.

VI135-ED-TUA10

Transcaval Approach for Embolization of Abdominal Aortic Aneurysm Type II Endoleak

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #10

Participants
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Dan I. Cohen-Addad, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Review the types of abdominal aortic aneurysm (AAA) endoleaks and current therapies. Discuss the different approaches for type II endoleak repair using images and illustrations. Learn the indication and technique of transcaval endoleak embolization

TABLE OF CONTENTS/OUTLINE

Abdominal aortic aneurysm (AAA) is a life-threatening condition as rupture is usually fatal. Endovascular abdominal aortic aneurysm repair (EVAR) is now standard of care for most patients with high success rates and lower morbidity compared to open surgery. An endoleak is an EVAR complication and indicates persistent blood flow into an aneurysm sac after endoluminal graft placement. In this review we focus on type II endoleaks, which are the most common and arise from collateral arterial backflow commonly from the mesenteric and lumbar arteries. Treatment by embolization of collaterals can be difficult and thus techniques to embolize the aneurysm sac itself with CT guided percutaneous approach have started to increase in popularity. However, in cases where the aneurysm sac is located in a position that is difficult to access with standard percutaneous or transarterial technique, a transcaval approach provides an alternative with reduced risk of inadvertent abdominal organ injury. The transcaval approach offers an option when cases arise that were previously thought to be inoperable.

VI136-ED-TUA9

Fire Burn and Cauldron Bubble: Contrast-Enhanced Ultrasound for Abdominal Interventions

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #9

FDA Discussions may include off-label uses.

Participants
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Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Consultant, Johnson & Johnson; Consultant, Bayer AG; Consultant, Merck & Co, Inc; Consultant, Amgen Inc; Consultant, Profound Medical Inc

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TEACHING POINTS

Since FDA approval for contrast enhanced ultrasound (CEUS), its applications in an array of clinical arenas are rapidly expanding, including in image guided procedures. Intravascular ultrasound contrast agents use microbubbles to enhance imaging of solid tumors, with no nephrotoxicity. Lesions not discernible on grayscale or Doppler ultrasound become amenable to contrast enhanced ultrasound guided biopsy or ablation. Case studies will illuminate this primer on the use of contrast enhanced ultrasound in abdominal interventions. 1. Provide a how-to primer on contrast-enhanced ultrasound interventions 2. Demonstrate utility in hepatic, renal and peritoneal/soft tissue interventions, including improved targeted biopsies and thermal ablation guidance and monitoring

TABLE OF CONTENTS/OUTLINE

1. Introduction to CEUS interventions to target the most enhancing parts of lesions and to avoid vascular structures 2. Ultrasound contrast agents and mechanism of action 3. Renal interventions: examples of targeted biopsies and pre and post ablation imaging 4. Hepatic interventions: examples of hyper and hypovascular lesion biopsies and pre and post ablation imaging 5. Peritoneal and soft tissue nodules: utility of CEUS for visualization and for biopsy and ablation targeting 6. Pearls and pitfalls 7. Summary and references

VI227-SD-TUA1

'SpineJack®' Percutaneous Placement in Magerl A2 and A3 Traumatic Vertebral Compression Fractures of the Thoracolumbar Spine

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #1

Participants
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Dario Notaro, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To prospectively evaluate safety and effectiveness of SpineJack® device (SJ) (Stryker, Kalamazoo, MI, USA) to achieve anatomical restoration of traumatic vertebral compression (VCFs) in Magerl A2 and A3 thoracolumbar fractures

METHOD AND MATERIALS

18 patients (16 male; mean age 57 years, age range 27-83 years) with traumatic thoracic (N=12) and the lumbar VCFs (N=7) within 3 weeks from the time of injury classified as Magerl type A2.2 (N=2), A2.3 (N=11) and A3.1 (N=6) were enrolled; exclusion criteria were spontaneous/osteoporotic and neoplastic vertebral fractures, posterior wall involvement of more than 1/3 than of the spinal canal. Visual analog scale (VAS) score and CT and/or MRI has been perforfed before and 48 hours, 1 and 6 months after procedure. Technical success was defined as correct placement of SJ implant.

RESULTS

A total of 11 VCFs has been treated with 100% technical success. 1 patient performed at 2 levels in the same session. No major complications related to procedure were registered; asymptomatic cement leakages occurred in 4 patients along fractures lines. All cases showed relevant improvement of symptoms with preoperatively mean VAS score of 7.4 dropped to 1,05 , 0,22 and 0,11 within 48 hours,1 and 6 months respectively. Mean height lift of 8.5 mm has been registered after procedure; 5 VCFs presented height lifting greater than 11 mm.

CONCLUSION

SJ placement can be effective and safe in traumatic VCFs, leading to immediate and lasting relief of pain and vertebral height recovery.

CLINICAL RELEVANCE/APPLICATION

Respect to standar balloon kyphoplasty, the Spinejack System permits unidirectional controlled anatomical vertebral high restoration even in A.2 and A.3 Magerl burst fractures. Replace the anatomy & biomechanics of the disc-vertebral joint.

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VI228-SD-TUA2

The Influence of High-Intensity Focused Ultrasound Ablation of Uterine Diseases with an Immediate Non-Perfused Volume Ratio > 90% on Ovarian Reserve

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To assess whether HIFU ablation with the achievement of a non-perfused volume (NPV) ratio greater than 90% should be recommended for women in childbearing age with extensive fibroids or adenomyosis, or whether it should be restricted only to patients who do not wish to preserve their fertility.

METHOD AND MATERIALS

One hundred twenty women (39.5 ± 5.8 years) with symptomatic fibroids (group 1) and 66 women (40.6 ± 6.6 years) with symptomatic adenomyosis (group 2) underwent HIFU treatment. In group 1, the patients were subdivided into "group 1A, n = 72" comprised of patients with an NPV ratio > 90% and "group 1B, n = 48" comprised of patients with an NPV ratio < 90%. In group 2, the patients were subdivided into "group 2A, n = 26" comprised of patients with an NPV ratio > 90% and "group 2B, n = 40" comprised of patients with an NPV ratio < 90%. The Anti-Müllerian hormone (AMH) level (ng/mL) prior to treatment and at 6-month follow-up was assessed as a measure of ovarian reserve.

RESULTS

The AMH levels before and at 6-months follow-up were 1.98 ± 1.86 (0.03-9.23) and 1.97 ± 1.85 (0.02-9.2; p = 0.077) in group 1A and 1.81 ± 1.42 (0.21-7.1) and 1.79 ± 1.42 (0.21-7.1; p = 0.06) in group 1B, respectively. The AMH concentrations before and at 6 months after treatment were respectively 1.98 ± 1.15 (0.57-4.61) and 1.98 ± 1.15 (0.57-4.61; p = 0.327) in group 2A and 1.65 ± 0.94 (0.09-4.11) and 1.65 ± 0.95 (0.09-4.11; p = 0.160) in group 2B. There was no significant difference between the AMH levels before or at 6-months follow-up within groups 1 and 2. In group 1, five patients conceived (2 still conceiving while 3 delivered live-birth with mean weight of 3200g ± 120); meanwhile, in group II, 3 patients conceived (1 still conceiving while 2 delivered live-birth with mean weight of 3150g ± 110).

CONCLUSION

Our findings suggest that there was no significant change in AMH levels before and 6 months after HIFU treatment both in fibroids and adenomyosis patients, suggesting that the ovary and its vessels were not adversely affected even with the achievement of a nonperfused volume (NPV) ratio greater than 90%.

CLINICAL RELEVANCE/APPLICATION

MRI guided HIFU treatment of both uterine leiomyomas and adenomyosis with the targeted endpoint of nonperfused volume (NPV) ratio of at least 90% can be achieved safely for women who wish to preserve their fertility.

VI229-SD-TUA3

CT-Perfusion in Peripheral Arterial Disease - Correlation of Baseline with Post-interventional Perfusion Parameters

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #3

Participants
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PURPOSE

The purpose of this study was the assessment of volumetric CT-perfusion (CTP) of the lower leg musculature in patients with symptomatic peripheral arterial disease (PAD) before (pre) and after (post) interventional revascularization, and comparing it with established angiographic and hemodynamic parameters.

METHOD AND MATERIALS

Thirty-five consecutive patients with symptomatic PAD of the lower extremities requiring interventional revascularization were assessed prospectively. All patients underwent a CTP scan of the lower leg, and hemodynamic and angiographic assessment, before and after intervention. Hemodynamic parameters such as ankle-brachial pressure index (ABI) were determined. CTP parameters were calculated with a perfusion software, acting on a no outflow assumption. A sequential two-compartment model was used. Differences in CTP parameters and correlations between CTP, hemodynamic and angiographic parameters were assessed with non-parametric tests.

RESULTS

The cohort consisted of 27 subjects with an occlusion, and eight with a high-grade stenosis. The mean blood flow pre/post (BFpre and BFpost) was 7.71 ± 2.96 / 10.95 ± 6.64 mL/100mL*min-1, and mean blood volume pre/post (BVpre and BVpost) 0.71 ± 0.33 / 1.24 ± 1.07 mL/100mL. BFpost and BVpost values were significantly higher than BFpre and BVpre in the symptomatic limb (p=0.003/0.02) but not in the asymptomatic limb (p=0.641/0.719). The ratios BFpost/BFpre and BVpost/BVpre, were not correlated to the ratio ABIpost/ABIpre.

CONCLUSION

Treatment options in PAD patients are still limited, but this might change shortly, since several new molecular and regenerative therapeutic agents are under investigation. Hence, there is a basic need for a non-invasive method that provides reliable, reproducible, and observer-independent data on muscle perfusion in the lower leg. In our study, we have proven CTP to be feasible for assessing PAD before and after revascularization.

CLINICAL RELEVANCE/APPLICATION

CTP might serve as a non-invasive method for the surveillance and therapy control of patients with PAD.

VI254-SD-TUA6

Impact of Dynamic Intima Motion on Renal Injury in Patients with Type B Acute Aortic Dissection: Quantitative Assessment with Dose-Regulated Retrospectively ECG-Gated CT Angiography in Dual-Source CT

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #6

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To quantitatively evaluate the impact of dynamic intima oscillation on acute kidney injury (AKI) in patients with type B acute aortic dissection (TB-AAD) before thoracic endovascular aortic repair (TEVAR) with retrospectively ECG-gated CT angiography (CTA), and further identify the association with early adverse events postoperatively.

METHOD AND MATERIALS

With IRB approval, a total of 108 patients (mean age 50.3±9.4 years, 79 male) with TB-AAD who underwent retrospectively ECG-gated CTA and received TEVAR were retrospectively enrolled. Patients were divided into AKI and non-AKI groups, respectively. Area of the true lumen (TLA) at the upper level of kidney artery origin was measured in the R-R intervals for every 5% step from 0-95% (Fig. 1, 2). The relative change of TLA (Crel-TLA) was calculated according to the formula (Crel-TLA = ([TLA]max - [TLA]min) / [TLA]max) in each cardiac cycle. Additionally, various morphologic parameters were further evaluated for the impact on AKI. Logistic regression analysis was performed to identify independent predictors for AKI. Receiver operating characteristic (ROC) analysis was used to determine the best cut-off value of each predictor. Freedom from early adverse events was estimated using the Kaplan-Meier method and log-rank test.

RESULTS

Forty-three patients were sorted into the AKI group (39.8%). Patients with AKI showed significantly larger Crel-TLA than those of the non-AKI group (49.1±18.7 vs 31.8±14.3, $p<0.001$) (Fig. 3). Significantly larger maximum diameters of the descending aorta ($p=0.023$) and the primary entry tear ($p=0.012$) were found in the AKI group. Crel-TLA and elevated systolic blood pressure were both independent predictors for AKI. Patients with Crel-TLA>=42.6% were associated with a high incidence of renal ischemia before TEVAR and early adverse events postoperatively (all $p<0.001$) (Fig. 4). Figure 5 showed an example of dynamic intima motion in one 54-year-old female patient, who ultimately developed acute renal failure after interventional surgery (Fig 5. A). The TLA change was variable in the entire cardiac cycle; Crel-TLA was 51.1% (Fig 5.B, C).

CONCLUSION

Dynamic intima motion has a significant influence on renal injury and some other adverse events as quantitatively evaluated by CTA.

CLINICAL RELEVANCE/APPLICATION

Retrospectively ECG-gated CTA can identify dynamic intima motion, which is helpful to guide clinical therapies for high-risk patients with TB-AAD.

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VI255-SD-TUA7

Combined MR Imaging for Pulmonary Embolism and Deep Venous Thrombosis by Contrast-Enhanced MR Volume Interpolated Body Examination

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #7

Participants
Qing Fu, MS,MS, Wuhan , China (*Presenter*) Nothing to Disclose

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PURPOSE

MR pulmonary angiography(MRPA) combined with MR venography(MRV) was attempted by using contrast-enhanced MR volume interpolated body examination (CE-VIBE) sequence. Agreement rate for deep venous thrombosis (DVT) detection between MRV and duplex sonography(DUS) was evaluated; the potential of this method for venous thromoembolism (VTE) was also investigated.

METHOD AND MATERIALS

Thirty-four patients with DUS-identified DVT were enrolled in this feasibility study. MRI was performed after a single administration of Gadopentetate dimeglumine. Fat suppressed CE-VIBE was applied for visualizing pulmonary arteries, abdominal veins, pelvic and bilateral leg veins, ranging from lung apex to ankle level. Two radiologists observed the MR images in consensus, recorded the location and number of emboli. MRV of the abdominal, pelvis and lower extremities veins were assessed based on per-vein segment. The agreement rate between MRV and DUS for venous segment-to-segment comparison was analyzed by Wilcoxon rank sum test.

RESULTS

All patients were diagnosed with DVT by MRV. MRV detected 55 more venous segments with thrombi than DUS based on per-vein segment analysis. Twenty-three patients with pulmonary embolism (PE) were detected by MRPA. Twenty-one patients underwent both pulmonary CT angiography and MRPA, consistency for PE detection between the two examinations was 100%. Total examination time of the combined MR protocol was 7 minutes for each patient.

CONCLUSION

CE- VIBE can visualize pulmonary arteries, abdominal-pelvic veins and bilateral lower extremity veins by single administration of contrast material, which makes it possible for detecting PE and DVT simultaneously. This proved to be a promising method for VTE diagnosis in one-stop MR scanning procedure.

CLINICAL RELEVANCE/APPLICATION

The combined MR protocol scanned by contrast-enhanced VIBE could diagnose PE and DVT simultaneously, which takes only 7 minutes for per patient and needs only a single administration of contrast material.

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VI256-SD-TUA8

Comparison of Early Tissue Shrinkage Following Hepatic Microwave Ablation and Multipolar Radiofrequency Ablation in an In-Vivo Porcine Liver Model in CECT

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #8

Participants
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PURPOSE

Microwave ablation (MWA) and radiofrequency ablation (RFA) are minimally invasive local ablation techniques that use thermal tissue coagulation to eliminate solid tumors. It is known from several studies, mostly ex-vivo, that the methods are associated with tissue shrinkage. Our aim was to quantify the early tissue shrinkage following hepatic MWA and RFA in an in-vivo porcine liver model using contrast-enhanced computed tomography (CECT).

METHOD AND MATERIALS

Multiple hepatic MWAs and multipolar RFAs (with three applicators) with constant energy parameters were performed in healthy, anesthetized and laparotomized domestic pigs. Volumes of ablated areas were obtained from venous phase CT-scans immediately after ablation and during a short-term course of up to 90 minutes after MWA or RFA.

RESULTS

A total of 26 thermally ablated areas (13 MWA and 13 RFA) in 18 porcine livers were analyzed, each case with three volume measurements. In both cohorts CECT-scans showed a volume reduction of the ablated zones ($p<0,001$ [MWA and RFA]). There was no statistically significant difference in volume change between RFA and MWA-lesions detectable, even though the dimension and dynamics in RFA ablated zones seem slightly less and more homogenous.

CONCLUSION

In our study we observe significant tissue shrinkage directly after hepatic MWA or RFA. The volume reduction of ablated tissue was not significantly different in the two methods.

CLINICAL RELEVANCE/APPLICATION

Early tissue shrinkage following RFA or MWA must be taken into account in assessing the technical success of tumor treatment by these techniques in clinical practice.

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VI257-SD-TUA4

Local Tumor Control and Survival Rates in Unresectable or Recurrent Hepatic Cholangiocarcinoma (CCC): Transarterial Chemoembolization (TACE) versus Combined TACE and Microwave Ablation (MWA)

Tuesday, Dec. 3 12:15PM - 12:45PM Room: VI Community, Learning Center Station #4

Participants
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PURPOSE

To evaluate the effect of local targeted liver therapy using transarterial chemoembolization (TACE) with or without microwave ablation (MWA) in patients with unresectable or recurrent cholangiocarcinoma (CCC) regarding overall survival and local tumor control.

METHOD AND MATERIALS

In this retrospective study from January 2007 to December 2017 152 patients (69 males/83 females; mean 58.7 years; range 25-86) with CCC with either unresectable (123/152=80.2%) or recurrent (29/152=19.8%) lesions were treated with at least three sessions (range 3-26) of TACE. Patients were subclassified into non-metastatic (86/152=56.5%), nodal metastatic (39/152=25.7%), systemic metastatic (18/152=11.8%) and both nodal and systemic metastatic (9/152=5.9%). 30 patients received combined TACE and MWA. Follow-up was performed using MRI and CT to evaluate local tumor control according to the modified RECIST criteria and survival was evaluated using the Kaplan-Meier method.

RESULTS

Mean survival for all patients was 28.7 months (CI 21.8-35.7). The survival for patients with non-metastatic, nodal, systemic metastatic and combined metastases was 37, 23.4, 17.5 and 12.4 months, respectively (p value = 0.006). Tumor response after three cycles of TACE was either stable (35.5%), partial response (41.4%) or progressive (23%) and the response at the last follow up was 25.7%, 15.2%, 59.2% and 3.5%, respectively. Patients who received additional MWA showed significantly longer survival vs those with only TACE (median 28 momths and 18 months, respectively, p<0.007). Significant prognostic factors for local tumor control and survival were nodal and/or systemic metastases, pre-therapeutic tumor size, initial local tumor response and additional application of MWA. However, no significant correlation was found between recurrent and unresectable tumors.

CONCLUSION

Local targeted liver therapy of unresectable or recurrent hepatic CCC using TACE or combined TACE and MWA provides an adequate therapeutic option for loca tumor control and improves patient survival

CLINICAL RELEVANCE/APPLICATION

TACE with additional MWA is a promising therapeutic tool in patients with advanced CCC involvement.

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AI024-EB-TUB

A Filter-Level Pruning Method for More Efficient Deep Learning Inference on Medical Images

Tuesday, Dec. 3 12:45PM - 1:15PM Room: AI Community, Learning Center Hardcopy Backboard

Participants
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Conclusion

Methods of accelerating DL inference will facilitate the use of complex model architectures in clinical settings. This, in turn, can improve the speed and accuracy large quantities of medical data can be processed, enabling faster, evidence-based treatment decisions and improve patient care.

Background

Deep learning (DL) can be leveraged to process large amounts of medical image data and facilitate more rapid clinical decisions. This is of high value for patients with critical or emergent conditions. However, state-of-the-art DL architectures for medical image data tend to be complex with high computation time. Thus, these models are often unsuitable for real-time clinical use, especially on hardware unequipped with GPUs. While model compression techniques have been developed for non-medical images, methods specific for biomedical data are still in their infancy. In this work, we propose and evaluate a compression technique for medical image DL models that uses convolutional filter pruning to reduce run-time without compromising accuracy.

Evaluation

We compressed 2D and 3D U-Net models trained for aorta segmentation on 6000 image slices and 800 CT volumes, respectively. For each model, filters from each convolutional layer were ranked via L1-norm, and a fraction of the lowest-ranking filters were removed. The smaller models were then retrained. Each model was evaluated via segmentation accuracy (dice coefficient, or DC) and inference speed on 600 image slices (2D model) or 80 image volumes (3D model) using only CPUs. The original models were compressed by varying degrees and results were compared to determine maximum possible compression. Segmentation accuracy of the 2D model was maintained (DC within 1%) when the model was reduced to as small as 8.8% of its original size. This compression produced more than a 3-fold increase in inference speed. Similarly, the 3D model accuracy was preserved when compressed to 8.0% of its size and yielded more than a 3-fold speed increase.

Discussion

These results demonstrate the efficacy of using filter pruning to achieve a more efficient neural network model for medical image segmentation. This approach ought to be evaluted on other model architectures.

AI205-SD-TUB2

Automatic Segmentation of 3D Hip Ultrasound for Detection of Hip Dysplasia

Tuesday, Dec. 3 12:45PM - 1:15PM Room: AI Community, Learning Center Station #2

Participants
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CONCLUSION

Neural network segmentation demonstrates accurate labelling of anatomic structures in 3D US of the infant hip. This pilot study shows it is feasible for AI to segment echogenic (acetabular) and hypoechoic (femoral head cartilage) regions in musculoskeletal ultrasound, and represents a promising step toward fully automating detection of infant hip dysplasia.

Background

Ultrasound is a front-line tool in the early detection of developmental dysplasia of the hip (DDH). Previous methods of diagnosis revolved around 2D ultrasound indices such as the Graf alpha angle and femoral head coverage. Our group has previously shown that 3D ultrasound (3DUS) can acquire images of the hip more reliably, even with inexperienced users. Measurements of hip dysplasia may also be more reliable when performed with assistance from artificial intelligence (AI). Since the first step in this is detecting anatomic structures, we sought to determine if AI can consistently and accurately segment the acetabulum and femoral head in hip 3DUS.

Evaluation

3DUS scans of 60 infant hips were acquired prospectively with ethics approval and parental consent. Hips ranged from normal to severely dysplastic. The acetabulum and femoral head were manually segmented from ultrasound images using ITK-SNAP software by a user trained by a pediatric musculoskeletal radiologist. The binary masks corresponding to the segmentation of 46 femoral head and 85 acetabular images were then used to train a convolutional neural network (CNN) based on the 3D U-Net architecture. Segmentation overlap accuracy was tested by Dice score (100% = perfect overlap).

Discussion

Compared to gold-standard manual segmentation, AI femoral head segmentation gave Dice score >0.85 in all scans, and >0.9 in 78% of scans. Automatic segmentation of the acetabulum was more challenging, with 85% of images having a Dice score >0.75. Much of the error appeared to be the difference in the number of slices labelled by AI vs. manual labels. On the central slices most important for DDH diagnosis, the manual and AI segmentations were more closely matched than the Dice scores suggest.

AI225-SD-TUB3

Paging Dr. Robot: A Chat Bot with a Machine Learning Algorithm for Predicting Pediatric Bone Age Through Hand-Wrist X-Rays

Tuesday, Dec. 3 12:45PM - 1:15PM Room: AI Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
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CONCLUSION

Development of tools, such as this, that have practical applications of AI are useful in broadening the understanding of radiologists in this field, also by generating interactions that provide more data for algorithm training, as well as creating perspectives of future applications, eventually with diagnostic purpose.

Background

We developed a tool that consists of a chat bot available on a freeware texting app, which deploys an algorithm developed using machine learning techniques, that attempts to accurately determine skeletal age in pediatric hand radiographs.

Evaluation

Access to the chat bot must be made through Telegram Messenger, either with the app or web browser version. The first step is to search for the user 'BoneAge_bot' and begin a chat with it by clicking on the 'start' icon. A message warns the user that this tool is not for diagnostic purpose. The user must then paste an image, in any format (although cropped images work best), of a hand-wrist radiograph, which will be used as the input for the algorithm. This will set in motion its mathematical functions that in turn generate a bone age output for each sex. This information will be displayed as a message, including the confidence interval, followed by a reminder that these results should not be used for medical decisions. Next, an explanation of the inner workings of this process is offered in the form of an activation map made over the original image, plotted with a title and yet another warning against the use of these results for diagnostic purpose. The following messages are a request for feedback by the user, in the form of multiple options regarding the correct sex and bone age of the patient, including an 'I don't know' option and a refusal to answer. Finally, the last message is an invitation to attempt another bone age prediction.

Discussion

This tool has the objective of being an available and practical instrument for radiologists, as well as other health and IT professionals, in order to demonstrate the potential of AI algorithms applied to imaging diagnostics in an easily understandable manner. The interactions with the user also provides new data for further training of the algorithm in different data distributions.

AI226-SD-TUB1

Convolutional Neural Network for Respiratory Motion Artifact Reduction in Multiphasic Liver MRI: Network Architecture and Clinical Evaluation

Tuesday, Dec. 3 12:45PM - 1:15PM Room: AI Community, Learning Center Station #1

Awards
Trainee Research Prize - Resident

Participants
Marie-Luise Kromrey, MD, Greifswald, Germany (*Presenter*) Nothing to Disclose
Daiki Tamada, Chuo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisashi Johno, Chuo-shi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Utaroh Motosugi, MD, Chuo, Japan (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

Clinical evaluation of the novel CNN-based filter MARC showed significant reduction in image degradation caused by respiratory motion artifacts and improvement in lesion conspicuity in gadoxetate disodium-enhanced liver MRI. MARC is especially effective in cases with substantial artifacts and offers a new perspective in artifact-reduced high quality MRI.

Background

Respiratory motion artifacts are a major problem in magnetic resonance imaging (MRI) of the abdomen, particularly in the arterial phase after gadoxetate disodium administration.

Evaluation

A deep convolutional neural network (CNN) based filter (MARC) was developed, consisting of 7 layers. For network training, 14,190 cropped images were generated from abdominal MR images of 6 patients and motion artifacts were simulated by adding periodic k-space domain noise to the images. The cropped images with and without motion artifact were used for input and output of the network.To investigate clinical utility, data sets of 192 patients (131 men, mean age 68.7±10.3 years), who received gadoxetate disodium-enhanced liver MRI in 2017 and did not include the training images, were submitted to MARC. Original and filtered images of precontrast and 6 arterial phases were examined regarding respiratory motion artifacts rated on a 4-point scale by 2 independent radiologists (1=no motion artifacts, 4=severe artifacts). Image quality was significantly improved over all phases after MARC with an average motion artifact score of 1.97±0.72 compared to 2.53±0.71 in original MR images ($p<0.001$). The filter led to a decrease in motion scores from 2 to 1 in 29.65%, 3 to 2 in 72.12% and 4 to 3 in 62.96%.Additionally, lesion conspicuity before and after filter was compared side-by-side using a 5-point scale. MARC filter significantly improved lesion conspicuity ($p<0.001$) without removing anatomical details.

Discussion

Artifact reduction is essential for MR image-based diagnosis. Compared to strategies, such as respiratory triggering or fast scanning by compressed sensing, postprocessing artifact reduction bears the advantage of not disrupting the clinical workflow and allowing for standardized scan protocols.

BR206-ED-TUB8

Beware the Axillae: Presentations of Breast Cancer Recurrence in the Axilla

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #8

Participants
Shu-Tian Chen, MD, Chiayi, Taiwan (*Presenter*) Nothing to Disclose
Rafik Zarifa, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Christine S. Lo, MBBS, Hong Kong , Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Nelly Salem, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Kathleen Horst, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Wendy B. Demartini, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Debra M. Ikeda, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

• To review recurrence of breast cancer in the axilla, management and prognosis • To illustrate cases of axillary recurrence of breast cancer with clinical presentations and imaging findings (mammogram, US, MRI, PET) and pathologic correlation. • We emphasize pitfalls, diagnostic difficulties, and differential diagnosis of masses and growing lymph nodes in the axilla after breast cancer treatment

TABLE OF CONTENTS/OUTLINE

Introduction: Breast Cancer Recurrence in the Axilla Rare Cases of Axillary Recurrence Pitfalls/Diagnostic Difficulties Management and Prognosis of Axillary Recurrence

BR207-ED-TUB9

Help Your Pathologist Help You: Successfully Arriving at a Diagnosis on Breast Biopsy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #9

Participants
Evguenia J. Karimova, MD, Memphis, TN (*Presenter*) Research Consultant, Intrinsic Imaging LLC
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Vandana M. Dialani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Rashmi Mehta, MBA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Tejas S. Mehta, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1.Understand the steps involved in processing a breast tissue sample in the pathology department. 2. Review steps to improve accuracy of lesion sampling and appropriately identify discordant results. 3. Review important information radiologists can provide pathologists to optimize tissue diagnosis

TABLE OF CONTENTS/OUTLINE

1.Illustrate the steps involved in processing and preparing a breast biopsy tissue sample in the pathology department. 2.Provide tips for improving accuracy of lesion sampling. 3.Review what additional information is helpful to narrow down pathologic diagnosis. 4.Problem-solving: how to identify and manage discordant biopsy results. 5.Review benefits of routine interdepartmental radiology-pathology consultation. Areas of diagnostic challenges (fibroepithelial and spindle cell proliferations, extra-mammary metastases, other).

BR208-ED-TUB10

Mixed and Purely Hyperechoic Breast Lesions: A Radiologic-Pathologic Review

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #10

Awards
Certificate of Merit

Participants
Allyson L. Chesebro, MD, Boston, MA (*Presenter*) Nothing to Disclose
M G. Kuba, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Susan Lester, MD,PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Catherine S. Giess, MD, Wellesley, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of this educational exhibit is to:1. Define echo patterns of breast lesions at ultrasound2. Present radiologic-pathologic correlation of hyperechoic breast lesions, both benign and malignant entities3. Illustrate characterization of hyperechoic breast lesions - homogeneously hyperechoic vs heterogeneously hyperechoic with radiologic-pathologic correlation4. Increase awareness of heterogeneously hyperechoic breast lesions as a manifestation of malignancy

TABLE OF CONTENTS/OUTLINE

1. Review and illustrate echo pattern at breast ultrasounda. Anechoicb. Hyperechoicc. Hypoechoicd. Complex cystic and solid2. Illustrate hyperechoic breast lesions with radiologic and pathologic correlation case examplesa. Homogeneously hyperechoic - all benign entitiesb. Heterogeneously hyperechoic - both benign and malignant entities

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BR237-SD-TUB2

Radiation Dose Reduction in Digital Mammography by Image Reconstruction Using Deep Learning Algorithm: Clinical Evaluation

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #2

Participants
Su Min Ha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eunhee Kang, Daejon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bora Yoon III, MD,MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the diagnostic performance in detection and characterization of breast cancer on synthesized 40% dose mammographic images using the new deep learning algorithm to 40% dose and standard full dose mammographic images.

METHOD AND MATERIALS

65 patients who underwent mammography for preoperative evaluation of breast cancer were prospectively included. Bilateral mammography with standard full dose through automatic exposure control (AEC) and additionally unilateral mediolateral oblique view of cancer side with 40% dose were obtained. The proposed de-noising method is designed based on unsupervised learning with cycle consistency loss due to the difficulty of matched labels. We trained two generators (network G and F) and two discriminators (network Dx and Dy). The training set consisted of 40% dose and standard full dose mammographic images and performed cross-validation. Five breast radiologists blindly rated the 40% dose and synthesized 40% dose images in comparison with the reference standard full dose image. Quantitative assessments were made using a McNemar's or marginal homogeneity test.

RESULTS

The standard full dose, 40% dose and synthesized 40% dose images showed similar detection rates of 87.4-97.5%. The 'not acceptable' image quality rating was higher for both masses and calcifications on the 40% dose images (28.6% and 36.4%, respectively) than synthesized 40% dose images (8.9% and 21.2%, respectively, $p<0.001$). The 'better' image quality rating was significantly higher for both masses and calcifications on the synthesized 40% dose images (73.1% and 10.7%, respectively) than 40% dose images (1.9% and 2.9%, respectively; $p<0.001$).

CONCLUSION

The detection rate of synthesized 40% dose mammography using the new deep learning algorithm is comparable with standard full dose and the image quality is superior to 40% dose. Therefore, the radiation dose of mammography could be considerably reduced using this deep learning algorithm.

CLINICAL RELEVANCE/APPLICATION

Image reconstruction using the new deep learning algorithm is effective in dose reduction of mammography, especially in young women with high risk who are routinely examined with mammography for screening.

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BR238-SD-TUB3

Tissue Sound Speed: A Novel Imaging Biomarker for Measuring Tamoxifen Response

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #3

Participants
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Sharon Fan, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Gretchen Gierach, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Studies have shown that a decrease in mammographic density (MD) or lowering of background parenchymal enhancement (BPE) on MRI after initiation of tamoxifen therapy predicts a favorable response in the preventive or adjuvant settings. However, performing serial mammograms poses radiation concerns, while serial MRIs carry high cost as well as risk of multiple Gadolinium doses. Previous studies have shown that tissue sound speed, derived from whole breast ultrasound tomography measurements, is a surrogate biomarker of MD. Ultrasound is ideal for performing serial measurements because it is fast and poses almost no risks. The purpose of this study was to evaluate repeated measures of the sound speed biomarker at 3, 6 and 12-months following tamoxifen initiation.

METHOD AND MATERIALS

We performed a case-control comparison involving 74 participants referred by a health professional to undergo tamoxifen therapy (cases) and 150 matched participants with no history of breast cancer (controls). The cases were scanned with ultrasound tomography at baseline (i.e. before start of tamoxifen therapy), and then at 3, 6 and 12 months after tamoxifen initiation. Controls were scanned at baseline and 12 months. In the case group, sound speed was measured pre-treatment in the contralateral breast to avoid potential influences of tumor-related changes on density. In the control group, a single randomized breast was scanned. A pairwise t-test was used to assess differences in sound speed over time and between cases and controls.

RESULTS

There was a steady decline in sound speed over the 12-month period for women undergoing tamoxifen therapy (mean(SD): -3.0(8.2) m/s; P=0.001). Furthermore, significant sound speed reductions were observed as early as 4-6 months after tamoxifen initiation (mean(SD): -2.1(6.8) m/s; P=0.008); Figure 1. In contrast, the controls demonstrated no significant change in sound speed over a 12-month period, and the difference between case-control groups was statistically significant (P=0.0009).

CONCLUSION

Breast sound speed decreases rapidly after tamoxifen initiation; further studies are needed to assess whether this can predict clinical response.

CLINICAL RELEVANCE/APPLICATION

Ultrasound tomography may have utility in monitoring breast sound speed change as a potential biomarker of clinical tamoxifen response.

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BR269-SD-TUB4

Quantitative Analysis of Background Parenchymal Enhancement in Breast MRI May be Predictive of Breast Cancer Risk

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #4

Participants
Bethany L. Niell, MD,PhD, Tampa, FL (*Presenter*) Nothing to Disclose
Mahmoud Abdalah, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Olya Stringfield, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Malesa M. Pereira, MPH, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Natarajan Raghunand, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Yoganand Balagurunathan, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Higher background parenchymal enhancement (BPE) categories may increase breast cancer risk, suggesting that BPE category is a modifiable risk factor with moderate effect size but with poor to moderate inter-reader agreement. Using a semi-automated segmentation algorithm, we extracted quantitative measures of BPE to investigate the volume and intensity of enhancement most predictive of breast cancer risk.

METHOD AND MATERIALS

In this IRB approved HIPAA compliant study, we retrospectively identified 19 high-risk women without a personal history of breast cancer who underwent breast MRI and subsequently developed breast cancer. Each case was age-matched to four controls (76 controls total). From each dynamic contrast-enhanced MRI, quantitative measures of enhancement were computed on each post-gadolinium phase by averaging voxels with relative intensity change above pre-defined enhancement ratio thresholds; totaling the volume that enhances above threshold (absolute volume of BPE in cm3); and estimating the percentage of tissue that enhances above threshold relative to total breast volume (BPE%). We investigated the ability of each of these 91 characteristics to stratify cases from controls using logistic regression. Each BPE feature's predictive ability was evaluated using the hold out (80/20) cross validation method, and features were selected based on Youden's J index and area under the curve (AUC).

RESULTS

Women subsequently diagnosed with breast cancer were 3 fold more likely to have mild, moderate, or marked BPE (referent category: minimal BPE; odds ratio = 3.0; 95% confidence interval 0.92-10.0, Fisher's exact p=0.07). BPE volume measures demonstrated similar AUC across all four post-gadolinium phases (AUC 0.63-0.79). First post-gadolinium (phase 1) BPE% at the 30 and 40% enhancement ratio thresholds each demonstrated the highest AUC (0.84) (Figure) and Youden's indices (J = 0.28 and 0.23, respectively).

CONCLUSION

Quantitative BPE measures have the potential to predict subsequent breast cancer risk. Future research is warranted to quantify BPE measures in a larger cohort of diverse patients to validate our findings.

CLINICAL RELEVANCE/APPLICATION

If demonstrated to be significant predictors of risk, future research could incorporate quantitative BPE measures into risk prediction models to more accurately estimate each woman's risk of breast cancer.

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BR270-SD-TUB5

Whole-Breast Malignancy Rating for MRI Using Deep Learning

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #5

Participants
Daniel Truhn, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
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Hannah S. Schneider, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Mirjam Broeckmann, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Dorit Merhof, DIPLENG, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Simone Schrading, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This work presents a deep learning approach to automatically rate a full, clinical-routine, multiparametric breast MRI examination with regard to the presence of malignancy. While deep learning has been applied extensively to 2-dimensional image analysis (e.g. x-ray or single CT-slices), the extension to a 3-dimensional multiparametric dataset (MRI) has proven to be challenging. Based on previous works of patch-based (i.e. cropped 2D images) classification of breast lesions, a dedicated network architecture and curriculum learning strategy was devised that results in a comprehensive deep learning analysis of a full breast MRI-examination.

METHOD AND MATERIALS

Clinically routine breast MRI scans of 2000 patients acquired at our institution were used to train the 3D convolutional neural network in a two-stage curriculum process: First, the network is pretrained on a subset of 500 patches of size 64x64x4 voxels (4 slices with dimension of ca. 38 mm each) that encompass a known breast lesion (manually marked by radiologist). Second, to make use of the far greater availability of non-annotated data, the network is enlarged to allow for an input of 512x256x32 voxels that comprise the full breast. In this stage the network is trained on 1400 MRI examinations by only being given the BIRADS score for the whole breast. The network performance is evaluated on a test set of 100 MRI examinations and its area under the curve (AUC) as well as sensitivity and specificity are compared to an experienced radiologist in the field.

RESULTS

Training of the full network in the two-stage approach takes about 6 hours on a graphical processor unit. The AUC for the presented network architecture is 0.89+-0.01 and sensitivity and specificity are 0.84 and 0.81 respectively. Sensitivity and specificity of an experienced radiologist on the test dataset were 0.92 and 0.94 respectively. Without the two-stage learning approach, training fails.

CONCLUSION

Employing an optimized training strategy and dedicated network architectures, convolutional neural networks can be trained to rate a full breast MRI examination. Expert rating is still superior.

CLINICAL RELEVANCE/APPLICATION

The fully automated rating system can be used as an adjunct diagnostic tool and may approach expert performance once trained on a larger dataset.

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BR271-SD-TUB6

Developing an Artificial Intelligence Algorithm Pipeline for Predicting Malignancy Risk for Mammographic Microcalcifications Leveraging the ACR Data Science Institute (DSI) Use Case Library

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #6

Participants
Elizabeth S. Burnside, MD,MPH, Madison, WI (*Presenter*) Research Grant, Hologic, Inc
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Daniel L. Rubin, MD, Stanford, CA (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd
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Jennifer R. Cox, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Vikas Singh, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study implements a pipeline to develop artificial intelligence (AI) algorithms to diagnose mammographic microcalcifications using the publicly-available use case authored by the Data Science Institute (DSI) breast imaging panel.

METHOD AND MATERIALS

Our pipeline, focuses on the clinical goals of the DSI use case entitled 'Classifying Suspicious Microcalcifications,' simultaneously codifying how to 1) extract relevant mammography cases using widely available National Mammography Database (NMD) fields, 2) construct AI algorithms integrating computational and clinical input, and 3) formalize clinically-relevant evaluation metrics; all designed to support proof of generalizability. We collected mammograms with microcalcifications using an NMD database of consecutive screening and subsequent diagnostic mammograpms (1/1/2006-12/31/2015) from an academic practice for women $\geq$40. Matched outcomes from a Cancer Center registry confirmed final pathology using 6 ordinal subcategories: 4 malignant categories (invasive>DCIS grade 3> DCIS grade 2> DCIS grade 1) and 2 benign categories (high risk>normal). According to the DSI use case, we developed AI algorithms to calculate malignancy risk (using 10-fold cross validation) for ROC curve comparison using the DeLong method-as an example. We also derived a binary classification (benign versus malignant) and a 6-class stratification in order to classify pathologic severity and use BI-RADS to derive generalizable metrics.

RESULTS

Our final dataset contained 10,834 images with microcalcifications and ground truth pathology: 778 cancers (385 invasive; 89 DCIS grade 1; 183 DCIS grade 2; 121 DCIS grade 3) and 10,056 benign (283 high risk; 9773 normal). An example result from our pipeline: our Graph Neural Network algorithm achieved an area under the ROC curve of 0.65 which was statistically significantly superior to a baseline model using logistic regression (AUC = 0.52; $p < 0.001$). Generalizability planning includes specification of a pre-assigned threshold to use for evaluation metrics according to BI-RADS.

CONCLUSION

We demonstrate feasibility of developing an AI pipeline for realizing an important DSI use case in breast imaging.

CLINICAL RELEVANCE/APPLICATION

Assessing if microcalcifications on mammography are malignant is a clinically important pursuit. The relevant DSI use case effectively guided a promising pipeline for AI algorithm development.

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BR272-SD-TUB7

Qualitative Analysis of the Intensity and Patterns of Enhancement on Contrast-Enhanced Spectral Mammography

Tuesday, Dec. 3 12:45PM - 1:15PM Room: BR Community, Learning Center Station #7

Participants
Ying Liu, Chengdu, China (*Presenter*) Nothing to Disclose
Jianqun Yu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate the relationship between histological results and the intensity and patterns of enhancement on contrast-enhanced spectral mammography (CESM) with a qualitative analysis

METHOD AND MATERIALS

CESM was conducted on patients with clinically or ultrasonically suspected breast lesions. 104 patients who had obtained pathological diagnosis were enrolled. Three radiologists interpreted the images. The intensity of enhancement was qualitatively classified as: no enhancement, mild enhancement, moderate enhancement and severe enhancement. By comparing the degree of enhancement in the two subtraction images (CC position and MLO position) from index lateral breast, the patterns of enhancement were classified as three types: ascending (type 1), steady (type 2), and descending (type 3). The intra-rater agreement and inter-rater agreement were calculated.

RESULTS

A total of 121 lesions were found in 104 patients. There were 31 breast cancers and 90 benign lesions. Most breast cancers presented with moderate enhancement or severe enhancement while most benign lesions showed no enhancement or mild enhancement. The proportion of enhancement patterns of malignant lesions was type 1, 13.3% (4 of 30); type 2, 36.7% (11 of 30); type 3, 50.0% (15 of 30). For benign cases, type 1 accounted for 28.8% (15 of 52), type 2 accounted for 63.5% (33 of 52) and type 3 accounted for 7.7% (4 of 52). Combining the enhancement intensity with enhancement patterns, the area under ROC were 0.835, and the sensitivity, specificity, and accuracy were 77.4%, 76.7%, and 76.85%, separately. There were significant differences on both the intensity and patterns of enhancement between benign and malignant groups (P<0.001). For a qualitative analysis, the intra-rater and inter-rater agreement varied from moderate to substantial.

CONCLUSION

The intensity and patterns of enhancement on CESM are related to the distribution of benign and malignant breast lesions. Qualitative analysis of enhancement characteristics is feasible to the diagnosis practice on CESM.

CLINICAL RELEVANCE/APPLICATION

The intensity and patterns of enhancement on CESM may contribute to the differential diagnosis of benign and malignant lesions.

CA165-ED-TUB7

Clinical Applications of Deep Learning in Cardiovascular Imaging

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CA Community, Learning Center Station #7

Participants
Yusuke Yagi, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Karen G. Ordovas, MD, Seattle, WA (*Abstract Co-Author*) Advisor, Arterys Inc;

TEACHING POINTS

The purpose of this exhibit is: To describe major concepts in deep learning. To review general principles, clinical utility, and added value of current clinical applications of deep learning in cardiovascular imaging. To discuss potential future directions for deep learning in cardiovascular imaging.

TABLE OF CONTENTS/OUTLINE

In this educational exhibit, we will first use educational diagrams to describe and illustrate the major concepts involved in the development of deep learning networks. Through this process, the goal is to help clinical radiologists understand this advanced machine learning technique. We will then review and illustrate the current use of deep learning-based software in clinical cardiovascular imaging practice, including the following: Cardiac Magnetic Resonance (CMR) Cardiovascular Anatomic Segmentation CMR Myocardial Feature Tracking Computed Tomography-derived Fractional Flow Reserve Calculation Finally, we will discuss potential future directions for the use of deep learning in the cardiovascular imaging field.

Printed on: 10/29/20

CA168-ED-TUB8

Multimodality Imaging of Right Atrium: Potential Entities and Radiological Findings

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CA Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
Maria Leturia Etxeberria, MD, San Sebastian, Spain (*Presenter*) Nothing to Disclose
Maria Gredilla Saenz, San Sebastian, Spain (*Abstract Co-Author*) Nothing to Disclose
Alberto Serdio, Donostia-San Sebastian, Spain (*Abstract Co-Author*) Nothing to Disclose
Alba Aguado Puente, Donostia, Spain (*Abstract Co-Author*) Nothing to Disclose
Francisco Jose Barba Tamargo, MD, San Sebastian- Donostia, Spain (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

- To describe the spectrum of pathologic entities involving the right atrium from a multimodality approach.- To achieve familiarity with these conditions and their potential treatment to ensure that appropriate imaging modalities are selected in each case.

TABLE OF CONTENTS/OUTLINE

Cardiac imaging typically focuses on the coronary arteries and left ventricle. The remaining cardiac structures, including the right atrium, also merit clinical and diagnostic attention. Understanding the anatomic structure and pathologic findings of the right atrium is essential because there are important pathologic conditions which require early diagnosis and treatment.This review aims to provide a comprehensive review of some of the pathologic entities on which the right atrium is involved, including:-Congenital atrial anomalies-Atrial septal defects-Atrial pseudomasses-Atrial and periatrial masses-Other disorders and pitfallsWhen interpreting cardiac imaging studies, one should be familiar with the wide variety of right atrial pathologic characteristics and imaging indicators that can potentially guide treatment. In this presentation, all these findings will be shown through a muldimodal review.

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CA215-SD-TUB1

Multiparametric Cardiovascular Magnetic Resonance Imaging in Acute Myocarditis: A Comparison of Different Measurement Approaches

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CA Community, Learning Center Station #1

Participants
Darius Dabir, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
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Alexander Isaak, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Feisst, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
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Daniel K. Thomas, MD, PhD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Myocardial T1 and T2 mapping are reliable diagnostic markers for the detection and follow up of acute myocarditis.The aim of this study was to compare the diagnostic performance of current mapping measurement approaches to differentiate between myocarditis patients and healthy individuals.

METHOD AND MATERIALS

50 patients with clinically defined acute myocarditis and 30 healthy controls underwent cardiac magnetic resonance (CMR) including myocardial T1 and T2 mapping. Native T1 and T2 relaxation times, as well as ECV were measured for the entire left ventricular myocardium (global), within the midventricular short axis slice (SAX), within the midventricular septal wall (ConSept), and within the remote myocardium (remote). Receiver operating characteristics analysis was performed to compare diagnostic performance.

RESULTS

All measurement approaches revealed significantly higher T1 and T2 relaxation times as well as ECV values in patients compared to controls ($p<0.05$ for all parameters). The global measurement approach showed highest diagnostic performance regarding all mapping parameters (AUCs, native T1: 0.903, T2: 0.847, ECV: 0.731). Direct comparison of the different measurement approaches revealed significant differences in diagnostic performance between the global and the remote approach regarding T1 relaxation times and ECV ($p=0.001$ and $p=0.002$ respectively). Further, the global measurement approach revealed significantly higher T1 relaxation times compared to the ConSept approach (AUCs: 0.903 vs. 0.783; $p=0.003$) and nearly significant differences compared to the SAX approach (AUC: 0.850; $p=0.051$).T2 relaxation times showed no significant differences between all measurement approaches ($p>0.050$ for all parameters).

CONCLUSION

Native T1 and T2 mapping allow for accurate detection of acute myocarditis irrespective of the measurement approach used.Even measurements performed exclusively within remote myocardium allow for reliable detection of acute myocarditis, proving diffuse involvement of disease despite a mostly regional or patchy distribution pattern of visible pathologies.The global measurement approach provides the overall best diagnostic performance in acute myocarditis for both T1 and T2 mapping.

CLINICAL RELEVANCE/APPLICATION

Our results give new insights into the pathophysiology of disease and contribute to a single common mapping measurement approach in patients with clinically suspected myocarditis.

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CA216-SD-TUB2

The Early Warning Value of Low-Dose CT Coronary Angiography for Assessment of Vulnerable Plaque and Screening Coronary Heart Disease

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CA Community, Learning Center Station #2

Participants
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PURPOSE

To evaluate the early warning value of prospectively ECG-triggered high-pitch mode low-dose coronary computed tomography angiography using a third-generation dual-source CT for assessment the plaque in the coronary lumen. The risk factors of plaque development, the relationship between the vulnerable plaque and cardiovascular events were analyzed.

METHOD AND MATERIALS

Between July 2015 and February 2016, a total of 1,004 high-risk patients, including 465 males and 539 females aged from 26 to 83 (58.15±10.29) years, were enrolled prospectively in our hospital. ECG-triggered high-pitch mode was adopted to scan, the subjects were divided into group A (normal group,439 patients) and group B (plaque group,565 patients). Group B was divided into group B1 (vulnerable plaque group, 335 patients) and group B2 (stable plaque group, 230 patients). Demographic indicators, cardiovascular risk factors and some biochemical indicators were collected from the patients. An average of 3 years of follow-up was conducted to study the relationship between vulnerable plaques and cardiovascular events.

RESULTS

Multivariate Logistic regression analysis showed that gender, age, history of diabetes, history of hypertension, fasting blood glucose, TG, TC, and LDL-C were independent risk factors for the occurrence of vulnerable plaque. During the mean (35.12 ± 2.61) months of clinical follow-up, 38 patients (3.78%) had MACE. Univariate Cox regression model showed that compared with group A, MACE incidence in group B1 significantly increased. Kaplan-meier survival curve showed that the cumulative event-free survival rate of group B1 was significantly lower than that of other groups. The Effective Dose received by the patients was 1.15±0.40 (0.25~6.94) mSv.

CONCLUSION

Low-dose coronary artery CT imaging can be used as a non-invasive and simple method for screening high-risk groups. Male, aged, a history of diabetes, hypertension and patients with high levels of fasting blood glucose, TG, TC, LDL-C, Cys-C are at increased risk of coronary artery plaque. The risk of major adverse cardiac events of vulnerable plaques increases, and the risk factors can be analyzed for early intervention to reduce the occurrence of major adverse cardiac events.

CLINICAL RELEVANCE/APPLICATION

A simple and non-invasive early warning model of cardiovascular disease risk was established to identify and prevent vulnerable plaques causing adverse cardiovascular events.

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CA217-SD-TUB3

Decreased Left Atrial Longitudinal Strain is Associated with Cardiac Amyloidosis

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CA Community, Learning Center Station #3

Participants
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PURPOSE

Late gadolinium enhancement (LGE) is used clinically to inform the diagnosis of cardiac amyloidosis (CA). The aim of this study is to evaluate the association between cardiac magnetic resonance (CMR) imaging variables and CA beyond LGE.

METHOD AND MATERIALS

20 patients (5 women) age (mean ± SD) of 61±13 years old with clinical suspicion for CA, referred to CMR who underwent cardiac biopsy were included in this single institution retrospective study. The CMR exam consisted of: 1) cine images, which were used for measuring indexed left ventricular (LV) mass, ventricular volume, ejection fraction (EF), and ventricular and left atrial (LA) strain; and 2) LGE images, which were used for assessing myocardial amyloid deposition. Logistic regression analysis adjusted for cardiovascular disease risk factors was performed to identify CMR variables that are associated with CA.

RESULTS

Twelve patients (60%) were diagnosed with CA at biopsy. Ten patients (50%) had systemic light chain amyloidosis, 9 of which had CA. The remaining 3 patients had transthyretin CA. Nine out of 13 patients that demonstrated LGE were diagnosed with CA. Patients with CA had significantly lower left atrial global longitudinal strain (LA GLS) than patients with no CA (mean ± SD = 15±12% versus 33±13%, p=0.01, Figure 1). In a multivariable analysis adjusted for cardiovascular disease risk factors, only LAGLS remained significantly associated with CA (p=0.03), while LGE was not (p=0.48) (Table 1).

CONCLUSION

Decreased LA GLS is independently associated with biopsy-proven CA. CMR strain is a valuable tool for evaluating CA beyond the need for gadolinium administration.

CLINICAL RELEVANCE/APPLICATION

Left atrium longitudinal strain may be used as a biomarker to diagnose patients with cardiac amyloid

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CA249-SD-TUB4

Correlation between Extracellular Volume Expansion and Late Gadolinium Enhancement in Dilated Cardiomyopathy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CA Community, Learning Center Station #4

Participants
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PURPOSE

Proper evaluation of the amount of myocardial fibrosis in Dilated cardiomyopathy patients by correlating ECV with LGE

METHOD AND MATERIALS

This study involved a total of 28 patients with mean age of 44 years. All patients were diagnosed as Dilated cardiomyopathy by 2D echocardiography. CMR was done including cine images, LGE sequences as well as native T1 and post contrast T1mapping. Consents were obtained from all patients.

RESULTS

The mean EF for the left ventricle was 25.4%, EDV was 318.07ml, mean ESV was 245.89ml with SV of 72.5ml. The right ventricle showed 39.4% EF with EDV of 189.6ml and ESV of 118.7ml and SV of 64.4ml. The mid ventricular lateral wall showed no evidence of LGE in all patients, however 15 patients showed ECV% expansion. The mid ventricular septal wall showed LGE in 3 patients , however there was expansion of ECV% in 20 other patients giving a P value of 0.5. The mid ventricular anterior wall showed no evidence of LGE, yet 16 of our patients showed ECV% expansion. The mid ventricular inferior wall showed LGE in (2 patients) while ECV expansion was found in 20 patients. The basal lateral wall showed no evidence of LGE with expansion of ECV% in 18. The basal septal wall showed LGE in 5 patients with 25patients having expansion of ECV%. The basal anterior wall showed no evidence of LGE, yet 18 patients showed ECV % expansion. LGE was noticed in 3 of our patients within the basal inferior wall, while 25 patients showed ECV% expansion. Overall we had 157 walls showing ECV% expansion and only 13 walls with LGE. Correlation between the ECV and the native T1 value was significant in the septal mid, lateral basal, anterior basal and septal basal segments only. Negative correlation was found between the LV EF% and the ECV% with correlation coefficient of -0.370 as well as between LV EF% and the mean nativeT1 with correlation coefficient of -0.474 and P value of 0.011. Correlation made between the LV EDV and the mean native T1was positive with correlation coefficient of 0.382 and 0.045 P value . Correlation between LV EDV and the mean ECV % was positive with correlation coefficient of 0.221.

CONCLUSION

ECV has a better predictive value for fibrosis than the LGE in evaluating of Dilated cardiomyopathy and should be used for better prognosis of patients.

CLINICAL RELEVANCE/APPLICATION

(Dealing with dilated cardiomyopathy) ECV expansion is better than LGE in predicting myocardial fibrosis

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CA250-SD-TUB5

Assessment of Left Ventricular Deformation using CMR Tissue Tracking in Patients with Connective Tissue Diseases: Comparison between Idiopathic Inflammatory Myopathy and Non-Idiopathic Inflammatory Myopathy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CA Community, Learning Center Station #5

Participants
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PURPOSE

To assess left ventricular (LV) deformation in patients with connective tissue diseases (CTDs) by cardiac magnetic resonance (CMR) tissue tracking and compare LV deformation between idiopathic inflammatory myopathy (IIM) and non-idiopathic inflammatory myopathy (non-IIM).

METHOD AND MATERIALS

A total of 98 patients with CTDs, including 56 with IIM and 42 with non-IIM, and 33 control subjects were enrolled in 3.0T CMR scanning. The LV function, global and regional radial, circumferential, and longitudinal peak strain (PS) were quantified and compared among the three groups of normal controls, IIM, and non-IIM group. The relationships between strain parameters with the N-terminal pro-brain natriuretic peptide (NT-proBNP) and LV ejection fraction (LVEF) were evaluated.

RESULTS

Among the three groups of normal controls, IIM, and non-IIM, NT-proBNP was gradually increased [64 (31, 88) vs. 119 (57, 306) vs. 1272 (267, 5047), $p < 0.05$]. Compared to control subjects, the global and regional PS in the three directions significantly impaired in CTDs patients (all $p<0.05$), while LVEF was preserved (LVEF>50%). In the IIM group, the global radial PS (GRPS), global longitudinal PS (GLPS), radial PS at the mid slice, and longitudinal PS at the apical slice were lower than those in the control group. In the non-IIM group, all of the strain values decreased compared with the control subjects and IIM group (all $p<0.05$), except for GLPS and longitudinal PS at the apical slice by comparison with IIM. Furthermore, the global strain parameters (radial, circumferential, and longitudinal) correlated with NT-proBNP ($|r|=0.289$-0.658, all $p<0.05$) and LVEF ($|r|=0.524$-0.906, all $p<0.05$) both in the IIM group and non-IIM group.

CONCLUSION

The abnormal LV myocardial deformation in CTDs patients with preserved LVEF can be identified by CMR tissue tracking. LV myocardial deformation may impaired more severe in CTDs patients with non-IIM than IIM.

CLINICAL RELEVANCE/APPLICATION

Early identification of LV deformation, especially in the subclinical state, provide the evidence of the efficacy of an early treatment that targets the heart and improve prognosis in CTDs patients.

CA251-SD-TUB6

Performance of Cardiac CT for the Diagnosis of Arrhythmogenic Cardiomyopathy of The Right Ventricle

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CA Community, Learning Center Station #6

Participants
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PURPOSE

Task-Force diagnostic criteria for arrhythmogenic right ventricular cardiomyopathy (ARVC) currently do not include cardiac CT. Regional wall motion abnormalities and fatty infiltration of the right ventricular (RV) wall have been described in CT. Taking advantage of 4D-CT of the RV we propose to : 1. apply in cardiac CT the 2010 TASK FORCE (TF) criteria initially designed for MRI; 2. investigate the distribution patterns of RV motion and fatty infiltration; 3. Propose a combined diagnostic parameter based on co-localized segmental analysis of wall function and fatty infiltration.

METHOD AND MATERIALS

We performed a single reference-center, retrospective study of 106 individuals: 54 patients with ARVC (70% with identified mutation) and 52 age and sex-matched controls without ARVC consulting for unrelated conditions. We applied the 2010 TASK FORCE MRI criteria to CT imaging including dilatation or dysfunction of the RV with severe kinetic abnormalities. Volumes, EF, mass, segmental wall motion and fatty infiltration of the left ventricle were assessed. We proposed and studied the diagnostic yield of a composite CT index combining segmental wall motion and fatty infiltration.

RESULTS

Thirty-nine (72%) patients and 0 controls met the major TF criteria. Two patients (4%) and 0 controls met the minor TF criteria. Of the patients who met no diagnostic criteria, 7 (54%) had extensive fatty infiltration of the RV versus 4 controls (8%); and 2 (15%) had extensive LV fatty infiltration. We found a very good diagnostic performance for the composite index of akinesia or dyskinesia and transmural fatty infiltration. AUC=0,86, accuracy=84%. Two patients with genetic mutations associated to ARVC who were considered phenotype-negative had abnormal CT and positive composite index.

CONCLUSION

Our study suggests that 2010 TASK FORCE criteria for ARVC are applicable to cardiac-CT. Furthermore, the presence of co-localized fatty infiltration of the RV and severe wall motion abnormalities could enhance the diagnostic yield of imaging in this disease. Such composite CT index could be assessed as a new diagnostic criterion and may be particularly useful to detect localized forms of ARVC or infraclinical familial cases.

CLINICAL RELEVANCE/APPLICATION

2010 TASK FORCE criteria designed for MRI in ARVC are applicable in cardiac-CT, co-localized fatty infiltration of the RV and kinetic abnormalities could enhance diagnostic performance for this disease.

CH006-EB-TUB

Primary Thoracic Lymphomas: Spectrum of Imaging and Histopathologic Manifestations

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CH Community, Learning Center Hardcopy Backboard

Awards
Certificate of Merit

Participants
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TEACHING POINTS

1) Illustrate imaging and histopathologic features that distinguish primary thoracic lymphoma subtypes. 2) Highlight the natural history, prognosis, and therapeutic options for the various primary thoracic lymphomas. 3) Discuss the Lugano classification system for standardized lymphoma staging and the impact of imaging findings on staging and treatment response assessment. 4) Describe common imaging findings that are typically seen following chemotherapy and/or radiation.

TABLE OF CONTENTS/OUTLINE

Lymphomas are heterogeneous neoplasms with frequent intra-thoracic involvement. Primary thoracic lymphomas are distinct entities falling along a wide spectrum, with overlap of clinical behavior, histopathology, imaging features, and prognostic implications. This project illustrates imaging and histopathologic features that distinguish primary thoracic lymphoma subtypes. In addition, the Lugano classification system and its impact on staging and evaluating treatment response is discussed, while highlighting the natural history, prognosis, and therapeutic options for the various subtypes. Radiologists that understand differences among the various subtypes, and recognize key distinguishing radiologic findings, are better able to contribute to the multidisciplinary management of patients with thoracic lymphoma thus impacting morbidity and mortality.

CH228-ED-TUB6

It's Not Just Crack That's Whack: Cardiothoracic Complications of the Opioid Epidemic

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CH Community, Learning Center Station #6

Participants
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Anna S. Bader, MD, New Haven, CT (*Presenter*) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is: 1. To understand the emergence of the opioid crisis 2. To review the imaging findings of complications of opioid abuse in the chest 3. To identify the appropriate imaging modalities for optimal evaluation of these entities

TABLE OF CONTENTS/OUTLINE

1. Magnitude of and contributing factors to the opioid epidemic 2. Imaging evaluation and features of: Mycotic thoracic aortic aneurysm on CTA and MRA Aortic root abscess on cardiac-gated CTA and MRI Endocarditis with vegetations affecting native valves, prosthetic valves Appearance and complications of tricuspid valvectomy Septic emboli in the lungs Bone and joint infections, including vertebral osteomyelitis/discitis using CT and MRI Non-cardiogenic pulmonary edema Overall immunosuppression with resulting infectious complications Sarcoid-like reaction to injected particles

CH229-ED-TUB7

Pearls and Pitfalls in Interpreting Thoracic CTA for Acute Aortic Pathology

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CH Community, Learning Center Station #7

Awards
Identified for RadioGraphics

Participants
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TEACHING POINTS

Chest computed tomography (CT) angiography (CTA) is the major imaging modality for evaluating patients suspected to have acute nontraumatic aortic pathology. An understanding of the causes of acute aortic presentations and pitfalls encountered when interpreting aortic CTA is essential for accurate and prompt diagnoses. Therefore, the objectives are: a) To review diagnoses and complications of acute aortic diseases b) To discuss interpretive pearls and pitfalls, including those related to aortic surgery and intervention that can be encountered when imaging the aorta in the acute scenario.

TABLE OF CONTENTS/OUTLINE

1. CTA protocol 2. Acute aortic diseases, diagnoses and complications: Aortic dissection, penetrating atherosclerotic ulcer, acute intramural hematoma (IMH), aneurysm rupture, incomplete intimal tear 3. Pitfalls and Pearls in interpreting CTA in acute aortic scenarios i. Ulcer like projection in IMH ii. Aortic thrombus vs. dissection iii. Mycotic aneurysm iv. Intercostal sleeve tears v. Vasculitis vs IMH vi. Intermittent occlusion of branch vessels in dissection vii. Related to surgery/vascular intervention (Graft vs. IMH, pledget vs aneurysm, aortic graft side arms vs aneurysm, elephant trunk repair)

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CH258-SD-TUB2

Correlation Study of EGFR in Lung Adenocarcinoma Based on Energy Spectral CT

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CH Community, Learning Center Station #2

Participants
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PURPOSE

To analyze the correlation between quantitative parameters of energy spectrum CT imaging (GSI) and CT features and EGFR mutations in lung adenocarcinoma, and to explore the value of quantitative parameters of energy spectrum CT and CT features in reflecting EGFR mutations in lung cancer.

METHOD AND MATERIALS

This study was approved by the institutional review board, with waiver of informed consent. We collected 300 patients with lung adenocarcinoma confirmed by surgical and pathology from January 2016 to February 2019 in our hospital. All patients underwent chest CT enhancement scan. Among them, 120 patients were scanned in GSI mode.A total of 15 CT features were evaluated.EGFR mutations at exons 18-21 were determined by using the amplification refractory mutation system(ARMS).Energy spectrum CT parameters include iodine (water) concentration, energy spectrum curve slope[K=(CT40keV-CT70keV)/30)], water (iodine) concentration, and single-energy CT values from 40 keV to 100 keV. All data were measured during arterial and venous phases.The statistical method uses IBM SPSS 24.0 analysis software. The two-category variables were tested by chi-square test, and the comparison between groups was performed using an independent sample t test.

RESULTS

Among 300 patients with lung adenocarcinoma, EGFR mutations were 148, with a mutation rate of 49.3% (148/300).EGFR mutations were found more frequently in (a) female patients (P<.001); (b)those who had never smoked(P=.003);(c)Pleural depression(P=.001),air bronchogram(P=.011),bubblelike lucency(P<.001),ground-glass opacity(P=.002),spiculation(P=.004); (d)arterial phase iodine(water) concentration(P=.048), energy spectrum curve slope(P=.029),CT value from 40keV to 70 keV(P<.05);(e)venous phase iodine(water) concentration(P=.031), energy spectrum curve slope(P=.003),CT value from 40keV to 70 keV(P<.05);other CT features and energy spectrum CT parameters were not statistically significant(P>.05).

CONCLUSION

CT features and energy spectrum CT parameters of patients with lung adenocarcinoma can be used to predict the status of EGFR mutations, and can provide valuable imaging information for clinically effective treatment options.

CLINICAL RELEVANCE/APPLICATION

CT features and energy spectrum CT parameters can better predict EGFR mutation status, which can reduce the economic burden of patients and guide clinicians to rational treatment.

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CH259-SD-TUB3

Performance and Outcomes of Suspicious Lung-RADS Categorization

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CH Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate the performance and outcomes of Lung-RADS categorizations in low-dose CT lung cancer screening.

METHOD AND MATERIALS

Eligible patients undergoing low-dose lung cancer screening CT between January 2015 through January 2019 from 12 outpatient imaging centers that service a large portion of southern New England were analyzed. Lung-RADS categorization rates for screening and follow-up CTs were evaluated by year. For Suspicious studies (Lung-RADS 4A, 4B, 4X), positive predictive values (PPV) for lung biopsy pathology cancer diagnoses and Important PET result (RADCAT-3 or 4) were determined.

RESULTS

A total of 5836 screening CTs were completed. Of those, 7% (397/5836) were categorized as Lung-RADS 4 or Suspicious. A total of 970 follow-up CTs were completed. Of those, 10% (103/970) were Suspicious. Of the Suspicious screening studies, those categorized as Lung-RADS 4B had the greatest PPV across the years for being tissue-proven cancer (0.88, range: 0.67-1.0), followed by Lung-RADS 4X (mean PPV = 0.60, range: 0.0-0.88) then Lung-RADS 4A (mean PPV = 0.51, range: 0.25-0.75). Of the Suspicious follow-up CTs, studies categorized as Lung-RADS 4B had the greatest PPV across the years for being tissue-proven cancer (mean PPV = 0.78, range: 0.33-1.0), followed by Lung-RADS 4X (mean PPV 0.56, range: 0.0-1.0). Of the Suspicious screening studies, those categorized as Lung-RADS 4A or 4X had a 1.0 PPV for important PET results; those categorized as Lung-RADS 4B had a mean PPV of 0.95 (range: 0.82-1.0) for Important PET results. Of the follow-up CTs, those categorized as Suspicious (Lung-RADS 4A, 4B, or 4X) had a 1.0 PPV for Important PET results.

CONCLUSION

This is the first study to longitudinally evaluate performance and outcomes of Lung-RADS categorization. Suspicious lung cancer screening and follow-up studies have strong positive predictive values for cancer tissue diagnoses and Important PET results.

CLINICAL RELEVANCE/APPLICATION

Suspicious lung cancer screening and follow-up CT studies have strong positive predictive values for cancer tissue diagnoses and Important PET results.

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CH286-SD-TUB4

Volume Doubling Time of Primary Lung Cancers in Interstitial Lung Disease

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CH Community, Learning Center Station #4

Participants
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PURPOSE

The aim of this study is to use tumor volume doubling time (VDT) as a marker of tumor aggressiveness to determine if concurrent lung cancers in interstitial lung disease (ILD) demonstrate more rapid growth than non-ILD patients, and to determine if VDT is affected by tumor development in fibrotic versus non-fibrotic areas of the lung.

METHOD AND MATERIALS

In this retrospective study, a pool of potential patients with ILD and primary lung cancer was identified via radiology report search engine tool. This list was narrowed to identify 36 patients with pathology proven lung cancer and two chest CT scans separated by at least 4 weeks. Tumor size was measured using its largest axial diameter and the corresponding perpendicular axial dimension. Separate measurements performed by a radiology fellow and a cardiothoracic fellowship trained radiologist were averaged and the VDT of each nodule was calculated. Detterbeck et al. previously reported the mean VDT for lung cancers detected in the context of routine care: 169 days for adenocarcinoma and 104 days for squamous cell carcinoma. Differences in VDT were compared using Mann-Whitney U test.

RESULTS

Of the 36 ILD patients diagnosed with lung cancer, 14 were adenocarcinoma, 16 were squamous cell, 4 small cell and 1 non-small-cell carcinoma. The cancer was located in the fibrotic area in 16 (51.6%) cases. Median VDTs for adenocarcinoma, squamous, small cell and non-small cell were 84.8, 69.3, 90.7 and 25.9 days, respectively. ILD patients had significantly faster tumor growth compared to patients without ILD. (84.8 vs. 169, p=0.03 for adenocarcinoma, 69.3 vs. 104, p=0.02 for squamous cell). When tumor was located in the fibrotic area, VDT was faster compared with those that were not (median 69.3 days vs. 84.8 days, p=0.40).

CONCLUSION

Our results suggest increased tumor aggressiveness of primary lung cancer in patients with concurrent ILD, particularly when the tumor is located in the ILD affected part of the lungs.

CLINICAL RELEVANCE/APPLICATION

This study supports a need to review cancer screening guidelines in patients with interstitial lung disease and may warrant shorter screening intervals. In addition, the diagnostic workup of indeterminate pulmonary nodules in patients with ILD would also need to be reviewed to account for the shorter volume doubling times.

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CH287-SD-TUB5

The Robustness of Lung Nodule Computer-Aided Detection (CAD) Performance in Low-Dose CT Across Heterogeneous Acquisition and Reconstruction Conditions

Tuesday, Dec. 3 12:45PM - 1:15PM Room: CH Community, Learning Center Station #5

Participants
Muhammad W. Wahi-Anwar, BS, Los Angeles, CA (*Presenter*) Nothing to Disclose
Nastaran Emaminejad, MSc, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Most Computer Aided Diagnosis (CAD) tools have been trained on cases from conventional (diagnostic) dose exams. However, the robustness of CAD performance in low-dose (screening) conditions across a range of acquisition and reconstruction conditions has not been evaluated. The purpose of this study was to investigate the effects of these conditions on CAD in lung nodule detection within the low-dose screening paradigm.

METHOD AND MATERIALS

Raw data of low-dose, chest CT images were acquired from 98 screening patients, 58 with solid nodules > 4 mm diameter. Dose reduction was simulated via a validated noise-addition model, simulating reduced doses of 50%, 25%, and 10% of original dose (1-2mGy). Images were reconstructed at varying slice thicknesses (0.6, 1 and 2mm) and with three different kernels (smooth, medium and sharp) using both conventional filtered back-projection and iterative reconstruction algorithms. This resulted in 40 different conditions. To investigate CAD performance over a range of conditions, two categories of imaging conditions were described (moderate, and extreme). For each case and each condition, the CAD was run, nodule ROIs of suspected lesions were generated and then compared to reference truth from radiology reports to quantify detection performance. Performance was assessed both in terms of nodule detection sensitivity and false positive per case across conditions. Performance was also assessed across LungRads rating based on nodule size and composition.

RESULTS

In comparison to the reference condition (wFBP, medium kernel, 1.0mm s.t., 100% dose), sensitivity performance remained comparable (or better) across more conditions in wFBP than SAFIRE, especially as dose was reduced. Sensitivity for LungRADs 4a nodules was higher than 80% at several conditions. False positive rate generally remained between 2-3 per scan, beginning to increase at 25% dose with SAFIRE and remaining more robust for wFBP until 10% dose.

CONCLUSION

CAD performance in the low dose screening paradigm is lower than earlier reported results from diagnostic level scans. CAD performance was shown to be more robust when wFBP reconstructions are used compared to iterative reconstructions.

CLINICAL RELEVANCE/APPLICATION

This study shows that CAD performance can be sensitive to the acquisition and reconstruction settings used for the low dose CT scan, including being more robust for conventional FBP than for iterative reconstructions.

ER167-ED-TUB4

CNS Emergencies and Complications of HIV

Tuesday, Dec. 3 12:45PM - 1:15PM Room: ER Community, Learning Center Station #4

Participants
Liwei Jiang, MD, Boston, MA (*Presenter*) Nothing to Disclose
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Gayatri Joshi, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Tarek N. Hanna, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc
Keith D. Herr, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

After viewing this exhibit, the learner will: 1. Describe the epidemiology and pathophysiology of brain manifestations of HIV disease. 2. Describe the major brain conditions associated with HIV disease, such as opportunistic infections, HIV-associated neurocognitive disorder, immune-reconstitution inflammatory syndrome (IRIS) and central nervous system (CNS) malignancy. 3. Recognize the structural and functional neuroimaging features of HIV-related brain pathology and treatment using a range of imaging modalities.

TABLE OF CONTENTS/OUTLINE

According to the most recent data from the Centers for Disease Control and Prevention, 1.1 million people in the US are HIV-positive. Of these, 49% have attained viral suppression with antiretroviral therapy. However, 1 in 7 are unaware of their diagnosis. Over 20% of newly diagnosed HIV cases are stage 3-disease (AIDS) at diagnosis. Neurologic complications of HIV contribute to significant morbidity & mortality. The most recent epidemiologic data regarding HIV infection and treatment will first be presented. This will be followed by case-based illustration of the range of HIV-related CNS pathology using CT, MRI and functional imaging, such as PET. The exhibit will focus on entities related to HIV infection itself, opportunistic CNS infections, treatment-related pathology (IRIS), and malignancy, such as CNS lymphoma.

ER168-ED-TUB5

The Temporal Rift: Making the Key Features of Temporal Bone Fractures Accessible to the Non-Neuroradiologist

Tuesday, Dec. 3 12:45PM - 1:15PM Room: ER Community, Learning Center Station #5

Awards
Cum Laude

Participants
Susanna C. Spence, MD, Houston, TX (*Presenter*) Nothing to Disclose

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TEACHING POINTS

-Key features for recognizing the 'occult' temporal bone fracture (to include unexplained emphysema in the glenoid fossa or adjacent to the skull base, pneumocephalus, mastoid air cell opacification, sphenoid hemosinus, soft tissue thickening of the walls of the external auditory canal) -Basic classification schemes, with emphasis on otic-capsule involvement, including anatomy, clues to diagnosis, and implications. -One key pathology to look for in the outer ear (fracture of the anterior wall of the external auditory canal), middle ear (ossicular dislocation) and inner ear (otic-capsule involving fracture) will be presented.

TABLE OF CONTENTS/OUTLINE

-Basics of anatomy: margins of the inner ear, middle ear and inner ear -Components of the otic capsule, with clear delineation of how a non-neuroradiologist can rapidly identify the otic capsule on CT -Tips and tricks to identifying the 'occult' temporal bone fracture -Significance/complications of the key injuries chosen for the outer ear, middle ear, and inner ear -Major classifications systems: longitudinal vs transverse and otic-capsule violating vs involving -Significance of the otic capsule and complications associated with otic-capsule involvement. -Other complications of temporal bone fracture (CSF leak, intracranial infection, encephalocele, vascular injury, perilymphatic fistula)

ER213-SD-TUB1

MAPAC Project: Image Algorithm for Acute Chest Pain with Suspicion of Coronary Heart Disease in the Emergency Department

Tuesday, Dec. 3 12:45PM - 1:15PM Room: ER Community, Learning Center Station #1

Participants
Fernando Gonzalez-Tello, MD, Madrid, Spain (*Presenter*) Nothing to Disclose
Nicolas A. Almeida SR, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
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Jesus Corres Gonzalez SR, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Agustina Vicente Bartulos, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Javier Zamora Romero, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether the Diamond-Forrest scale (DFS) used to calculate the pre-test probability (PTP) of ischemic heart disease in patients with chest pain, correlates with findings of coronary multidetector computed tomography (CMCT) in emergency department (ED). To evaluate the adherence to the recommendation of a computer decision support system (CDSS) on the appropriateness of exploration with CMCT.

METHOD AND MATERIALS

Retrospective study of 284 consecutive patients who underwent an urgent CMCT, recruited from February 2014 to March 2018, after implementing a CDSS aimed to aid in the selection of patients who would benefit or not from imaging test. Patients with a PTP of ischemic heart disease between 15-85% were recruited. CAD-RADS classification was used to harmonize the radiological diagnosis. Significant coronary stenosis (SCS) is considered when the luminal diameter reduction was >50% in at least one vessel. Diamond Forrest algorithm was implemented as a CDSS, using the clinical characteristics of age, sex and chest pain.

RESULTS

173 of the patients were men and 111 were women, with an average age of 57. Typical angina was present in 44 patients (15.4%), atypical angina in 70 (24.6%) and non-anginal pain in 170 (60%). 7.7% (22) of CMCT were not considered conclusive. Among the remaining 262 scans, none of them had PTP <15% or >85%. 244 patients had PTP within of 15-65%, in whose group only 22% had a radiological coronary stenosis >50%. The remaining 18 patients, with PTP in the range of 66-85%, only 33.3% showed a SCS >50%.

CONCLUSION

The observed frequency in our series reveals that the pathological findings found in the CMCT are correlated with the increase in the pretest probability according to the DFS. However, this scale overestimates the risk of ischemic heart disease. In our ED, clinicians fully adhered to the CDSS recommendations. We are currently conducting a prospective study to make a more adjusted scale than the DF.

CLINICAL RELEVANCE/APPLICATION

DFS is not well calibrated for being used in patients with chest pain. The score overestimates PTP, although it shows a positive correlation between DFS and prevalence of radiological finding.

ER214-SD-TUB2

Is the Intravascular Gas of the Organs on Early Postmortem CT Always Related to Cardiopulmonary Resuscitation?

Tuesday, Dec. 3 12:45PM - 1:15PM Room: ER Community, Learning Center Station #2

Participants
Tomonori Murakami, MD, PhD, Nagasaki, Japan (*Presenter*) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuki Abe, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Takehiko Murase, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiromi Yamashita, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuya Ikematsu, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Intravascular gas (IVG) of the organs on early postmortem CT (PMCT) has been known as the results of cardiopulmonary resuscitation (CPR); however, it is not clear whether other factors, such as putrefactive change, are related with IVG. The purpose of this study was to clarify the frequency and significance of IVG of the organs on early PMCT in subjects without CPR.

METHOD AND MATERIALS

Between August 2014 and July 2018, 1860 subjects underwent PMCT at our institute. Of these, 561 subjects underwent PMCT within 24 hours after death. Finally, 394 subjects were enrolled in this study. Excluded were 167 subjects who underwent CPR. A board-certified radiologist retrospectively assessed the incidence and frequency of IVG in the 6 organs (brain, heart, liver, kidney, spleen, and pancreas).

RESULTS

IVG of the organs was positive in 129 (32.7%) of 394 subjects (1 organ, 27 subjects; 2 organs, 24 subjects; 3 organs, 41 subjects; 4 organs, 17 subjects; 5 organs, 4 subjects; and 6 organs, 16 subjects). The number of subjects with IVG of each organ is: brain, 64 subjects; heart, 108 subjects; liver, 112 subjects; kidney, 52 subjects; spleen, 23 subjects; and pancreas, 23 subjects. IVG of the brain, heart, and liver was the most frequent combination and observed in 22 subjects.

CONCLUSION

IVG of the organs was frequently observed on PMCT obtained within 24 hours after death, even in subjects without CPR.

CLINICAL RELEVANCE/APPLICATION

IVG of the organs on early PMCT was frequently observed even in subjects without CPR or trauma. Thus, we should not mistake these findings for IVG related with fatal pathologic process before death.

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ER236-SD-TUB3

Small Bowel Feces Sign in The Setting of Mesenteric and Bowel Injuries Due to Blunt Bowel Trauma

Tuesday, Dec. 3 12:45PM - 1:15PM Room: ER Community, Learning Center Station #3

Participants
Muhammad O. Afzal, MD, MBBS, Memphis, TN (*Presenter*) Nothing to Disclose
Lou J. Magnotti, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Dina Filiberto, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Sridhar S. Shankar, MD, MBA, Memphis, TN (*Abstract Co-Author*) Equipment support, Clarius Mobile Health Corp

PURPOSE

Small bowel feces sign is a common CT finding in patients with small bowel obstruction. In contrast, this is seen infrequently in patients with bowel and mesenteric injuries (BBMI) after blunt abdominal trauma. It is our contention that the presence of small bowel feces sign on CT following blunt trauma can accurately diagnose BBMI when associated with other signs of BBMI on CT. Thus, the purpose of this study was to determine the impact of small bowel feces sign on the diagnosis of BBMI.

METHOD AND MATERIALS

All patients undergoing laparotomy for suspected mesenteric injury after blunt trauma were identified over a 5-year period. Admission CT scans were reviewed by a radiologist (blinded to the patient's management) to identify the presence of small bowel feces sign. Patients were then stratified by operative intervention (therapeutic vs. non-therapeutic laparotomy) and compared. Sensitivity, specificity and positive predictive value (PPV) of the presence of small bowel feces sign was then determined.

RESULTS

Of the 114 patients undergoing operative intervention, 75 patients underwent therapeutic laparotomy. Small bowel feces sign was seen in 25 cases. Overall sensitivity, specificity and PPV of small bowel feces sign for the presence of BBMI resulting in a therapeutic laparotomy was 28%, 87%, and 79.2%, respectively.

CONCLUSION

Small bowel feces sign is seen infrequently in cases of suspected bowel and mesenteric injuries after blunt abdominal trauma. However, when present, in combination with other signs it is highly suggestive of BBMI . Thus, the presence of small bowel feces sign on CT following blunt trauma can potentially identify those patients that would benefit from prompt operative intervention.

CLINICAL RELEVANCE/APPLICATION

Small bowel feces sign in combination with other signs of bowel and mesenteric injuries increases the confidence to consider therapeutic laparotomy in patients suspected of bowel and mesenteric injuries due to blunt trauma.

GI301-ED-TUB13

Achalasia: A Primer for Radiologists

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #13

Participants
Nour Nakrour, MD , Shreveport, LA (*Abstract Co-Author*) Nothing to Disclose
Alberto I. Carbo, MD, Shreveport, LA (*Presenter*) Nothing to Disclose

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TEACHING POINTS

The purposes of this educational exhibit are to: • Describe the anatomy and physiology of the esophagogastric junction (EGJ) • Discuss the physiopathology of achalasia • Explain the fluoroscopic technique • Discuss the diagnosis and differential diagnosis of achalasia • Describe the associated swallowing disorders and complications • Explain the radiologic evaluation after treatment

TABLE OF CONTENTS/OUTLINE

• Definition. Frequency. Symptoms • Anatomy of the EGJ • Physiology of the lower esophageal sphincter (LES) • Pathophysiology of achalasia • Radiologic technique • Diagnosis and differential diagnosis of achalasia on plain films and CTs • Diagnosis of achalasia on esophagogram: stricture evaluation (location, shape, mucosal surface, pliability), associated esophageal dysmotilities, megaesophagus, estimation of severity • Differential diagnosis with secondary achalasias: gastric, cardial and esophageal tumors, gastroesophageal reflux disease, extrinsic compressions, Schatzky ring, Chagas disease, failed fundoplication • Differential diagnosis with other esophageal motility disorders: vigorous achalasia, hypertonic LES and scleroderma • Detection of complications: aspiration pneumonia, candidiasis, esophageal tumors • Associated swallowing abnormalities • Radiologic evaluation after treatment: dilatation, Heller myotomy, gastric fundoplication

GI302-ED-TUB14

The New 2017 World Health Organization (WHO) Classification of Pancreatic Neuroendocrine Tumors: A Primer for Radiologists

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #14

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Lokesh Khanna, MD, San Antonio, TX (*Presenter*) Nothing to Disclose
Matthew Milam, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Sainath Kondapaneni, San Antonio,, TX (*Abstract Co-Author*) Nothing to Disclose
Anil K. Dasyam, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Varaha Tammisetti, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Alia Nazarullah, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Umber Salman, MD, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Abhijit Sunnapwar, MD, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Srinivasa R. Prasad, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Venkata S. Katabathina, MD, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Familiarize the audience with updates of 2017 WHO Classification Pancreatic Neuroendocrine Tumors (PanNETs) 2. Describe pathology, genetics & select genetic syndromes associated with PanNETs 3. Anatomic & Functional Imaging of Pan NETs 4. Review current & evolving treatment options for PanNETs & role of multimodality imaging techniques in management

TABLE OF CONTENTS/OUTLINE

• Introduction • The 2017 WHO classification (well-differentiated vs. poorly differentiated NETs) • Genetic Mutations: MEN1 & ATRX/DAXX • Genetic Syndromes with PanNETs: MEN1, VHL, Tuberous Sclerosis & Glucagon Cell Hyperplasia & Neoplasia • Types of PanNETs (Insulinoma, Glucagonoma, Somatostatinoma, VIPoma, Gastrinoma, Serotonin-producing, ACTH producing & Non-Functioning) and their unique imaging, genetic, molecular, pathologic & clinical findings • Pancreatic Neuroendocrine Carcinoma: Genetics & Imaging • Mixed NE/ductal & NE/acinar carcinoma • Anatomic Imaging: US, CT & MRI Radiogenomics (ATRX/DAXX mutations) • Functional Imaging: PET with different tracers, including Dotatate • Management • Novel Targeted Therapeutics • Natural History & prognosis • Conclusion The new 2017 WHO classification of PanNETs has provided strong diagnostic & prognostic tools to better assess clinical outcomes & therapeutic strategies. Imaging plays a pivotal role in diagnosis & appropriate patient management.

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GI303-ED-TUB10

A Diagnosis Difficult to Swallow: Dysphagia Revisited

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #10

Participants
Pramod K. Gupta, MD, Plano, TX (*Presenter*) Nothing to Disclose
Gregg D. Rice, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Francisco Garcia-Morales, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Dysphagia, also known as difficulty in swallowing, is a common clinical problem with increasing prevalence, specifically with aging population. Barium swallow is the imaging modality of choice for the investigation of dysphagia due to its ability to evaluate the esophageal anatomy and motility. The purpose of this scientific exhibit is: 1. To review the common and uncommon causes of oropharyngeal and esophageal dysphagia. 2. To illustrate and describe the salient imaging findings of these disorders on barium swallow.

TABLE OF CONTENTS/OUTLINE

The contents of this exhibit will be organized as follows with short discussions, illustrated examples and images: (1). Oropharyngeal and esophageal anatomy (2). Dysphagia cases which will be organized and presented in following manner: 1. Oropharyngeal disorders: A. Functional: Aspiration, Cricopharyngeal bar B. Structural: Zenker's diverticulum, Killian-Jamieson diverticulum, Esophageal web, Post operative edema 2. Esophageal disorders: A. Functional: Achalasia, Scleroderma, Diffuse esophageal spasm (corckscrew esophagus) B. Structural: Diverticula (traction and epiphrenic), Extrinsic compression (from aberrant right subclavian artery, lymphadenopathy, lung carcinoma), Infection (candidiasis), Benign strictures, Malignant strictures, Neoplasms (benign and malignant). 3. Short quiz.

Printed on: 10/29/20

GI304-ED-TUB11

Right Lower-Quadrant Ultrasound Techniques, Tricks, and Pitfalls for Tenderness to Palpation

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #11

Participants
Jamie N. Holtz, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Hailey Choi, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Dorothy J. Shum, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Loretta M. Strachowski, MD, San Francisco, CA (*Abstract Co-Author*) Royalties, Reed Elsevier; Speaker, World Class CME

TEACHING POINTS

• Right lower quadrant ultrasound (RLQ U/S) is an important modality in the diagnosis of acute appendicitis, especially in children. • Specific ultrasound techniques maximize success in visualization and diagnosis of acute appendicitis. • Diagnostic criteria for acute appendicitis include visualization of a noncompressible appendix greater than 6-7 mm in diameter. Secondary signs of appendicitis, when present, can also lead to the diagnosis. • Common pitfalls and differential diagnoses should be considered when using RLQ U/S to evaluate for acute appendicitis.

TABLE OF CONTENTS/OUTLINE

Objectives Introduction Right lower quadrant ultrasound technique: (A) Overview of graded compression technique; (B) Importance of patient positioning; (C) Using anatomy to your advantage Imaging features and diagnostic criteria of acute appendicitis: (A) Appendix size cutoffs; (B) Secondary signs of appendicitis Common pitfalls in ultrasound imaging for suspected appendicitis: (A) Noncompressible, borderline enlarged appendix; (B) Imaging differential diagnosis (for example; mesenteric adenitis, appendiceal mucocele, diverticulitis, lymphoid hyperplasia, intussusception, appendiceal neoplasm, typhlitis) Summary

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GI305-ED-TUB12

Dual Energy CT Applications in Pancreatic Pathologies

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #12

FDA Discussions may include off-label uses.

Participants
Julia A. Miranda, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD, Sao Paulo , Brazil (*Abstract Co-Author*) Nothing to Disclose
Gabriela R. Camerin, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Publio C. Viana, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

? Understand the physical principles of Dual Energy CT (DE CT) ? Recognize post processing techniques of DE CT ? Comprehend advantages and limitations of DE CT compared to Single Energy CT ? Know applications in pancreatic pathologies ? Be familiar with future directions of DE CT in pancreatic pathologies.

TABLE OF CONTENTS/OUTLINE

? INTRODUCTION - Importance of DE CT and pancreatic pathologies for diagnostic imaging ? PHYSICAL PRINCIPLES - Physical principles of DE CT and how to perform ? POST PROCESSING - Explanation of how post-processing techniques enables creation of virtual non-contrast and virtual monoenergetic images, as well as the assessment of enhancement through iodine maps. ? CLINICAL APPLICATIONS - Cases of different pancreatic pathologies to illustrate and solidify the concepts ? FUTURE DIRECTIONS - What's in the horizon for DE CT in pancreatic pathologies

GI306-ED-TUB15

Clinical Impact of State-of-the-Art CT Technology in Abdominal CT: Ultra-High Resolution CT (UHRCT) and Low-Voltage CT

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #15

Participants
Haruomi Yamaguchi, MD, Hidaka, Japan (*Presenter*) Nothing to Disclose
Eriko Maeda, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Ichikawa, MD, PhD, Hidaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Morisaka, MD, Hidaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuhiro Sano, MD,PhD, Hidaka, Japan (*Abstract Co-Author*) Nothing to Disclose
So Tsushima, Otawara, Japan (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Kenji Ino, PhD, Bunkyo-Ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Jiro Sato, MD, Bunkyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Osamu Abe, MD, PhD, Itabashi-ku, Japan (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

A It is important to learn the principle and clinical applications in the abdomen of the new CT technologies. B.UHRCT (acquisition in combination with 1024x1024 matrix and 0.25-mm section thickness) has a great impact on visualizing fine abdominal arteries (e.g., cystic artery, pancreatic-arcade arteries, or branches of segmental arteries) which are important to decide therapeutic strategies (e.g., laparoscopic cholecystectomy, pancreatoduodenal surgery, or liver transplant) especially on three-dimensional, volume rendering (3D-VR) images. C. Low-voltage CT improves to visualizing fine abdominal vessels on 3D-VR images in combination with UHRCT. D. Low-voltage CT also improves the detectability of small hypervascular (e.g., hepatocellular carcinoma or pancreatic neuroendocrine tumors), or hypovascular (e.g., pancreatic carcinoma) neoplasms on multiphasic contrast-enhanced CT. E. UHRCT is useful to improve the diagnostic accuracy of local extension of pancreatic carcinoma to peripancreatic neural plexus.

TABLE OF CONTENTS/OUTLINE

A The principle of UHRCT B. The basic performance of UHRCT C. The clinical usefulness of UHRCT for the pre-operative plan of the liver transplantation D. The visualization of a cystic artery with 3D-VR images with UHRCT compared to conventional CT E. the visualization of normal pancreatic external nerve plexus

GI348-SD-TUB1

Radiomic Analysis of Contrast-Enhanced CT Predicts Microvascular Invasion and Outcome in Hepatocellular Carcinoma

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #1

Participants
Xun Xu, Nanjing, China (*Presenter*) Nothing to Disclose
Hai-Long Zhang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Yu-Dong Zhang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Xi-Sheng Liu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Microvascular invasion (MVI) impairs surgical outcomes in hepatocellular carcinoma (HCC) patients. As a single highly reliable factor to preoperatively predict MVI is lacking, we developed a computational approach integrating large-scale clinical and imaging modalities, especially radiomic features from contrast-enhanced CT, to predict MVI and clinical outcomes in HCC patients.

METHOD AND MATERIALS

In total, 495 surgically resected patients were retrospectively included. MVI-related radiomic scores (R-scores) were built from 7,260 radiomic features in six target volumes. Six R-scores, 15 clinical factors, and 12 radiographic scores were integrated into a predictive model, the Radiographic-Radiomic (RR) model, with multivariate logistic regression.

RESULTS

Radiomics related to tumor size and intratumoral inhomogeneity were the top-ranked MVI predicting features. The related R-scores showed significant differences according to MVI status ($p < 0.001$). Regression analysis identified 8 MVI risk factors, including 5 radiographic features and a R-score. The R-score (odds ratio [OR], 2.34) was less important than tumor capsule (OR, 5.12), tumor margin (OR, 4.20), and peritumoral enhancement (OR, 3.03). The RR model using these predictors achieved an area under curve (AUC) of 0.909 in training/validation and 0.889 in the test set. Progression-free survival (PFS) and overall survival (OS) were significantly different between the RR-predicted MVI-absent and MVI-present groups (median PFS: 49.5 vs. 12.9 months; median OS: 76.3 vs. 47.3 months). RR-computed MVI probability, histologic MVI, tumor size, and Edmondson-Steiner grade were independently associated with disease-specific recurrence and mortality.

CONCLUSION

The computational approach integrating large-scale clinicoradiologic and radiomic features demonstrates good performance for successfully predicting MVI and disease clinical outcomes, but radiomics with current CT imaging analysis protocols do not provide statistically significant added value to radiographic scores.

CLINICAL RELEVANCE/APPLICATION

The R-score, together with 7 clinico-radiologic biomarkers, forms a set of independent predictors of histologic MVI of HCC; and the R-score does not provide statistically significant added value to radiologist scores in predicting MVI.

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GI349-SD-TUB2

Hepatocellular Carcinoma with Hilar Bile Duct Tumor Thrombus Versus Hilar Cholangiocarcinoma on Enhanced Computed Tomography: A Diagnostic Challenge

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #2

Participants
Xiaoqi Zhou, Guangzhou, China (*Presenter*) Nothing to Disclose
Jifei Wang, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Mengqi Huang, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhenpeng Peng, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Shiting Feng, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Ziping Li, MD, PhD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hepatocellular carcinoma (HCC) with hilar bile duct tumor thrombus (HBDTT) often mimic hilar cholangiocarcinoma (hilar CC). The purpose of this study is to analyze the Computed Tomography (CT) characteristics of HCC with HBDTT and to identify imaging features to aid its differentiation from hilar CC on enhanced CT.

METHOD AND MATERIALS

We retrospectively identified 58 cases with pathologically proved HCC with HBDTT between 2011 and 2018. 53 cases of pathologically proven hilar CCs were randomly selected during the same period. The clinical features and CT findings of the two groups were reviewed and compared.

RESULTS

HCC with HBDTTs are more commonly found in men (87.9% vs 67.9%; $p = 0.011$) with lower onset age (49.84 vs 59.55 years; $p < 0.001$) in comparison to hilar CCs. Correlation were find between HCC with HBDTTs and chronic HBV infection (72.4% vs 11.3%, $p < 0.001$), increasing of serum AFP level (67.2% vs 1.9%; $p < 0.001$), CA19-9 level (58.6% vs 88.7%; $p < 0.001$) and CEA level (3.4% vs 26.4%; $p = 0.001$), parenchymal lesion with intraductal lesion (100% vs 13.2%; $p < 0.001$),washout in portal venous phase (84.5% vs 5.7%; $p < 0.001$), thickened bile duct wall (8.6% vs 94.3%; $p < 0.001$), intrahepatic vascular embolus (44.8% vs 5.7%; $p < 0.001$), splenomegaly (34.5% vs 0.0%; $p < 0.001$). A scoring system consisting of the five parameters mentioned above was trialed. The sensitivity and specificity for diagnosing HCC with HBDTT were 96.39%, 100% and 92.5% respectively when the total score was 2 or more.

CONCLUSION

HCC with HBDTTs are often distinguishable from hilar CCs based on washout in portal venous phase without thickened bile duct wall. HBV infection and serum AFP level facilitate the differentiation.

CLINICAL RELEVANCE/APPLICATION

Enhanced CT could help differentiate HCC with HBDTT from hilar CC and is recommended to be carefully evaluated in the preoperative examination.

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GI350-SD-TUB3

Iodine Map Imaging Using Dual-Energy CT has Ability to Evaluate the Severity of Liver Fibrosis

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #3

Participants
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PURPOSE

Liver biopsy is the gold standard for diagnosis of the degree of fibrosis in the liver. However, liver biopsy is invasive and it causes the possibility of adverse events. Therefore, new noninvasive methods are required. In recent years, Dual Energy CT (DECT) has appeared, and it has become possible to measure iodine concentration quantitatively by iodine map analysis. Focusing on the iodine map analysis of DECT, we examined whether iodine map analysis could be possible to evaluate the severity of liver fibrosis.

METHOD AND MATERIALS

The subjects were 120 participants who were diagnosed with normal liver, hepatitis, and cirrhosis since January 2016 to March 2018. All participants underwent a contrast enhanced CT examination with DECT. ROI was set in the liver (1 point in the left lobe, 2 points in the right lobe) and the spleen (2 point in the spleen parenchyma). The iodine concentration ratio of liver and spleen (H/S ratio) was calculated with the obtained iodine concentration. As the statistical analysis, the relationship between H/S ratio and severity of liver fibrosis was analyzed using t-test. In addition, the correlations between H/S ratio and biomarker of liver fibrosis such as Platelets and Fibrosis 4 index (FIB-4) were assessed using univariate linear regression analysis.

RESULTS

H/S ratio was significantly decreased with severity of liver fibrosis (H/S ratio; normal liver 0.94 ± 0.14, hepatitis 0.81 ± 0.11, and cirrhosis 0.60 ± 0.10). H/S ratio was also correlated with Platelets and FIB-4 ($p<0.0001$ of both; $r=0.4850$, 0.5180, respectively).

CONCLUSION

Iodine map of DECT may be able to assess the severity of liver fibrosis.

CLINICAL RELEVANCE/APPLICATION

Iodine map analysis using DECT has ability to assess the severity of liver fibrosis.

GI398-SD-TUB4

Macro Regenerative Nodules in PSC Disease: MRI Features

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #4

Participants
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PURPOSE

This present study describes the features of macro regenerative nodules (MRN) on Magnetic Resonance Imaging (MRI) in patients with Primary Sclerosing Cholangitis.

METHOD AND MATERIALS

Retrospective study approved by the ethics committee of the institution. Patients with diagnosis of PSC with at least one MRI between 2000 and 2018 were gathered from the institution database. Cases were reviewed by 2 radiologists for all MRI imaging studies of each patient. Clinical data was collected regarding first and last study dates.

RESULTS

A total of 97 patients with PSC were included and 190 imaging studies were reviewed. 52 patients (54%) were male and the most prevalent race was Caucasian (74%). Median disease duration at first MRI was 4.9 years (range 0.03-49.1). MRN were perceived as hypertrophic nodules of the liver with discrepancy in signal in at least one sequence and with architectural distortion of surrounding area. Frequency of MRN was 64.9% (63 patients) in the first study. A frequency of 62.2% (38 patients) with MRN on both first and last studies was observed; 5 patients developed them only on follow up studies. Segments 4b and 3 were most frequently involved (76% of the cases). Nodules were isointense in signal in relation to the rest of the liver in major sequences, however, were lower in signal intensity on T2 haste sequences (60.4%) and maintained the same signal characteristics on last study in 75% of cases. Lower signal compared to the rest of the parenchyma was seen in gadolinium studies on immediate phase sequences (76%), 1 to 2 min phase sequences (73%) and delayed phase sequences (76%). Gadoxetate disodium contrast enhanced studies were present in 3 patients revealing functioning hepatocytes within MRN. Spleen size increase between first and last study in MRN+ patients was 11.6mm (95% CI). Spleen size greater than 12cm and Ursodeoxycholic acid use showed correlation with MRN (p=0.024 and p=0.027 respectively).

CONCLUSION

MRN are distinguishable from other entities for its specific characteristics on MRI in PSC patients. T2 Haste and gadolinium phases sequences showed to be the best sequences for appreciation of the nodules. Their etiology and significance remain unknown, however appropriate acknowledgment is imperial for ruling out malignancy and essential for diagnosis. Further studies may elucidate their significance.

CLINICAL RELEVANCE/APPLICATION

Diagnosis improvement of patients with Primary Sclerosing Cholangitis

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GI399-SD-TUB5

Impaired Glucose Tolerance: Relationship with Pancreatic Fibrosis Using T1 Mapping and Pancreatic Exocrine Function Estimated by Cine-Dynamic MRCP Using a Spatially Selective Inversion-Recovery Pulse

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #5

Participants
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PURPOSE

The effects of impaired glucose tolerance (IGT) on pancreatic fibrosis and pancreatic exocrine function (PEF) are not clear. This study aimed to evaluate the relationship between IGT and PEF, and IGT and pancreatic fibrosis, using glycosylated hemoglobin (HbA1c) and quantitative analysis with 3T MRI.

METHOD AND MATERIALS

This retrospective study received institutional review board approval. It included 193 patients with suspected hepatobiliary and pancreatic diseases who were undergoing 3T MRI, including cine-dynamic MRCP using a spatially selective inversion-recovery pulse (SSIR) and T1 mapping of the pancreatic parenchyma using a modified Look-Locker inversion recovery (MOLLI) sequence, and assessment of IGT with HbA1c. As an estimate of PEF, secretion grade (SG) based on the distance of pancreatic juice inflow in the main pancreatic duct on cine-dynamic MRCP was assessed. Patients were classified into four groups using modified American Diabetes Association criteria (non-diabetes, HbA1c < 5.7%; prediabetes, 5.7% <= HbA1c < 6.5%; type 2 diabetes mellitus (T2DM), 6.5 <= HbA1c < 8; and severe T2DM, HbA1c > 8).

RESULTS

A significant correlation was identified between pancreatic T1 value and HbA1c, and SG and HbA1c (r= 0.264, P< 0.0001 and r= -0.24, P= 0.001, respectively). Comparison of pancreatic T1 values among groups indicated a significant difference between all pairwise comparisons (P= 0.009 to < 0.001), excluding pairwise comparisons of non-diabetes and prediabetes (P< 0.05). The SG of non-diabetes was significantly higher than those of T2DM and severe T2DM (P= 0.032 and P= 0.001, respectively), although no significant difference was found in the comparison between a group and its immediately greater severity group (all P< 0.05).

CONCLUSION

IGT is associated with pancreatic fibrosis and PEF. Pancreatic fibrosis progresses gradually with increasing IGT. On the other hand, PEF tends to be maintained until advanced stages of IGT.

CLINICAL RELEVANCE/APPLICATION

Quantitative 3T MRI parameters obtained with T1 mapping and cine-dynamic MRCP using SSIR show potential for noninvasively elucidating the mechanism of IGT.

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GI400-SD-TUB6

Can Single-Section, Machine Learning-Based Radiomics Differentiate Normal Liver from Diffuse Liver Diseases?

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #6

Participants
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PURPOSE

We hypothesized that machine learning (ML)-based segmentation and radiomic features of liver from a single section of dual-energy CT can differentiate between normal, fatty and cirrhotic liver.

METHOD AND MATERIALS

Our IRB-approved study included 75 patients (mean age 54 ± 16 years; 44 females, 31 males) who underwent clinically-indicated, contrast-enhanced, portal venous phase, dual-energy abdomen-pelvis CT (SOMATOM Flash, Siemens). Low and high tube potential (80 and 140 kV) image datasets were de-identified and exported to a DECT segmentation and radiomic features analyses prototype (Radiomics, Siemens). The prototype enabled automatic segmentation of liver on a single CT section at the level of the porta hepatis. DECT iodine quantification and radiomics features were derived for the segmented portion of the liver in XML file format. The XML files were imported into a separate ML-based statistical analysis prototype (Radiomics, Siemens) for univariate and multivariate logistic regression and random forest classification.

RESULTS

Both iodine quantification (best AUC 0.95) and radiomic features (best AUC 0.95) differ significantly between normal, fatty and cirrhotic livers ($p<0.0001$). Normalized iodine concentration was superior than the iodine concentration and mean iodine uptake ($p<0.0004$) for differentiating the normal from fatty and cirrhotic liver. Amongst the radiomic features, the first order statistics demonstrated the highest accuracy (AUC 0.90-0.95, $P< 0.0001$). Machine learning based random forest classification yielded an AUC of 0.91 for differentiating normal from cirrhotic liver, 0.95 (AUC) for differentiating fatty and normal liver and 0.93 (AUC) for differentiating fatty and cirrhotic liver.

CONCLUSION

Single-section, DECT iodine quantification and radiomics features enable near-perfect differentiation (AUC up to 0.954) of normal, fatty, and cirrhotic liver from single-section analyses. The most accurate features were iodine concentration and first order statistics from radiomic analyses.

CLINICAL RELEVANCE/APPLICATION

Machine learning-enabled radiomics from single-section DECT can enable automatic distinction of normal liver from fatty and cirrhotic liver.

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GI401-SD-TUB7

Feasibility of a Non-Invasive Short MRI Surveillance (SMS) Protocol as a Screening Tool for Hepatocellular Carcinoma (HCC) in High-Risk Patients

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #7

Participants
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PURPOSE

To investigate the feasibility of a non-invasive short MRI surveillance (SMS) protocol as an effective tool for detection of HCC in a high risk population

METHOD AND MATERIALS

From 2010 to 2019 patients were recruited who received yearly MRI liver for HCC screening in a surveillance program. These patients recieved more than two full MRI liver protocol. We hypothesized that SMS consisting of axial: T2W fat saturation, DWI (b=0 and 600, 800) and T1W in-and oppose phase, with an aquisition time of less that 10 minutes, could suffice for detection of HCC suspected lesions. MRI with HCC on first detection and the second to last MRI in HCC naive patients were included for evaluation. Imaging data consisting of SMS was anonymized and uploaded on a separate research server. Two radiologist with different levels of experience (reader 1: 12 years, tertiary center; reader 2: 4 years, general hospital) reviewed the imaging data seprately and blinded using a CRF in the online clinical software program 'openclinica'. Confidence scores on presence, size and type of lesions were attributed to a five-point scale per SMS sequence: 1) HCC, 2) probably HCC, 3) uncertain, 4) benign, 5) no lesions. Results were compared to the reference standard (full MRI liver protocol). Sensitivity, specificity of SMS were calculated with Excel and SPSS.

RESULTS

215 patients were included; 78 (83 %) with cirhosis and the remaining 37 patients with non-cirrhotic hepatitis. Thirty nine patients (18.1 %) had true HCC. The intra-class correlation coefficient (ICC) was good (0.82). Reader 1 scored better (sens. 94 %, spec. 80 %, false neg. 6 %, false pos. 20 %) than reader 2 (89 %, 72 %, 11 %, 29 % respectively). When 'uncertain'lesions are also included as suspect for HCC then specificity increases for both readers, albeit with loss of sensitivity (reader 1: sens. 78 %, spec. 95 %, false neg. 22 %, false pso. 5 %; and reader 2: 72 %, 94 %, 28 %, 4 % respectively).

CONCLUSION

Our proposed short MRI surveillance (SMS) protocol yield high sensitivity and specificity both for the experienced and in-experienced observer for detection of lesions that can be regarded as suspect for HCC.

CLINICAL RELEVANCE/APPLICATION

Our SMS protocol can be considered as an effective screening tool for HCC and may potentially replace ultrasound (US) with better sensitivity and specificity for detection of early HCC than reports from the literature on screening with US.

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GI402-SD-TUB8

Prediction of Disease-Free Survival in Colorectal Cancer Patients with Liver Metastasis Using Radiomics Features

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #8

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PURPOSE

To evaluate whether radiomics features predict disease free survival (DFS) in colorectal cancer patients with liver metastasis and to compare diagnostic performance of radiomics parameters with clinical factors.

METHOD AND MATERIALS

In this retrospective study, a total of 161 colorectal cancer patients (mean age, 59.8 years old; male ratio, 112/161) with liver metastasis who underwent curative resection from January 2006 to October 2014 were included. Radiomic features (n = 469) were extracted from the largest area of the liver metastasis on preopertive portal venous phase CT image using pyradiomics. CT scans and clinico-pathologic factors were obtained. A radiomics score was made using penalized cox regression with a least absolute shrinkage and selection operator (LASSO Cox) to predict DFS. Diagnostic performance of radiomics score, clinical parameters only model, and combined model were built and comapred by the area under the receiver operating characteristic curve (AUC). The radiomics score and combined models were internally validated in primary cohort using bootstrap methods.

RESULTS

Tumor recurrence was found in 53% (85/161) of patients during the follow up period. The median DFS of patients was 848 days (Interquartile range {IQR}, 214-1880 days). Among 468 radiomics features, 15 features were selected in the LASSO Cox regression model. The radiomics score and combined models for DFS were successfully validated through internal validation. The AUC of clinical features, radiomics score and combined model were 0.653 (95% confidence interval: 0.540, 0.734), 0.694 (0.630, 0.758) and 0.746 (0.670, 0.822), respectively. The combined model improved DFS prediction when compared with models containing only clinical parameters. (AUC difference 0.094, p=0.003).

CONCLUSION

The combination of radiomics features based on CT images and clinical parameters can improved DFS prediction in colorectal cancer patients with liver metastasis.

CLINICAL RELEVANCE/APPLICATION

The addition of radiomics features to clinical parameters can provide a more accurate prediction of DFS in colorectal cancer patients with liver metastasis.

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GI403-SD-TUB9

Non-Invasive Liver Iron Overload Measurements by MRI: Comparison of Two Validated Protocols

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GI Community, Learning Center Station #9

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PURPOSE

MRI is an approved method to measure liver iron concentration (LIC). Presence of iron accelerates T2 relaxation and T2* signal decay, thereby causing signal loss on T2 weighted spin echo and T2* weighted gradient echo images. In this study, we compared R2 (1/T2) relaxivity and its derived LIC values to R2* relaxivity and its derived LIC on patients referred for iron overload evaluations.

METHOD AND MATERIALS

We performed a retrospective study of patients scanned for liver iron overload evaluation. In studies which R2 and R2* measuring sequences had been acquired, were included for analysis. All liver scans were performed on a 1.5T scanner. R2* acquisitions were done by acquiring gradient echo multi-echo images collected at increasing echo time (TE). All echoes were acquired in a single acquisition. We used 8-12 echo times with the first TE set as short as technically possible, which in practice is as close to 1ms as possible. For R2, five separate series of spin echo images were acquired with a fixed repetition time (TR) and increasing TE values of 6ms, 9ms, 12ms, 15ms and 18ms (spaced at 3ms interval) for an acquisition time of approximately 10-15 mins. The spin-echo image acquisitions were acquired free-breathing without respiratory compensation techniques. R2 and R2* maps were generated using parametric MRI software (www.parametricMRI.com, Philadelphia, PA, USA). Three regions of interest (ROIs) were drawn per subject and per dataset. 1 mid-slice whole liver ROI and 2 liver parenchyma ROIs were chosen. This was done to examine variability in ROI selection by the user.

RESULTS

140 studies where included. Mean age = 13.9 ± 10.1 years. LIC ranged from 1 to 43 mg/g covering a broad range from close to normal levels to extremely high iron levels. Representative maps of 3 separate patients ranging from low, mid to high LIC is shown in Figure. A linear relation was observed between LIC generated using R2 and by R2* ($y=0.95x$; $R2=0.71$). A higher user depended ROI variability was observed in R2 measurements as compared to R2* measurements.

CONCLUSION

LIC as measured by R2 and R2* methods is statistically comparable, with no significant statistical difference between these methods for LIC<30 mg/g.

CLINICAL RELEVANCE/APPLICATION

Non-invasive MRI LIC measurement using R2* show a better inter-observer and intra-observer correlation, less motion artifacts and a strong correlation to LIC measured using R2.

GU215-SD-TUB1

Machine Learning-Based MRI Radiomics Signature for Preoperative Prediction of ISUP Nuclear Grade in Clear Cell Renal Cell Carcinoma

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #1

Participants
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PURPOSE

This study aimed to preoperatively predict nuclear grade based on MRI radiomics signature with machine learning method.

METHOD AND MATERIALS

A total of 381 consecutive patients with pathologically comfirmed ccRCC in our Hospital were retrospectively evaluated. A set of 254 patients was used as the training cohort and the remaining 127 patients was set as the test cohort. For each patient, a total of 646 radiomics features were extracted from preoperative T2WI. Logistic regression model in conjunction with the Recursive Elimination Algorithm was used to determine the number of features based on the 3-fold cross-validation score. In order to get better classification results, we combined the logistic regression model based on clinicoradiological risk factors. The receiver-operating characteristic curve and the area under the curve (AUC) were used as evaluation index.

RESULTS

Out of 646 features, 613 radiomics features with excellent reproducibility (ICC equal to or higher than 0.75) were included in the further feature selection process. The logistic regression model using 8 selected features from T2WI showed a favorable effect of discriminating lower-grade ccRCC (ISUP 1 and 2) from higher-grade ccRCC (ISUP 3 and 4) in test cohort. The sensitivity, specificity and AUC were 57.1%, 91.5% and 0.73 (95%CI 0.649-0.809), respectively. Multiple logistic regression model showed that adding radiomics signature to clinicoradiological risk factors model resulted in a slightly improvement of predicting value with the AUC increasing from 0.74 (95%CI 0.655-0.814) to 0.78 (95%CI 0.701-0.851), but the statistical differences have not reached significance (DeLong test, P>0.05).

CONCLUSION

The machine learning-based MRI radiomics signature of T2WI can predict ISUP nuclear grade in patients with ccRCC with a satisfying performance. Prediction value of the combined model is comparable to that of radiomics signature of T2WI or clinicoradiological factor score.

CLINICAL RELEVANCE/APPLICATION

The machine learning-based MRI radiomics signature of T2WI can predict ISUP nuclear grade and is recommended in the initial evaluation of clear cell renal cell carcinoma.

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GU216-SD-TUB2

Diagnostic Value of DCE-MR Imaging for Differentiating Malignant Adnexal Masses Compared with Contrast Enhanced T1-W1 with DWI

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #2

Participants
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PURPOSE

To compare the diagnostic performance of DCE-MRI with delayed contrast enhanced(CE)-T1-weighted images(WI) with diffusion WI (DWI) for differentiating malignant adnexal tumors from benign tumors.

METHOD AND MATERIALS

This study included 99 consecutive patients with ovarian tumors who underwent preoperative imaging and surgery at our institution. Excluded were; pure cystic tumor, endometriotic cyst without solid portion, teratoma, and tumors with peritoneal dissemination or lymph node metastasis. MR images were analyzed by two radiologists; one specialized in gynaecological radiology (reader A) and a non-specialized (reader B). Three sets of images were evaluated: (Set 1) Conventional MRI including T1/T2WI and DWI with ADC map, (Set 2) Set 1 and delayed CE-T1WI, and (Set 3) Set 1 and DCE-MRI with dynamic curve. The reviewers evaluated the presence of tumor features, including thickened regular/irregular septa, vegetation, solid portion, low SI on T2 and DWI, enhancement effect at tumor wall and others in each cases. The criteria predictive benignity/malignancy were defined according to the previous reports. Finally, the reviewer decided lesion characteristic by three point scale (benign, indeterminate, malignant). Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy were calculated. Surgical pathologic findings were used as the reference standard.

RESULTS

Sensitivities for Set 1, 2 and 3 were 88%, 89.8%, and 89.8% respectively in reader A and specificities were 83.7%, 84%, and 74%. PPVs were 84.6%, 84.6%, and 77.2%. NPVs were 87.2%, 89.4, and 88.1%. Accuracies were 85.9%, 86.9%, and 81.8%. In reader B, sensitivities were 77.6%, 85.1%, and 89.7%, respectively. Specificities were 82.9%, 75%, and 71.7%. PPVs were 86.5%, 75.5%, and 67.3%. NPVs were 72.3%, 84.8, and 91.5%. Accuracies were 79.8%, 79.8%, and 78.8%. Intra-reader agreement was substantial agreement (κ = 0.63) in Set 1, moderate in Set 2 (κ=0.57) and in Set 3 (κ=0.48).

CONCLUSION

DCE-MR did not show superiority for differentiating malignant adnexal tumors from benign tumors compared to those with conventional MR, DWI and delayed CE-T1WI.

CLINICAL RELEVANCE/APPLICATION

Adnexal tumors can be correctly diagnosed using only conventional MR, DWI and delayed CE-T1WI without using DCE-MRI in almost about 80% of adnexal tumors.

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GU217-SD-TUB3

Diagnostic Efficiency of Intravoxel Incoherent Motion Diffusion-Weighted Imaging (IVIM-DWI) in Staging of Diabetic Nephropathy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #3

FDA Discussions may include off-label uses.

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PURPOSE

To analyze the diagnostic efficiency of IVIM-DWI parameters of kidneys in various stages of DN.

METHOD AND MATERIALS

48 patients with DN were enrolled as the observation group,and 35 healthy volunteers as the control group.The eGFRs were calculated for all subjects ,and combined with laboratory examination of renal function parameters(UAER,Scr,BUN) for DN staging. IVIM-DWI(b=0,50,100,150,200, 400,600,800sec/mm²)and Diffusion weighted imaging(DWI,b=50,800 sec/mm²) sequence were obtained on a 3T scanner. A total of 12 regions of interest were drawn for each subject in the different renal cortex and medulla region .The average value of all results is taken to ensure consistency of measurement results.ADC map was automatically generated on the Siemens MRWP workstation after DWI sequence executed. IVIM-DWI parameters(ADC,D,f and D* values) were generated by using a prototype software body diffusion toolbox. Using the laboratory examination of renal function parameters as the criteria to distinguishing the stage of DN,the observation group were divided into three groups, I and II stage, III stage and IV stage, respectively.The renal cortex and medulla IVIM-DWI parameters and laboratory examination of renal function parameters were compared among the groups using the single-factor analysis of variance.ROC curve analysis was used to distinguish the diagnostic performance of IVIM-DWI parameters.A p value less than 0.05 was considered statistically significant for all analyses.

RESULTS

From the healthy control group to the DN IV stage group, the IVIM-DWI parameters of the renal cortex and medulla were gradually decreasing.The laboratory examination of renal function parameters and IVIM-DWI parameters were statistically different between the four groups($p<0.05$). After ROC analysis,the D values of the renal cortex was an optimal parameter for distinguishing healthy control group from observation group,the ADC values of the renal medulla was an optimal parameter for distinguishing healthy control group and the DN I stage group from other two groups, and the ADC values of the renal medulla was an optimal parameter for distinguishing DN IV stage group from other three groups.

CONCLUSION

The D values of the renal cortex and ADC values of the renal medulla have higher diagnostic efficiency in distinguishing the staging of DN.

CLINICAL RELEVANCE/APPLICATION

IVIM-DWI parameters can provide supplementary information for DN clinical staging.

GU249-SD-TUB4

A Radiomic Nomogram Based on Arterial Phase of CT for Differential Diagnosis of Ovarian Cancer and Ovarian Metastases

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #4

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PURPOSE

To develop and validate a radiomic nomogram based on arterial phase of CT to discriminate the primary and metastatic ovarian tumors preoperatively.

METHOD AND MATERIALS

The institutional review board approved this study and the written informed consent was waived. A total of 110 ovarian cancer patients including 62 primary and 48 metastatic ovarian cancer patients in our institution were reviewed from January 2010 to December 2018. Of 110 ovarian cancer patients, 66 patients were allocated to establish testing model, and the remaining 34 patients were used as validation group. Radiomic features based on the arterial phase of CT were generated automatically by Artificial Intelligence Kit software (A.K. software; GE Healthcare, China). Feature reduction was conducted using the ANOVA+KW test, binary logistic regression analysis, and LASSO regression. A prediction model based on radiomic features was established by logistic linear regression and cross-validation. A nomogram was constructed integrated arterial phase of CT radiomic features, and clinical features, including the CEA and CA125.

RESULTS

Six features(Root mean squared, percentile10,percentile95,Inverse Difference Moment_AllDirection_offset4_SD,InverseDifferenceMoment_AllDirection_offset1_SD,Short Run High Grey Level Emphasis) were selected from the arterial phase of CT images using the LASSO model, following which, the logistic regression model was constructed. The model showed good calibration and discrimination in the training cohort, with an AUC of 0.781 (95% CI: 0.804-0.937), yield the sensitivity of 95.3% and specificity of 51.5%. In the validation cohort, AUC was 0.761 (95% CI: 0.745-0.966), yield the sensitivity was 73.7%, and specificity was 86.7%. A visualized differential nomogram based on the radiomic score, CEA and CA125 was established. The decision curve showed good consistency.

CONCLUSION

The radiomic features of arterial phase of CT may provide great value for differential primary and metastatic ovarian tumors. The visualized nomogram incorporated radiomic features of arterial phase of CT with clinical features may have good prospects for clinical application.

CLINICAL RELEVANCE/APPLICATION

Radiemic-based model on arterial phase of CT is capable of distinguishing ovarian cancer from ovarian metastases.

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GU251-SD-TUB6

Nutcracker Syndrome: Diagnostic Accuracy of Jetting Sign and Expansion Ratio of Left Renal Vein in Multiphase CT

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #6

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PURPOSE

To assess the diagnostic values of multiphase CT findings of nutcracker syndrome (NCS).

METHOD AND MATERIALS

Eighty six patients (M:F = 29:57, mean age 43.2 years, range 18-83 years) that presented with hematuria, showed left renal vein (LRV) compression between the aorta and SMA (aortomesenteric portion) on CT and further evaluated by renal venography (n = 25) or cystoscopy (n = 61) were included. Patients with renocaval pressure gradient >= 3mmHg on renal venography (n = 10) or showing bloody urine jetting from left ureteral orifice on cystoscopy (n = 8) are defined as Nutcracker group, and the rest of 68 patients are set as control group. The CT findings were analyzed with presence of jetting contrast flow from LRV to IVC (jetting sign), aortomesenteric distance, presense of collateral veins and expansion ratio of LRV diameter in the aortomesenteric portion on delayed phase compared to that of late arterial phase. Clinical findings including age, gender and body mass index were also analyzed.

RESULTS

Jetting sign of LRV was found in 77.8% (14/18) of Nutcracker group and in 35.3% (24/68) of control group with the significant difference (P = 0.001). Between Nutcracker group and control group, aortomesenteric distance (P = 0.035), expansion ratio of LRV diameter on delayed phase (P = 0.019) and age (P < 0.001) differed significantly. Lower age (OR 0.95, 95% CI: 0.912-0.987, P = 0.009), presence of jetting sign (OR 4.99, 95% CI: 1.259-19.780, P = 0.022) and lower expansion ratio of LRV diameter on delayed phase (OR 0.29, 95% CI: 0.084-0.995, P = 0.049) are significant independent factors in multiple logistic regression. Presence of jetting sign shows area under the ROC curve (AUC) 0.712 with a sensitivity of 77.78% and a specificity of 64.71%. The expansion ratio of LRV diameter shows AUC 0.706 with a sensitivity of 83.33% and a specificity of 54.41% at cut-off value 1.7. Finally, AUC 0.874 was obtained with a sensitivity of 88.89% and a specificity of 77.94% for the diagnosis of Nutcracker group.

CONCLUSION

Jetting sign of LRV and expansion ratio of LRV diameter on delayed phase compared to that of late arterial phase can be useful in diagnosing NCS when Nutcracker feature is suspected on CT.

CLINICAL RELEVANCE/APPLICATION

We evaluated the morphology of contrast flow and diameter change of left renal vein at stenotic portion in two phases to predict Nutcracker syndrome.

HP125-ED-TUB5

Building a Decision Aid Tool for Femoroacetabular Impingement (FAI) Patients with Incorporation of Imaging

Tuesday, Dec. 3 12:45PM - 1:15PM Room: HP Community, Learning Center Station #5

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TEACHING POINTS

Review steps in building a decision aid tool using femoroacetabular impingement (FAI) as the model example Describe the Qualtrics platform Describe the tool's inputs and outputs for patient + provider

TABLE OF CONTENTS/OUTLINE

Building a decision aid tool for femoroacetabular impingement (FAI): Step 1: Systematic literature review Organize findings with tool inputs/outputs in mind. What outcomes are important to patients? (i.e. return to sport, conversion to total hip arthroplasty) Step 2: Interviews involving key stakeholders Patients: identify common gaps in knowledge Providers: identify information challenging to convey in the office Step 3: Build the tool Qualtrics is a flexible platform (can include text, animation/videos, multiple question types) Provide educational content (i.e. background of FAI, treatment options, etc.) Determine patient inputs (imaging information, clinical information and history, goals for treatment) Determine outputs = discussion points for patient/provider based on patient inputs, printed and brought to visit Step 4: Pre-testing (patients and providers) For patients, gauge tool's effectiveness with Decisional Conflict Scale For providers, determine usefulness of tool output

HP215-SD-TUB1

CT Examination and 3D Analysis of Egyptian Animal Mummies

Tuesday, Dec. 3 12:45PM - 1:15PM Room: HP Community, Learning Center Station #1

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PURPOSE

The ancient Egyptians used mummification procedures on animal subjects. The vast majority of animals preserved after death were intended to satisfy an incredible demand for votive offerings: communication devices acting as divine messengers between man and the gods. CT allows the study of the mummy wrappings without the need to physically unwrap the irreplaceable mummies. Mummy autopsies are now conducted virtually, leaving the mummies intact. Our aim is to describe the execution and the analysis on CT investigations of a series of animal mummies.

METHOD AND MATERIALS

13 mummies underwent CT examination on the same CT scanner (Siemens Sensation) with the following acquisition parameters : 120 kV; 140 mAs; slice thickness: 1 mm; reconstruction interval: 0.7 mm; rotation time: 0.75 sec. All datasets were reconstructed with both bone and soft tissue algorithms and archived on our picture archiving and communication system using their catalogue number as an identifier. Images were then transferred on IntelliSpace Portal (Philips Healthcare) for post processing multiplanar and 3D reconstructions. The acquired data were submitted to anthropological analysis.

RESULTS

CT enabled the identification of the bundles content: 4 cats with complete skeleton, 1 upper part of a cat mummy, 1 lower part of a cat mummy, 1 cat head with 4 cervical vertebrae, 2 crocodiles, 2 hawks, skeleton from 1 or more snakes and 1 fake mummy, containing long bones. All cats and hawks showed cervical fractures; in one cat the skull was collapsed inwards and in another cat the head was turned backwards; one cat presented a skeleton more radiopaque than normal with evidence of cracks beacuse the resins used for mummification were poured directly over the corpse. In the abdomen of one of the crocodiles, an hyperdense oval component was found, maybe a stone swallowed by the animal. Regarding the cause of the death, the analysis was inclined to suppression.

CONCLUSION

CT is a valuable non-invasive technique to study Egyptian mummies, enabling in-depth analysis whilst preserving the integrity of of the mummy bundles, ensuring protection of a valuable archaeological resource.

CLINICAL RELEVANCE/APPLICATION

CT provides accurate information on the mummy bundle contents, the species of the animals, the embalming procedures.

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HP217-SD-TUB3

Dissemination Patterns of Radiology-Defined Musculoskeletal Concepts Into Clinical Literature

Tuesday, Dec. 3 12:45PM - 1:15PM Room: HP Community, Learning Center Station #3

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PURPOSE

While radiology commonly identifies findings corresponding to established pathology, there are multiple concepts that were described on imaging first. We evaluate the patterns of dissemination of three recent radiology-defined musculoskeletal diagnoses into the medical and surgical literature.

METHOD AND MATERIALS

A PubMed search was performed for "athletic pubalgia," "meniscal root tears", and "ischiofemoral impingement" in multiple permutations with varying terminology to collect all related journal articles. "Posterolateral corner of the knee" was used as a control as it was described clinically first. Each article was classified into "radiology" or "clinical" based on a combination of article content and journal of publication. For each topic, the landmark article or inflection point in the radiology literature was identified. Trends in publication type were analyzed prior to the article, in the years immediately following the article, and several years after.

RESULTS

The number of clinical athletic pubalgia articles increased from an average of 0.5 per year from 2004-2007 (period prior to the landmark radiology papers) to 3.75 per year from 2008-2011 (year of and immediately following landmark papers) to 14.5 per year from 2012-2017. This equates to a rate of change in publication from 3.25 in the period before to 10.75 in the period after the defining radiology papers. Similarly for meniscal root tears and ischiofemoral impingement, the rate of change in publications per year in clinical journals was 4.75 and 4.25 leading up to the defining radiology papers compared to 15.7 and 9.5 afterwards, respectively. In contrast, the major radiology papers for posterolateral corner of the knee were in 2003, with a rate of change prior to 2003 similar to the rate of change after 2003 (12.7 and 11.75, respectively).

CONCLUSION

For musculoskeletal concepts first described in the radiology literature, there appears to be a strong impact on publication rates in medical and surgical journals when compared to publications of already-established concepts. This suggests the continued value of radiologists in identifying novel patterns of disease and the importance of publishing these findings.

CLINICAL RELEVANCE/APPLICATION

Radiologists continue to have an important role in identifying new disease patterns, as suggested by the positive impact on the medical and surgical literature.

HP234-SD-TUB4

Research Authorship and Gender Parity: Are We There?

Tuesday, Dec. 3 12:45PM - 1:15PM Room: HP Community, Learning Center Station #4

Participants
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PURPOSE

Ensuring a gender-diverse pipeline for radiology research remains a goal. Evidence of gender parity in research productivity, defined as author representation in scholarly publications, remains lacking. Our purpose is to describe the gender characteristics of early career stage vs mid/late career stage authors and gender disparity in author leadership in medicine and imaging.

METHOD AND MATERIALS

Retrospective review of Scopus from 2013-2017 were analyzed by All Science Journal Classification (ASJC) codes ['Medicine' (ASJC2700), all 'Radiology, Nuclear Medicine, and Imaging' (ASJC2741)]. Article types were limited to original articles, reviews and conference papers. Authors of identified articles were included for analysis if affiliated with a US-based institution (94% of authors). Gender was assigned to each unique author with a full name using Genderize.io. Authors were classified as unknown when assignment was not possible with > 0.85 probability. We describe trends over time in contributing author gender distribution by author career stage (defined as years from first publication) and leadership roles on a published project (defined as serving as corresponding author, an accepted bibliometric proxy).

RESULTS

Over the 5-year period, in medicine, 77,519 unique women contributed as authors (34%), 109,246 men (49%), 38,239 unknowns (17%). In imaging, 23,267 unique women contributed as authors (27%), 48,487 men (55%), 16,079 unknowns (18%). For unique corresponding authors in medicine, 16,750 (32%) were women, 27,777(54%) men, 7326 (14%) unknown; in imaging, 4,210 (24%) women, 10,586 (59%) men, and 3068 (17%) unknown. Women represented 27% of all author contributions to imaging, compared to 34% in medicine. The data demonstrates the impact of duration in research and gender on contributing and corresponding authorship, with marked gender disparity particularly in the early stage imaging authors.

CONCLUSION

Imaging female authorship continues to lag behind medicine, with a more pronounced disparity in the early career stage. This disparity lessens but does not achieve parity as imaging authors mature in their careers.

CLINICAL RELEVANCE/APPLICATION

Institutional programs to encourage research participation and leadership should continue to focus on gender parity, particularly focusing on early career investigators.

IN009-EB-TUB

Creating an Integrated Research Platform of the Basis of Clinical PACS

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Hardcopy Backboard

Participants
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Conclusion

Modification of the clinical PACS for imaging research purposes is feasible. The initial platform design uses best software engineering practices to mitigate the risk of complexity. Automating the research workflow reduces the time needed for image and data collection, minimizes human errors in data entry, and streamlines data analysis.

Background

Radiologists' participation in clinical and translational research is crucial for the vitality of the specialty, but impeded by insufficient time and resources. Creating an accessible and reliable electronic system to facilitate research data management and collaboration could empower radiologists to do research.

Evaluation

PACS software is designed for the clinical environment and is familiar to radiologists, but has limited research utility, being restricted to clinical care. A research platform built on the basis of clinical PACS could be the most cost effective solution for boosting research activities in radiology. A useful research platform should be HIPAA compliant and address the needs of each project by formalizing unique task function modules, identifying interaction patterns, and designing workflows to link imaging and software features, data, and tools.

Discussion

Our research PACS platform relies on small, isolated, but reliable software modules to accomplish research tasks such as grouping project data/images, anonymizing PHI data/images, PACS image import/export, data entry by radiologists, and transferring data to data scientists (Fig.1) To achieve this, the research requirements are partitioned into function categories such as PACS user story, security concerns, HIPPA concerns, data shape transformations, plug-in tools, and user visualization components. Their interaction patterns are created as interfaces to bridge the system together. The DevOps software methodology was used to mitigate the risks of system complexity. The goal was to create reusable components with flexible interfaces to satisfy any similar research requirements for other projects. The developed platform was successfully tested on a retrospective mammography multiple-reader study.

IN018-EC-TUB

An Interactive Web-Based Application for Enhanced Multi-Parametric Prostate MRI Training with Whole Mount Histology Correlation

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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TEACHING POINTS

Interpreting prostate MRI is challenging due to the complex multi-parametric approach where radiologists are expected to compare multiple complex 2D modalities with one another, and then translate the found pathology back into the patient's prostate in 3D. This can be even more challenging for radiology trainees, as less than 35% of year one residents showed any confidence in image diagnosis. Web-based, 3D models and interactive e-learning resources can support higher education. An interactive application with mpMRI - whole mount histology correlation was developed for enhanced prostate MRI training of radiologists. This web based interactive educational tool with curated database will aid radiologists in the process of learning mpMRI appearance of common pathological cases in the prostate and improve diagnostic performance.

TABLE OF CONTENTS/OUTLINE

Curated database with unique pathology (20 cases) Clinical history along with mpMRI images Teaching point: mpMRI - whole mount histology correlation for enhanced prostate MRI with teaching points and annotations from expert radiologist Quiz: Curated quiz and cases will improve learning 3D prostate models: Interactive 3D models will improve spatial understanding Assessment: The diagnostic performance of radiologists will be evaluated before and after they use this app.

IN032-EC-TUB

Development of TextIriX: A Texture Analysis Plugin for OsiriX

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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CONCLUSION

TA has the potential to unleash important heterogeneity biomarkers, however, currently, the methodology is lacking uniformity. We developed TextIriX as a plugin that uses standardized feature extraction methods provided by PyRadiomics. We hypothesize that TextIriX will be adopted by the research community and help improve TA standardization.

Background

Texture analysis (TA) of medical images provides a non-invasive method for quantification of signal heterogeneity. However, one of the main shortcomings in this field is the non-uniform implementation methodology. Different institutions are building their own codes or software, which have contributed to the variability seen in the literature. We aim to develop a solution that has the potential to be widely adopted by the research community. We developed a plugin, called TextIriX, which runs under OsiriX MD: an FDA-approved widely-used medical image viewer. TextIrix uses PyRadiomics for texture feature extraction with the ultimate goal to help harmonize TA methodology.

Evaluation

TextIriX was developed in Apple® Mac-native Objective-C language and libraries and using its open-source application program interface (API). Insight Segmentation and Registration Toolkit (ITK) and NumPy C libraries were implemented to preprocess the images and pass them as objects to Python, which was embedded to utilize PyRadiomics. Additionally, NumPy and SimpleITK were implemented for fast image manipulation. Also, we developed a graphical user interface (GUI) that provides several options including spatial resampling, intensity resampling, and intensity binning. The plugin has been installed on three different workstations running three different versions of OsiriX MD. TextIriX was tested on multi-modality images including CT, PET, and MR. The output file can be saved as a comma-separated value (.csv) with the option to generate parametric maps according to user-specifications.

Discussion

TextIriX was tested using phantom and real patients' data. Phantom PET-CT and MRI images were obtained from the RIDER study (cancerimagingarchive.net). TextIriX radiomics were validated against the 5-year survival of patients with oral cavity cancer (under publication).

IN033-EC-TUB

Open Source Platform and Cockpit for Storage and Sharing of Large Imaging Biobanks

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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CONCLUSION

This web-based platform accessible on any platform or device (including tablets and smartphones) is already being adopted successfully by different national and intranational projects. Its use will be demonstrated live at RSNA and users will be able to create their own account to accessing sets of shared images.

Background

In the field of personalized medicine, large data collections of digital images require a scalable infrastructure for storage, communication, wide distribution, processing and analysis of these images. Managing large databases of medical images adds a degree of complexity due to the size, and requirements for specific tools for visualization, analysis and processing of these images.

Evaluation

The project of our is to develop an Open-Source IT framework called KHEOPS to power open-access repositories of medical imaging data geared specifically toward the federation of multi-centric collaborative initiatives featuring: - Internationally accessible open databanks of imaging biomarkers (phenotype) that can be associated with genetic and proteomic biomarkers (genotype) - Based on contributions from research groups sharing curated and consented data - User-friendly cockpit for the management and distribution of images by users - Imbedded HTML5 viewer (OHIF) as well as links to popular open-source viewers (OsiriX/Horos, Weasis) - Open APIs for developers of image analysis and data mining tools - F.A.I.R. compliant by design, with secure token management (OpenID Connect, Keycloak) for access and tracking of data at the level of individual image series

Discussion

Developed by the team who created the popular OsiriX viewer this platform provides a flexible means for data sharing that gives access to Big Data repositories for machine learning and Radiomics. Its highly secured and flexible cockpit allows user to manage and exchange data through a simple paradigm of 'shared albums' that consists of subset of data from multiple sources. The use of unique and revocable tokens allows users to manage and monitor the use of their shared data. Special attention was given to facilitating the integration with existing institutional PACS as well as existing imaging databanks.

IN213-SD-TUB6

Renal Parenchyma Segmentation Using the Combined 2D and 3D Segmentation Networks for Analysis of Volume Changes of Contralateral Hypertrophy after Robot-Assisted Partial Nephrectomy in Abdominal CT Images

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Station #6

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CONCLUSION

Our method can be used to predict kidney function after RPN by measuring the volume changes of the contralateral renal parenchyma. (This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Science and ICT (NRF-2019R1A2C2004746).)

Background

Compensatory hypertrophy occurs in the contralateral kidney after robot-assisted partial nephrectomy (RPN), and the volume changes of the kidney affect renal function. The aim of this study is to segment the renal parenchyma for measuring the volume of the contralateral kidneys, and to analyze the relationship between renal parenchymal volume and renal function.

Evaluation

Patients were evaluated at 48 abdominal contrast-enhanced arterial phase CT images of 10 patients with 6 months, 1 year, and 2 years to 4 years follow-up after RPN. To localize the kidney in the abdomen, renal parenchyma, including the cortex and medulla, is segmented using 2D U-net in each axial, coronal, and sagittal planes, and positioned through majority voting of the segmented results in each plane. Then the renal parenchyma is refined using 3D U-net considering spatial information within the localized area. Experimental results showed that the segmentation performance of the renal parenchyma using the combined 2D and 3D segmentation network was 98% and 97.17% in the DSC at the left and right kidneys, and improved 2.32% and 0.58% in the DSC at the left and right kidneys compared to 2.5D segmentation network. In the relationship between renal parenchymal volume and renal function, the median volume changes of the contralateral renal parenchyma increased to 3.28%, 4.95%, 6.2%, 7.04%, respectively, and the median global eGFR changes increased to 4.36%, 7.8%, 9.53%, 9.55% at 1 year, 2 years, 3 years, and 4 years relative to 6 months, which eGFR also increased as the contralateral renal parenchyma volume increased.

Discussion

Our combined 2D and 3D segmentation network have improved the performance by limiting segmentation area to the localized area through the kidney localization, and by considering the spatial information within the segmented area.

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IN215-SD-TUB5

Actionable Findings in Daily Clinical Practice

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Station #5

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PURPOSE

To assess the prevalence of actionable findings in daily clinical radiology practice and to develop an algorithm that automatically detects actionable findings in radiology reports using natural language processing.

METHOD AND MATERIALS

The Institutional Review Board of the Erasmus MC approved this study. A random sample of 500 radiology reports was taken from 122,000 consecutive radiology reports from June 2017 till March 2018 in the Erasmus MC, one of the largest university hospitals in The Netherlands. Actionable findings in the 500 anonymized reports were independently annotated by two radiologists, following standards of the American College of Radiology. Interobserver agreement was calculated using the kappa statistic. Annotation disagreements were resolved in a consensus meeting. Based on the final annotations, the prevalence of actionable findings was estimated. Using a bag-of-word approach (unigrams and bigrams) and after negation detection, a generalized linear model was trained to detect actionable findings. Performance was assessed by the area under the receiver operating characteristic curve (AUC), using 10-fold cross validation.

RESULTS

The prevalence of actionable findings in our study population was 29.2% (149/500). Seven patients had urgency level 1, 61 had urgency level 2, and 81 had urgency level 3. The kappa statistic was 0.61. The AUC for the NLP-algorithm to detect an actionable finding was 0.884.

CONCLUSION

A substantial part of radiology reports in daily clinical practice contain actionable findings. NLP may help in automatically detecting those findings.

CLINICAL RELEVANCE/APPLICATION

A substantial part of radiology reports contain actionable findings, leading to substantial workload for radiologists. NLP might help in detecting those and improve communication to the referring physician.

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IN228-SD-TUB7

Clinical Usability Scores For PI-RADSv2 Conform Structured Multi-Parametric MRI Reports of The Prostate Using Natural Language Processing-Based RadLex® Mapping

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Station #7

Participants
Mate E. Maros, MD, Heidelberg, Germany (*Presenter*) Research funded, German Federal Ministry for Economic Affairs and Energy
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PURPOSE

The combination of the PI-RADSv2 system and structured reporting (SR) provides a robust framework for standardized reporting of multi-parametric prostate MRI (mpMRI). However, there are considerable personal variations among urologists about the information they require from high-quality reports when planning prostate biopsies. We investigated whether 1) mapping urosurgically relevant key content to RadLex® terms might be feasible to assess report quality with regard to clinical usability and 2) validated thresholds for text mining-based automated report assessment for computer-assisted reporting tools.

METHOD AND MATERIALS

A single center retrospective cohort study of 920 patients (01/2017-10/2018) mpMRI were retrieved from local RIS. All reports were generated using a SR template (www.smart-radiology.com). Two blinded urologists i) assigned report quality scores (RQS) using 7 items, each evaluated on 5-grade Likert-scale, to stratified random subsets of 200 (validation) and 100 (test) reports and ii) they defined biopsy relevant key information content (KIC) on remaining exploration set (n=620). Automatic, cross-lingual mapping of German reports, clinical KIC to RadLex® terms was performed using a proprietary information extraction tool (www.empolis.com; free for research purposes). Then these RadLex® converted texts were compared using cosine similarity index (CSI). CSI thresholds were validated against the RQS using only high-quality reports (RQS>=4 for all items) for both urologists (internal & external) respectively.

RESULTS

External urologist assigned significantly lower RQS for all items ($p<0.001$). RQS stayed robust intra-individually between validation and test sets for both urologists (p=n.s). The local urologist identified significantly ($p<0.001$) more reports as high-quality both in the validation (110 vs. 20/200) and test sets (68 vs.13/100). We identified CSI thresholds for internal and external urologists that ensure high clinical report usability.

CONCLUSION

Biopsy-relevant key RadLex® content could serve as an important surrogate measure for quality of mpMRI reports. Embedding RadLex-based quality thresholds into computer-aided reporting tools could streamline communication with urologists.

CLINICAL RELEVANCE/APPLICATION

We provide quality thresholds for automated scoring with respect to optimal clinical usability by urologists that can be easily embedded into computer assisted diagnostic and reporting tools.

IN238-SD-TUB1

Visceral Fat Quantification in Abdominal Computed Tomography Using Deep Learning

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Station #1

Participants
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CONCLUSION

The present model was able to quantify visceral fat in CT images using a fully automated algorithm. Its use will allow the radiologist to provide an objective measure of this condition highly related to morbidities in any CT study, without an increase of the time spent in the analysis of the images.

Background

Studies have shown the direct association of increased visceral fat as a risk factor for various morbidities such as metabolic syndrome and cardiovascular events - the latter being the leading cause of worldwide mortality. Regarding the quantification of visceral fat, current diagnostic imaging relies on semi-automated and time-consuming software's, requiring manual labor and therefore restricted to selected cases mainly under medical request. Since many patients undergo CT examinations daily and being the metabolic syndrome such a frequent and silent condition, any abdominal CT could represent a diagnostic opportunity, regardless of the current clinical indication for this examination. For this reason, we believe that a fully automated algorithm can become an accessible and available tool to be applied in any CT study, improving the evaluation of a such a morbid and underdiagnosed disease.

Evaluation

This retrospective study was approved by our institutional review board, and written informed consent was waived. A total of 381 anonymized subjects were selected, and the data was encrypted. For annotation, manual selection of subcutaneous fat and abdominal cavity of enhanced and unenhanced CT was performed at the umbilical level using md.ai (md.ai, New York). A LinkNet-based model was trained from scratch using this data, and its performance was evaluated through Dice similarity coefficient. Intra-abdominal fat was separated from bowel loops and other organs using a Python script with pixel selection by the threshold of attenuation.

Discussion

The segmentation algorithm had a good result, with a DICE of 0.96 for the test set, and 0.967 for the validation dataset. The result obtained by segmentation can be analyzed according to the percentage of visceral fat to total fat area, which has already been validated and has been used in semi-automated software's.

IN249-SD-TUB2

ROSA Robot Rehearsal: Utilizing 3D Printing to Facilitate the Integration of Robotic Stereotactic Assistance (ROSA) in Neurosurgery

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Station #2

Participants
Ritesh D. Patel, MD, Manhasset, NY (*Presenter*) Nothing to Disclose
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David Bonda, Queens, NY (*Abstract Co-Author*) Nothing to Disclose
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CONCLUSION

We demonstrated the utilization of 3D printing to construct physical models for surgical planning and simulation to facilitate the integration of new complex surgical robotic technology.

Background

The ROSA robot has significantly advanced neurosurgical practice and established efficient and accurate stereotaxis for the implantation of electrodes, catheters, probes, and biopsy needles. However, the introduction of new complex robotic technology into an existing practice poses technical and logistical challenges. These include work-flow logistics, patient and equipment positioning, and increasing staff familiarity. To mitigate some of these challenges and facilitate the integration of new surgical equipment, we utilized radiological advances in 3D imaging and printing. 3D printing technology provides a practical and anatomically accurate means of producing patient and disease-specific models for surgical planning and simulation for practitioners and in extension robotic technology.

Evaluation

We describe the use of a 3D printed patient-specific model with an in-situ tumor to create a learning environment in which the logistics of robotic setup, registration, and utilization could be optimized for presurgical positioning in the stereotactic biopsy of a pontine lesion prior to patient exposure. Patient-specific MRI imaging data was registered with CT imaging into 3D Slicer and anatomical regions of interest were segmented using appropriate threshold levels. The final segmentation of the model was exported to a STL file and subsequently printed as a 3D model to then be used for surgical planning and simulation. Members of the operating team enacted a rehearsal procedure with the goal of reducing unexpected intraoperative difficulties and patient intubation time.

Discussion

Utilization of a 3D printed model enabled workflow optimization, increased staff familiarity with the logistics of the ROSA robot, and demonstrated a successful biopsy trajectory for reaching the intralesional tissue. Total rehearsal session time was 92 minutes. Intraoperatively, patient positioning, pinning, and robot placement was performed in 45 minutes, a 50% reduction in time, and the biopsy was completed without complications.

IN260-SD-TUB3

Inter-Operator Variability in Diffusion Tensor Imaging Tractography for Tumor Resection Surgical Planning

Tuesday, Dec. 3 12:45PM - 1:15PM Room: IN Community, Learning Center Station #3

Participants
Vanitha Sankaranarayanan, MS, San Francisco, CA (*Presenter*) Nothing to Disclose
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CONCLUSION

It was observed that tracks can be missed in areas surrounding the lesions in tumor cases due to oversight, regardless of the operator experience. When processing pre-surgical tumor cases, it was concluded that using a conservative approach that is more inclusive in retaining tracks is preferable to achieve higher operator consistency.

Background

Prior studies have demostrated high correlation between Diffusion Tensor Imaging (DTI) tractography reconstructed fibers and actual pathways. DTI is being increasingly used in neuro-surgical planning, such as for assessing safety margins considered during tumor resection. Within the context of clinical use consistency amongst operators creating such tracks is imperative. This work presents inter-operator variability observed amongst highly-experienced, mid-level and beginner level operators.

Evaluation

Four operators, two with > 5 years of experience each, 1 with 2 years and one newly trained, analyzed Motor, Optic radiations and IFOF tracks. MRI images acquired using HARDI protocol for 20 normal controls and 20 subjects with glioma were used. The images were processed using the DiPy, with q-ball probabilistic tracking, an FA threshold of 0.15 and angle threshold of 60. Seed and target regions of interest (ROI) were created for each type of track. Streamlines generated by the DiPy software were used as baseline by each operator, blinded to each other's work. TrackVis was used to edit streamlines, select valid tracks and remove spurious ones thus leaving those most likely to correlate with actual pathways.

Discussion

The binary mask created for the tracks selected by each operator was compared using Sorenson-Dice Index. Paired evaluation was carried between operators for each type of track. Overall percent overlap for edited tracks was: IFOF - 89%; motor - 85%; optic - 76%. Average overlap for Motor tracks was 91% vs 81% and 84% vs 71% for optic between the two experienced operators and the mid-level operator respectively. The beginner level operator correlated closely with the experienced operator who trained the person. IFOF has the highest overlap and optic the least. The largest discrepancies were seen the in anterior temporal lobe for optic.

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MI210-SD-TUB1

CT-Based Radiomic Features as Prognostic Factors in ALK-Positive Non-Small-Cell Lung Cancer

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MI Community, Learning Center Station #1

Participants
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PURPOSE

To describe progression-free survival (PFS)-related radiomic features, and build a computed tomography (CT)-based radiomic signature for the prediction of PFS in stage IV anaplastic lymphoma kinase (ALK)-positive non-small-cell lung cancer (NSCLC) patients treated with tyrosine kinase inhibitor (TKI) crizotinib.

METHOD AND MATERIALS

From January 2012 to September 2016, 85 patients with ALK-mutant NSCLC who received crizotinib therapy were contained in this study, which was examined and approved by the review committee as a retrospective research. We extracted 481 quantitative 3D features including intensity, texture, and wavelet features of NSCLC tumor images from the manually segmented tumor volumes of interest. The prognostic performance of each radiomic feature was assessed by hazard ratio (HR) in the whole cohort. Then, all patients were randomly divided into a training cohort (n=43) and an independent validation cohort (n=42). In the training cohort, a CT-based radiomic signature was built for PFS prediction using a Cox proportional hazards model with the least absolute shrinkage and selection operator penalty. The performance of the radiomic signature was evaluated in the validation cohort using the Kaplan-Meier survival analysis and Harrell's concordance index (C-index).

RESULTS

After calculating the HR of all radiomic features, 22 radiomic features with P values less than 0.05 were screened out, and 68% of them were grey-level co-occurrence matrix (GLCM) texture features. A radiomic signature containing 2 CT-based radiomic features (both GLCM texture features) showed significant prognostic performance in the validation cohort (C-index, 0.654; 95% confidence interval, 0.556-0.753). A significant association between the radiomic signature and PFS was demonstrated in view of the Kaplan-Meier method and log-rank test ($P < 0.01$) in statistical analysis.A significant association between the radiomic signature and PFS was demonstrated in view of the Kaplan-Meier method and log-rank test ($P < 0.01$) in statistical analysis.

CONCLUSION

In ALK mutated NSCLC patients, the GLCM texture features showed good prognostic performance, the CT-based radiomic model was found to be effective for predicting PFS.

CLINICAL RELEVANCE/APPLICATION

This study discussed the correlation of a radiomic signature with progression-free survival and its predictive potential in stage IV ALK-positive NSCLC patients treated with crizotinib. The radiomic signature was found can predict resistance to ALK inhibitor, which can improve the individualized treatment with ALK inhibitors.

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MI221-SD-TUB2

The Use of Near Infrared Radiation Spectroscopy (NIRS) in Reconstructing 3D Oxygenated Dynamic Images as Biomedical Evidence in Monitoring Diabetic Foot

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MI Community, Learning Center Station #2

Participants
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Young-Jin Jung, PhD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study aims to provide biomedical images as clinical evidence using Near Infrared Radiation in monitoring diabetic foot which could be of use in improving patient's quality of life for it is portable, non-invasive, non-ionizing and not requiring manual calibration, additional medical supplies, and specifically trained personnel.

METHOD AND MATERIALS

The Toast C++ and MATLAB 2018b software applications were used to reconstruct 3D mesh files of the skin and bones of the foot. Subsequently, Diffuse Optical Tomography (DOT) method was applied to the generated mesh files having the forward and inverse problem for image reconstruction. In forward problem, diffusion equation was applied to predict the emission of NIR light based on the light source and interacting material parameters. Meanwhile, the inverse problem applied the forward problem to reconstruct the optical property distribution of interacting material from a measured data set.

RESULTS

The hemoglobin concentration measured allowed the 3D reconstruction of oxygenated dynamic imaging, in particular, the absorption reconstruction. The result illustrates the differences in the diffusive regime imaging of bodily structures and among the four reconstructions, a*bsorption recon* 1 has the lowest color map value ranging from 0.100000005 to 0.100000015 and a*bsorption recon 11* have the highest color map values obtained ranging from 0.0105 to 0.0115. *Absorption recon 1* has the lowest range of color map values for diffuse optical tomography occur in the most deep-seated area in comparison with the other three absorption reconstructions. On the other hand, *absorption recon 11* is in the most superficial area.

CONCLUSION

Contact and Remote based Near Infrared Spectroscopy could be of use in monitoring diabetic foot and the reconstructed 3D oxygenated dynamic images could be of use as biomedical evidence.

CLINICAL RELEVANCE/APPLICATION

NIR specifically works by exploring the oxygenated and deoxygenated hemoglobin concentration in the body which paved the way for the measurement of hemoglobin concentration that is used to identify wound healing potential.

MI222-SD-TUB3

The Value of Multifunctional Caramelized Fe3O4 Nanospheres in Magnetic Resonance Imaging, MRI, and Photothermal Therapy for Breast Cancer

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MI Community, Learning Center Station #3

Participants
Fang-qing Wang, Jinan , China (*Presenter*) Nothing to Disclose
De-xin Yu, Jinan , China (*Abstract Co-Author*) Nothing to Disclose
Hong Wang Jr, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the diagnostic and therapeutic effect of multifunctional caramelized Fe3O4 (Fe3O4-CNSs) in MRI and photothermal therapy for breast cancer.

METHOD AND MATERIALS

Fe3O4 and DOX were integrated into caramel carbon nanospheres (CNSs) by covalent binding and electrostatic adsorption , then their physical and chemical characteristics and cytotoxicity were determined. The subcutaneous xenograft of 4T1 cells in BALB-C mice was established. The mice models were divided into three groups, and then the saline (control group), Fe3O4@CNSs and Fe3O4@CNSs+DOX were injected through the mice tail vein respectively. After MR imaging at different time points (0, 3, 12, 24, 48 and 72 h), the changes in T2 signal value of the tumor were measured. At the time point of the peak value, the laser irradiation was performed for 10 minutes for photothermal therapy, and then irradiated again after 3 and 6 days, and the temperature changes were recorded. The imaging and therapeutic results were compared with the changes of tumor volume and the pathological findings.

RESULTS

Fe3O4@CNSs were cultured in MCF-10A cells at 200 ppm for 48 hours, and the cell viability was 82%. In Fe3O4@CNS or Fe3O4@CNSs@DOX group, the T2 signal value of tumor was gradually decreased within 24 hours, and reached the peak lowest value at 24 hour.Accumulation of Fe3O4@CNSs or Fe3O4@CNSs@DOX in the tumor resulted in increased temperature to 62 ? for photothermal therapy, 25 ? higher than that of the control group. Tumor volume ratio in Fe3O4@CNSs@DOX group was 0.8 in the twelfth day and the necrosis was more than that in control group or in Fe3O4@CNSs group.

CONCLUSION

Fe3O4@CNSs with higher biocompatible and self-degradable characteristics can realize the integration of MRI and photothermal therapy simultaneously, which is of great help to the diagnosis and treatment for breast cancer.

CLINICAL RELEVANCE/APPLICATION

Fe3O4-CNSs with MRI imaging and photothermal therapy functions provide a novel method for the precise and comprehensive diagnosis and treatment of breast cancer.

MK321-ED-TUB8

Walking on Pebbles: Beyond Morton's Neuroma

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
Snehansh R. Chaudhary, MBBS, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is to: Provide a list of common causes of central metatarsalgia Categorise the causes using a helpful classification Discuss anatomy of intermetatarsal spaces and collateral ligaments Review the imaging features of these lesions using example cases

TABLE OF CONTENTS/OUTLINE

Define central metatarsalgia (abnormalities related to 2nd, 3rd and 4th metatarsals and their respective MTP joints) List the differentials of central metatarsalgia Classification of the different causes of central metatarsalgia -Traumatic (including chronic repetitive injury) -Soft tissue type lesions (Inflammatory, Degenerative, Traumatic, Neoplastic) Review the anatomy of intermetatarsal space and collateral ligaments Sample cases for each condition Learning points and conclusion

MK323-ED-TUB9

Radiographic Measurements and Angles of the Ankle and Foot: What Every Radiologist Should Know

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #9

Participants
Julia E. Castro Anaya, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Silmara R. Coelho, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Taisa D. Gasparetto, MD, PhD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcelo S. Takahashi, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

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TEACHING POINTS

- Conventional radiography remains the main imaging tool for assessment and establish accurate diagnoses of musculoskeletal pathologies and to monitor several diseases and established structural changes.- To improve the knowledge about the different kinds of measures of the foot and ankle in conventional radiology, making possible to identify the pathologic status. - This study addresses the main angles and measures of the foot and ankle which can be used easily in daily routine, aiming to create a practical guide for a quick assessment.

TABLE OF CONTENTS/OUTLINE

1. How to diagnose: Pes planus Vs Pes Cavus 1.1 Sample cases and review of imaging findings.2. How to diagnose: Hindfoot Valgus Vs Varus3. Measures of the Forefoot and midfoot4. How to diagnose: Fracture of the calcaneus5. Sample cases of fracture of the calcaneus, metatarsus adductus, splayfoot and Hallux valgus.

MK324-ED-TUB10

Strategies to Upgrade your MSK MRI: Back to Basic Physics, Made Easy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #10

Participants
Young Kwang Lee, MD, Jeonju, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Myungjin Seol, MD, Iksan-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeong Sang Hong, Gwangju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Compare to other parts MRI (e.g. brain, breast, liver, etc), before scanning MSK MRI, there are lots of choices to make (e.g. where to scan = FOV, how fine image you need = resolution, which coil to use?). In this presentation, we introduce some of the key strategies to improve MSK MRI quality. We are focusing on basic physics with examples.

TABLE OF CONTENTS/OUTLINE

Introduction - if you set it right, you can get better MRI quality Basic physics to upgrade image quality 1) slice thickness and gap 2) FOV 3) Matrix number 4) NEX Choosing the coil Choosing Sequence 1) Fat suppression 2) 3D iso-voxel imaging 3) Dixon technique 4) Metal artifact reduction technique 5) MR arthrography Summary

MK325-ED-TUB12

MR Imaging of Peripheral Neuropathy: From Infectious to Compressive Causes

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #12

Awards
Cum Laude

Participants
Monique Purger, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Michel Bayouth Padial, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. Review the muscle innervation supply of the most affected nerves in peripheral neuropathies and correlating them with axial T1-weighted MR images2. Introduce the most common denervation patterns in MR images3. Present common and unusual cases of neuropathy

TABLE OF CONTENTS/OUTLINE

1. Introduction: an overview of the causes and types of neuropathies2. A table containing the most important nerves together with their muscle supply scheme through axial MR images and the expected pattern of muscle denervation for each nerve injury of the upper and lower limbs. 3. Illustrate with examples of the most common and unusual cases of neuropathy4. Final Pocket Guide to neuropathies

MK326-ED-TUB11

Pediatric Bone Tumors and Mimickers: Focused Imaging Overview with Pathologic Correlation

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #11

Participants
Khalid Al-Dasuqi, MD, New York, NY (*Presenter*) Nothing to Disclose
Lina Irshaid, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Kimia K. Kani, MD, Herndon, VA (*Abstract Co-Author*) Nothing to Disclose
Jack A. Porrino JR, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. To identify the radiologic features that separate benign from malignant pediatric bone lesions.2. To provide a systemic approach for the differential diagnosis for pediatric bones lesions based on age, location, matrix of lesion, margins, number of lesions, presence or absence of periosteal reaction, bony destruction, extraosseous component.3. To recognize the histopathologic correlation associated with common pediatric bone lesions.4. To make management decisions appropriately (i.e. when to recommend follow-up, when to proceed with biopsy or surgical intervention, when to leave the lesion alone).

TABLE OF CONTENTS/OUTLINE

• Bone forming tumors: o Enostosis o Osteoma o Osteoid osteoma o Osteoblastoma o Osteosarcoma • Cartilage forming tumors: o Enchondroma o Osteochondroma o Multiple hereditary exostoses o Chondroblastoma o Chondromyxoid fibroma o Chondrosarcoma• Marrow tumors: o Ewing's sarcoma o Lymphoma o Leukemia o Metastases• Bone benign tumors: o Intraosseous lipoma o Fibrous dysplasia o Unicameral bone cyst o Aneurysmal bone cyst o Giant cell tumor o Langerhans cell histiocytosis• Bone tumor mimickers: o Infection o Myositis ossificans o Trauma/stress fracture o Vascular lesions (e.g. hemangioma, angiosarcoma)

MK364-SD-TUB1

Quantitatively Whole Knee Cartilage Assessment in Vivo Using Ultrashort Echo Time Magnetization Transfer (UTE-MT) MRI

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #1

Participants
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Yajun Ma, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Hoda Shirazian, MD, San Diego, CA (*Presenter*) Nothing to Disclose
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Zhao Wei, San Diego , CA (*Abstract Co-Author*) Nothing to Disclose
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Saeed Jerban, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate the relationship between quantitative parameters, obtained from UTE-MT modeling, and the Whole-Organ Magnetic Resonance Imaging Score(WORMS) in vivo assessment of the whole knee cartilage.

METHOD AND MATERIALS

A total of 30 human subjects (aged 23-88 years, 55±17 years; 17 males, 13 females) was recruited for this study. Informed consent was obtained from all subjects in accordance with guidelines of the Institutional Review Board. Whole knee joint imaging was performed using 3D UTE-Cones sequences on a 3T MR750 scanner (GE Healthcare Technologies, Milwaukee, WI). An 8-channel knee coil was used for signal excitation and reception. The UTE-MRI scans involved: A) an actual flip angle-variable TR (AFI-VTR) method (AFI: TE=0.032, TR=20, 100 ms, FA=45°; VTR: TE=0.032, TR=20-100 ms, FA=45°) for T1 measurement, which is a prerequisite for accurate MT modeling; and B) a 3D UTE-Cones-MT sequence (saturation pulse power=500, 1000, 1500°; frequency offset=2-50 kHz; FA=7°) for MT modelling. Field of view (FOV), matrix dimension, and slice thickness were 15 cm, 256×256, and 2 mm, respectively. The whole knee cartilage was graded by two experienced radiologists according to the WORMS. The Pearson's correlations were calculated between UTE results and WORMS.

RESULTS

The proposed 3D UTE;Cones AFI;VFA method showed an average T1of 1024 ± 127 ms for cartilage of femur, 917 ± 109 ms for patella cartilage, 913 ± 65ms for cartilage of tibia. MT-f presented very good correlations with the corresponding WORMS for the cartilage in femur, patella, and the poster segment of tibia. MTR correlate with the WORMS of cartilage in the center segment of femur, patella, and the posterior segment of the tibia. T1 correlate with the WORMS of the cartilage in center and posterior segment of femur, and patella.

CONCLUSION

T1, and MT-f, MTR obtained from MT modeling showed significant correlations with WORMS of knee articular cartilage. This study highlighted UTE-MT MRI techniques as a useful method to detect the early degeneration of OA and monitor the effects of therapy.

CLINICAL RELEVANCE/APPLICATION

The 3D UTE-MT method provides valuable biomarkers of cartilage in whole knee joints on a clinical 3T scanner.

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MK365-SD-TUB2

Just a Coincidence? Magnetic Resonance Imaging Analysis of Kaplan Fiber Injury in the Setting of Acute Anterior Cruciate Ligament Tear

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #2

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PURPOSE

This study aimed to evaluate the incidence of Kaplan fiber injury on magnetic resonance imaging (MRI) in patients diagnosed with acute anterior cruciate ligament (ACL) tears. A secondary outcome of this study was to determine the intraobserver reliability in diagnosing Kaplan fiber injury on MRI.

METHOD AND MATERIALS

The PACS database at a single academic medical center was queried for MRI diagnosis of complete native ACL tears from January 2015 to November 2018. Included patients were between ages 17 and 55 and underwent MRI within six weeks of the initial injury date. A musculoskeletal radiologist reviewed the imaging exams and then again four weeks later to determine intraobserver reliability. After confirming the presence of a complete ACL tear and lateral compartment bone contusion, the radiologist assessed each Kaplan fiber band and other structures of the anterolateral complex as follows: grade 0, normal; grade 1, peri-fiber edema without fiber discontinuity; grade 2, edema within and surrounding the fibers as well as partial fiber disruption; and grade 3, complete fiber disruption. The results were analyzed using the Pearson's chi-squared test and Cohen's weighted kappa values.

RESULTS

102 patients (64 men and 38 women; age range, 17-53; mean age, 29.7 years; 52 right knees) were reviewed. 48% and 53% had injuries to the proximal and distal supracondylar Kaplan fibers, respectively, and 34% had injuries to the epicondylar Kaplan fibers. 43% of the included patients had no identifiable injury to the Kaplan fibers, while another 43% injured both the Kaplan fibers and the anterolateral ligament. Injury to these anterolateral complex structures were significantly associated with each other ($p<0.0001$). Also, the severity of anterolateral ligament injury was significantly associated with Kaplan fiber abnormality ($p=0.0008$). The kappa value for intraobserver reliability of identifying Kaplan fiber abnormality was 0.77, which indicates substantial agreement as defined by Landis and Koch.

CONCLUSION

This study shows that slightly more than half of patients with a known ACL tear on MRI have concomitant Kaplan fiber injury, and the level of intraobserver reliability of diagnosing such injury is significant.

CLINICAL RELEVANCE/APPLICATION

As interest in anterolateral reconstruction during ACL repair grows, assessing distal IT band Kaplan fiber injury on pre-operative MRI may optimize surgical planning of extra-articular approaches.

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MK366-SD-TUB3

Virtual Magnetic Resonance Lumbar Spine Images Generated from Computed Tomography Images Using Conditional Generative Adversarial Networks

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #3

Participants
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Yoshinori Funama, PhD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to generate virtual magnetic resonance (MR) lumbar spine T2-weighted images from computed tomography (CT) images using generative adversarial networks (GANs).

METHOD AND MATERIALS

We selected the assessments of 19 adults (11 women) with an average age of 61.3 (standard deviation = 18.7) years who had undergone CT and MRI examinations of the lumbar spine within the 4 months. Three examinations were used as test data and 16 examinations as training data. These were aligned with multiplanar reconstruction performed by medical image workstation for 914 paired data sets of MR and CT images. A conditional GAN was trained to generate virtual MR images from CT images using corresponding MR images as targets. After training, the generated virtual MR images of the test data in epoch 1, 10, 50, 100, 500, and 1000 were compared with the actual ones using mean square error (MSE) and structural similarity index (SSIM). Moreover, qualitative assessments were performed by two radiologists.

RESULTS

The MSE of the virtual MR images decreased as the epoch of GAN increased from the original CT images: 9046.8 ± 1186.8 (original CT), 2046.5 ± 539.8 (epoch 1), 1498.5 ± 286.5 (epoch 10), 1411.6 ± 437.8 (epoch 50), 1383.3 ± 439.4 (epoch 100), 1254.3 ± 510.5 (epoch 500), and 1190.4 ± 424.5 (epoch 1000). However, the SSIM of the virtual MR images increased as the epoch of GAN increased from the original CT images: -0.034 ± 0.016 (original CT), 0.429 ± 0.035 (epoch 1), 0.503 ± 0.034 (epoch 10), 0.550 ± 0.044 (epoch 50), 0.561 ± 0.043 (epoch 100), 0.596 ± 0.041 (epoch 500), and 0.600 ± 0.036 (epoch 1000). Furthermore, no considerable differences were observed in the quantitative evaluation between the virtual and actual MR images.

CONCLUSION

This method may be a promising technique to generate MR images from CT images without performing MRI examinations.

CLINICAL RELEVANCE/APPLICATION

This method may prove valuable for patients who cannot undergo MRI examinations because of reasons such as pain, implants, and claustrophobia.

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MK400-SD-TUB4

Comparison between Quantitative T2*-Analysis of the Retropatellar Cartilage and the TTTG Distance in Young Professional Soccer Players

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #4

Participants
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PURPOSE

The position of the tibial tuberosity related to the trochlear groove is important for the inferolateral force vector of the patella. However there is an ongoing debate about the impact of the tibial tuberosity-trochlea groove (TTTG) distance on lateral patellar instability and the initiating of cartilage degeneration. For further clarification we performed quantitative MRI analysis of the retropatellar cartilage in young athletes and compared T2*-relaxation times with TTTG distances.

METHOD AND MATERIALS

36 knees of 18 young professional, age- and BMI matched soccer players were evaluated. All participants underwent knee MRI at 3T with a qualitative and quantitative analysis. For quantitative analysis T2* measurements in 3D data acquisition were performed in sagittal orientation (22 echoes ranging from 4.6-53.6 ms; image resolution 0.5x2x2mm). All data sets were postprocessed using a dedicated software tool (qMapit) and quantitative maps were generated. The deep and superficial layer of 12 predefined cartilage segments were analysed in the lateral, medial and central part of the patella and TTTG distance was measured in MRI. In a qualitative analysis there was no structural cartilage damage and no abnormalities in patellar and trochlea shape. Statistical analysis included Typ 3-Test, confidence intervals and a MIXED effects model.

RESULTS

T2* relaxation times were significantly higher in the superficial (mean: 31.3±3.8ms) compared to the deep layers (mean: 20.5±4.2ms) ($p<0.001$). Significantly higher relaxation times were found in the central compared to the lateral predefined compartment ($p<0.001$) though no significant difference was spotted comparing the predefined lateral and medial compartments of the retropatellar cartilage. The mean TTTG distance was 10±4 mm (range 3-19). There was no significant correlation between the TTTG distance and T2* relaxation times in the retropatellar cartilage.

CONCLUSION

In a population of young professional healthy athletes there is no increase of T2*-relaxation times as indicator for early degenerative cartilage changes depending on an elevated TTTG distance.

CLINICAL RELEVANCE/APPLICATION

Our findings support the theory that the TTTG distance alone is not a significant risk factor for the development of retropatellar cartilage degeneration.

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MK401-SD-TUB5

Do Muscle Elastography and Echogenicity in Spastic Cerebral Palsy Correlate with Response to Botulinum Toxin Injection?

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #5

Participants
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PURPOSE

The purpose of this study is to quantify change in muscle stiffness properties of spastic muscles in children with unilateral upper extremity SCP following intramuscular Botulinum Toxin Type A (BTX-A) injection using shear wave elastography (SWE). SWE metrics and echogenicity of target muscles were compared to functional measures of muscle stiffness following BTX-A injection.

METHOD AND MATERIALS

Patients with unilateral SCP and dynamic muscle spasticity in the elbow and/or wrist flexors were enrolled. SWE measurements (m/s) and muscle echogenicity analyses were performed immediately before BTX injection (baseline), and at 1, 3, and 6 months. Functional assessment (Modified Ashworth Scale (MAS) for spasticity, and goniometric passive (PROM) and active (AROM) range of motion measurements of the elbow and wrist) was performed at the same time points. PROM and AROM were analyzed as percent of max. Spearman correlations were estimated to access for relationships between baseline SWE values and mean echogenicity in each muscle with PROM, MAS, and AROM values at the corresponding joint.

RESULTS

6 patients with SCP are currently enrolled in this ongoing study, with 11 muscles evaluated. The FCU had the highest number of data pairs at this point in the study (n=5). Correlation coefficient between SWE values and clinical outcomes was calculated for the FCU separately and then collectively for all the muscles. For the FCU, there were very strong negative correlations between baseline SWE values with baseline PROM [-0.95 (-1.00, -0.41)] and with % change in AROM at 1 month [-0.90 (-0.99, -0.09)]. Overall, there was moderate negative correlation between baseline muscle SWE values and PROM at 1 month [-0.44 (-0.85, 0.00)], and very strong negative correlation with % change in AROM at 1 month [-0.81 (-0.95, -0.36)]. Associations between muscle echogenicity and clinical outcomes at baseline and one month were weak.

CONCLUSION

Significant correlation between baseline muscle SWE values and ROM values at 1 month post intramuscular BTX-A injection suggests that baseline SWE values may be predictive of BTX-A response.

CLINICAL RELEVANCE/APPLICATION

Baseline muscle spasticity parameters could provide prognostic data that can be used to predict the effects of BTX-A and ultimately serve as a basis for development of a treatment model for muscle spasticity in patients with SCP.

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MK403-SD-TUB7

Deep Learning Takes the Pain Out of Back Breaking Work - Automatic Vertebral Segmentation and Attenuation Measurement for Opportunistic Osteoporosis Screening

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MK Community, Learning Center Station #7

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PURPOSE

Recent studies have highlighted the use of vertebral trabecular attenuation values for osteoporosis screening. The aim of this study was to evaluate a fully automated deep learning-based method for lumbar vertebral segmentation and measurement of vertebral volumetric trabecular attenuation values.

METHOD AND MATERIALS

A convolutional neural network (CNN) was trained to segment lumbar vertebrae using 117 manually pre-segmented non-contrast CT scans. The CNN was then applied to non-contrast CT scans of 519 patients (mean age 55 years ± 15, 299 male, 220 female) and each vertebral segmentation was reduced by 7 mm in all directions in order to avoid cortical bone. The mean and median volumetric attenuation values were obtained for L1 to L4 and plotted against patient age and sex.

RESULTS

The mean L1 attenuation values decreased linearly with age by -2.4 HU per year (age >= 30, 95% CI: -2.7, -2.0, females: -2,8 HU / year, males: -2.0 HU / year, p = 0.01). There was no significant difference between men and women in the age group 30-55 years old, nor in the group aged 55 years or older. The mean attenuation value was 216 ± 32 HU for patients younger than 30, and 102 ± 41 HU for patients older than 70. Although no significant difference was found, there was a tendency for higher attenuation values in premenopausal women compared to men of the same age. Median, mean and grouped L1-L4 attenuation values followed a similar pattern. A total of 135 patients had an L1 attenuation below 100 HU.

CONCLUSION

With results closely matching those of previous studies, we believe that our fully automated deep learning-based method can be used to obtain lumbar volumetric trabecular attenuation values which can be used for opportunistic screening of osteoporosis in patients undergoing CT scans for other reasons. The automated AI tool used in this study is available on request for research purposes at www.recomia.org.

CLINICAL RELEVANCE/APPLICATION

Our automated tool can be used to automatically identify patients at risk for osteoporosis in order to take preventive measures and decrease or delay the onset of fractures.

MS226-ED-TUB1

Granulomatous Diseases of the Abdomen and Pelvis

Tuesday, Dec. 3 12:45PM - 1:15PM Room: MS Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Awards
Certificate of Merit
Identified for RadioGraphics

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Christine O. Menias, MD, Chicago, IL (*Abstract Co-Author*) Royalties, Reed Elsevier
Vincent M. Mellnick, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review the findings in granulomatous diseases with primary focus on the abdomen and pelvis findings. 2. To review these granulomatous disease in 4 broad categories based on their histopathology: Foreign body granuloma, necrotizing granuloma, non-necrotizing granuloma and xanthogranuloma.

TABLE OF CONTENTS/OUTLINE

Outline. Discuss the four broad histopathological categories of granulomas. Diagramatic illustartion of granuloma formation. Imaging finings in Foeign body granuloma: Such as Suture granuloma etc. Imaging findings in Necrotizing granuloma: Such as Granulomatosis with Polyangitis etc. Imaging findings in non-necrotizing granuloma: Such as Syphilis etc. Imaging findings in Xanthogranuloma: Such as Rosai Dorfman disease etc. Summary

NM133-ED-TUB7

Radioisotope Safety Exam: What Every Radiology Resident Needs to Know to Pass the Exam

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NM Community, Learning Center Station #7

Participants
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TEACHING POINTS

-Regulations (training requirements, radiation safety program)-Radiobiology (measurements, radiation effects)-Dose limits (occupational, public, pregnancy)-Radiopharmaceuticals (regulations, transport, written directive, patient release)-Adverse Events (reporting, medical events, spills)-Common real-life challenges

TABLE OF CONTENTS/OUTLINE

-Radiation Physics-Radiation measurement instruments -Radiopharmaceutical administration -Management of radioactive sources-Administrative/practice controls and responsibilities -Radiation safety and protection -Radiation accidents/incidents

NM134-ED-TUB6

Tumor and Tumor-Like Diffuse Peritoneal Diseases on CT and FDG-PET/CT: A Correlation with Pathologic Findings

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NM Community, Learning Center Station #6

Participants
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TEACHING POINTS

Imaging features of peritoneal diseases including primary and secondary tumor and tumor-like lesions frequently overlap, and the radiological diagnosis is thus often difficult. The combination of CT and FDG-PET/CT can provide clues enabling a differential diagnosis in peritoneal diseases. The purpose of this exhibit is to: (1) Review the clinical and pathologic features of peritoneal tumors and tumor-like lesions (2) Demonstrate CT and FDG-PET/CT images of diffuse peritoneal diseases, in a comparison with pathologic findings (3) Describe key features of CT and FDG-PET/CT, which can narrow the differential diagnosis of peritoneal deceases

TABLE OF CONTENTS/OUTLINE

(1) Introduction (2) Overview of peritoneal diseases (3) Primary peritoneal diseases: (a)mesothelioma, (b)peritoneal serous carcinoma (4) Secondary peritoneal diseases: (a) carcinomatosis, (b) pseudomyxoma peritonei (PMP), (c) lymphomatosis, (d) sarcomatosis (gastrointestinal stromal tumor [GIST], leiomyosarcoma) (5) Tumor-like peritoneal diseases: (a) granulomatous peritonitis (tuberculosis, mycobacterium avium complex, histoplasmosis), (b) miscellaneous diseases (splenosis, endometriosis)

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NM216-SD-TUB2

Variable Scintigraphic Presentations of Parathyroid Gland Hyperplasia on Parathyroid Scintigraphy: Results of a Multi-Year Analysis

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NM Community, Learning Center Station #2

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PURPOSE

Scintigraphic imaging using Tc-99m sestamibi is often a routine diagnostic procedure for the preoperative localization of parathyroid adenomas. While the latter appears as an area of focal tracer uptake and retention, parathyroid gland hyperplasia (PGH) often presents as a negative study (i.e., no discrete focal tracer uptake). However, upon follow-up of our scan results, most cases of PGH were not normal scans, with a varying number of tracer foci. Our goal was to determine the various scan findings on all patients referred for parathyroid scintigraphy, who had histologically-proven PGH.

METHOD AND MATERIALS

Our study is both retrospective and prospective. Over a period of 12 years, we reviewed the sestamibi scans of all patients whose pathology report from surgical neck exploration indicated parathyroid gland hyperplasia, as the final histopathological result.

RESULTS

A total of 108 patients were diagnosed as having PGH. Of these, 29 (28.6%) patients had normal scans, 37 patients (34.2%) had one focus of tracer activity (27 of these had persistent tracer retention on the 3-hour delayed images, while 10 showed uptake on the initial images only). 39 patients (36.1%) demonstrated 2 foci of tracer retention. Two patients (1.8%) showed 3 areas of tracer retention, and there was one patient (less than 1%) with 4 foci of tracer retention. The histopathological description of those with 1, 2, and 3 focal areas was 'asymmetric hyperplasia.'

CONCLUSION

On sestamibi parathyroid scintigraphy, PGH has variable scan patterns, depending on the number of hyperplastic glands observed histiologically.

CLINICAL RELEVANCE/APPLICATION

1. A negative sestamibi scan is not the most common scan presentation of parathyroid gland hyperplasia. 2. In our series, 2 areas of sestamibi concentration was the most common scan appearance of parathyroid gland hyperplasia. 3. Two foci of sestamibi uptake on parathyroid scintigraphy does not necessarily indicate a double parathyroid adenoma; 39 patients in our series with this finding had parathyroid hyperplasia.

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NM217-SD-TUB3

Role of a Portable Gammacamera for the Assessment of Margins Involvement after Radioguided Surgery of Pulmonary Nodules

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NM Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate the role of an intraoperative portable gammacamera (PGC) to assess the resection margins of pulmonary nodules.

METHOD AND MATERIALS

We included 29 patients (16 men, 13 women), mean age 65±12 years, referred to Nuclear Medicine Department for the surgical biopsy of a pulmonary nodule with ROLL technique (radioguided occult lesion localization), with a total of 38 nodules. In 30 cases, radioguided surgery was helped with a PGC fitted with an optical view. A radiotracer was injected inside the nodule 2-23 h before surgery. Pulmonary nodules were removed by means of a gamma-probe and a Video-Assisted-Thoracoscopy (VATS) approach. Once removed, the specimen was imaged by a PGC to confirm the presence of the tracer inside the specimen and to assess if the margins were free of involvement. When the activity was in contact with the stitches, it was considered as an involved margin.

RESULTS

The PGC detected 22 lesions centered inside the nodule. In 8 cases the radiotracer was in contact with margins. Pathologic exam revealed free margins in 22/22 cases where the tracer was centered, that means a negative predictive value of 100%. Margins were involved in 1/8 cases in which the tracer was in contact with margins.

CONCLUSION

The assessment of margins with an PGC inside the surgical room could replace the intraoperative pathologic exam and shorten the length of surgery.

CLINICAL RELEVANCE/APPLICATION

The use of a portable gammacamera allows to shorten the length of surgery due to its high negative predictive value (100%) in detecting margins free of involvement.

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NM221-SD-TUB1

Clinical Significance of FDG Uptake by Bone Marrow on the Prognosis of Head and Neck Squamous Cell Carcinoma

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NM Community, Learning Center Station #1

Participants
Sang Mi Lee, Cheonan, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

FDG uptake of bone marrow (BM) on PET/CT is known to be a biomarker that reflects systemic inflammatory response. In patients with various malignant diseases, FDG uptake of BM is known to be associated with clinical outcomes, but, in patients with head and neck squamous cell carcinoma (HNSCC), the clinical significance of FDG uptake of BM has not been evaluated thoroughly. The purpose of this study was to assess the relationship between FDG uptake in the BM on PET/CT and serum inflammatory markers, tumor factors, and survival in patients with HNSCC.

METHOD AND MATERIALS

We retrospectively enrolled 157 HNSCC patients who underwent staging FDG PET/CT and subsequent treatment. On FDG PET/CT, the maximum standardized uptake value (SUV), metabolic tumor volume (MTV), and total lesion glycolysis (TLG) of the primary tumor, the mean FDG uptake of BM (BM SUV) and BM-to-liver uptake ratio (BLR) were measured. The correlations between FDG uptake of BM, serum inflammatory markers and tumor factors were evaluated. The prognostic values of BM SUV and BLR for predicting disease progression-free survival and distant failure-free survival were assessed by using Cox proportional hazards regression model.

RESULTS

The mean follow-up period of the patients was 25.4 months, During follow-up, 48 patients (30.6%) experienced disease progression, including 17 (10.8%) with distant failure. The BM SUV and BLR showed positive correlations with serum C-reactive protein level, neutrophil-to-lymphocyte ratio, tumor size, tumor stage, and maximum SUV, MTV, and TLG of the primary tumor. In multivariate analysis, BLR was significantly associated with disease progression-free survival along with TNM stage and maximum SUV of the primary tumor. For distant failure-free survival, TNM stage, tumor size, maximum SUV, MTV, and TLG of the primary tumor, and BLR showed prognostic significance on univariate analysis. However, all of the variables failed to show significance on multivariate analysis.

CONCLUSION

FDG uptake of BM in HNSCC patients was an independent predictor for disease progression-free survival and had significant association with stage and metabolic parameters of the tumor.

CLINICAL RELEVANCE/APPLICATION

In patients with HNSCC, FDG uptake of BM on PET/CT can be used as an imaging biomarker that reflects the degree of systemic inflammatory response and the risk of disease progression.

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NM242-SD-TUB4

Effects of New Block Sequential Regularized Expectation Maximization (BSREM) Reconstruction Algorithm on Visualization and Quantification of Small Abdominal Malignant Tumors in FDG PET-CT Examinations

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NM Community, Learning Center Station #4

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PURPOSE

BSREM reconstruction algorithm, or so called 'Q. Clear', was recently introduced to improve image quality and quantification in PET examinations. The purpose of this study was to evaluate the effects of this new algorithm on visualization and quantification of small abdominal malignant tumors in FDG PET-CT examinations, comparing the results to those by an ordered subset expectation maximization (OSEM) reconstruction algorithm.

METHOD AND MATERIALS

This study included 60 abdominal malignant (36 liver metastatic and 24 pancreatic cancer) lesions <1.5 cm in greatest diameter. FDG PET-CT images were acquired with a GE Discovery 710 scanner equipped with a time-of-flight system. Images were reconstructed using BSREM beta 700 and OSEM (subset 8, iteration 3, and Gaussian filter 4mm; regular setting in our hospital) algorithms. Visual image quality of each lesion was evaluated with a 4-point scale (1=poor, 2=fair, 3=good, and 4=excellent). SUVmax was obtained for quantitative metrics. Visual score and quantitative metrics were compared between BSREM and OSEM images. Tumor margin was delineated with SUVmax 2.5 threshold. Statistical analysis was performed with a Wilcoxon signed-rank test and a Spearman's correlation method.

RESULTS

Visual scores were 2.7+/-0.98 and 3.1+/-0.87 (mean+/-SD) in OSEM and BSREM, respectively. The score in BSREM was significantly higher than that in OSEM ($p < 0.001$). Increase in visual score was observed in 20 (33%) of all 60 lesions (11: 2 in OSEM to 3 in BSREM, 1: 2 to 4, 5: 3 to 4). SUVmax were 4.3+/-2.4 and 4.5+/-2.4 in OSEM and BSREM, respectively. SUVmax in BSREM was significantly higher than that in OSEM ($p < 0.05$) (5.7% increase with BSREM). Increase in visual score was negatively correlated with [score in OSEM] or [SUVmax in OSEM] ($|Rho| = 0.44$-0.48, $p < 0.001$), and was positively with [%increase of SUVmax with BSREM] ($Rho = 0.51$, $p < 0.001$).

CONCLUSION

This study demonstrated that BSREM improved visual image quality and SUVmax in small abdominal malignant tumors. The effect of BSREM was more prominent in lesions with low image quality or low SUVmax in OSEM.

CLINICAL RELEVANCE/APPLICATION

BSREM improved visual image quality and SUVmax in small abdominal malignant tumors, especially when the lesions represented low image quality or low SUVmax in OSEM.

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NM243-SD-TUB5

Qualitative [18F] FDG PET/MRI Assessment of Hypometabolism Patterns in Suspected Corticobasal Degeneration Syndromes

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NM Community, Learning Center Station #5

Participants
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PURPOSE

Corticobasal degeneration (CBD) is a rare neurodegenerative dementia that classically involves the parietofrontal cortex, basal ganglia, and thalami in addition to the primary sensorimotor cortex, typically in an asymmetric pattern. We aim to demonstrate lobar-specific patterns of CBD and their respective metabolic and volumetric abnormalities.

METHOD AND MATERIALS

74 patients (41 female, 33 male, mean age 70) with suspected neurodegenerative disease underwent hybrid FDG PET/MR brain imaging. Patients were categorized by dementia subtype into Alzheimer's, Frontotemporal, Lewy Body and CBD. NeuroQuant software was used for assessment of intracranial volumetric information compared to normal age-matched controls. MIM software provided semi-quantitative Z-score analysis of abnormal areas of hypometabolism compared to age-matched controls. Metabolic and volumetric data of each hemisphere was then compared to assess for symmetric or asymmetric involvement of regions of interest.

RESULTS

7 of 74 patients had cognitive impairment with clinical signs and symptoms as well as imaging patterns suggestive of CBD. 6 out of 7 had asymmetric FDG uptake. Most subjects with asymmetric patterns (83%) had sensorimotor cortex volumes in the <5th percentile for age. Regions involved include the pre/postcentral gyri, ipsilateral thalami, and basal ganglia. In patients with asymmetry, precentral gyrus mean Z scores in the affected and unaffected sides were -2.7 and 0.18, respectively ($p = .002$). The postcentral gyrus had mean Z scores of -2.2 and 0.150 in the affected and unaffected sides, respectively. One patient demonstrated symmetrically decreased metabolism within the precentral gyrus (Z-scores of -1.88 and -1.69 on the left and right, respectively) and postcentral gyrus (Z-scores of -1.66 and -1.90 on the left and right, respectively).

CONCLUSION

CBD demonstrates decreased volume and metabolism in one of two patterns. The first being marked asymmetric hypometabolism and volume loss of the parietofrontal cortex, sensorimotor cortex, ipsilateral subcortical structures, and the thalamus and basal ganglia. The second more atypical pattern is bilateral hypometabolism most pronounced in the sensorimotor cortex.

CLINICAL RELEVANCE/APPLICATION

This study addresses the knowledge gap in assessment of metabolic/volumetric abnormalities in cognitively impaired patients with movement disorders and suspected CBD syndrome undergoing FDG PET/MRI imaging.

NR347-ED-TUB10

Interpretation of CT Perfusion in Acute Ischemic Stroke: A Practical Guide

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #10

Awards
Cum Laude

Participants
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TEACHING POINTS

The purpose of this exhibit is to: • Review CT perfusion (CTP) acquisition parameters, related physiology and source data processing to obtain perfusion parameters and maps. • Provide a step-by-step guide to CTP quality assurance and troubleshooting to ensure study quality and avoid technical pitfalls. • Illustrate the qualitative and quantitative interpretation of CTP for acute ischemic stroke. • Demonstrate perfusion abnormalities in alternative diagnoses such as stroke mimics, proximal arterial stenosis, chronic infarcts, and cerebral hyperperfusion. CTP shortcomings and diagnostic pitfalls in such settings will be highlighted.

TABLE OF CONTENTS/OUTLINE

The availability of automated CTP post-processing software has lowered barriers for incorporating this computationally complex technique into standard stroke triage workflow, particularly for patients presenting late in the therapeutic window. Thus, there is an increasing need for radiologists to be familiar with its usage and interpretation. Outline: • CTP acquisition parameters • Perfusion parameters in relation to cerebral perfusion physiology • CTP source data processing • Step-by-step guide to quality assurance and troubleshooting • Interpretation of acute ischemic stroke: qualitative and quantitative methods • Case-based illustrations of alternative diagnoses and diagnostic pitfalls.

NR348-ED-TUB11

Artificial Intelligence and Stroke Imaging: Past, Present, and Future

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #11

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS

Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL) are evolving tools that will be increasingly used in stroke imaging, both from a clinical and research perspective. The purpose of this exhibit is: To discuss the differences between AI, ML, and DL as well as their strengths and limitations To summarize the current landscape of AI driven applications for stroke assessment To examine developing tools and methods for stroke evaluation, including tools for triage, quantification, surveillance, and prediction.

TABLE OF CONTENTS/OUTLINE

Background: Purpose of the summary Artificial intelligence, Machine Learning, and Deep Learning - what is what? Applications for Intracranial Hemorrhagic Stroke Applications for Ischemic Stroke Advantages and Limitations of AI Conclusion

NR349-ED-TUB12

Unperplexing the Brachial Plexus

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #12

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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TEACHING POINTS

The brachial plexus is an intricate network innervating the upper extremity, shoulder, and upper chest. Although commonly depicted on routine imaging, the brachial plexus can be challenging for the radiologist to assess due to its convoluted course and often subtle findings. Although diagnosis of brachial plexus lesions is mostly based on patient history, physical examination, and electrophysiologic testing, imaging plays an important role in lesion localization and impacts management. The aim of this educational exhibit is to provide a simplified, image-rich review of the brachial plexus, with emphasis on multimodality comparison including CT, ultrasound, and MRI. Both the normal appearance and most common pathologies will be reviewed.

TABLE OF CONTENTS/OUTLINE

Brachial plexus, review of basics Normal anatomy Clinical presentation / syndromes Diagnostic evaluation Brachial plexus, imaging appearance US CT MRI Brachial plexopathies, traumatic Spectrum of injury Newborn (obstetric) Adults Brachial plexopathies, non-traumatic Post-radiation Tumor Acute brachial neuritis

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NR379-SD-TUB1

Increased Resting State Synchronization within the Motor Cortex following Post-Stroke Rehabilitation

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #1

Participants
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PURPOSE

Stroke affects greater than 700,000 individuals in the U.S. each year. Two-thirds of stroke victims survive the initial insult and require rehabilitation to improve quality of life. While rehabilitation has been shown to improve motor outcomes, there is a paucity of literature describing the neurobiological basis for improvement. We sought to use resting state functional magnetic resonance imaging (rsfMRI) to investigate this question.

METHOD AND MATERIALS

Sixteen patients (thirteen female) who suffered a stroke underwent MRI both pre-rehabilitation and post-rehabilitation (mean follow-up of 2.3 months). Rehabilitation sessions lasted between 50 and 65 minutes and occurred two to three times per week for four to six weeks. Subjects performed task-related training activities (TRT) at varied locations across the workspace using the paretic upper-limb for approximately 200 reaching and grasping tasks. Scans were taken in a 3T Siemens MR scanner, including rsfMRI (TR=2000ms, TE=30ms, flip angle=90 degrees, spatial resolution=3.6×3.6×5.0mm). Images were preprocessed for correction of spatial and temporal artifacts. Regions of interest (ROIs) were defined using the Harvard-Oxford atlas. Resting state functional connectivity (RSFC) was calculated using the MatLab-based CONN toolbox. Significant RSFC differences among post-stroke patients both before and after rehabilitation were evaluated with an ROI-to-voxel analysis (FDR-corrected $p<0.05$).

RESULTS

Compared to post-stroke pre-rehabilitation scans, rehabilitation led to increased RSFC between the primary motor cortex and its connections to other cortical areas responsible for motor activity, including the superior frontal gyrus, middle frontal gyrus and inferior frontal gyrus ($p=0.002$) (Figure 1).

CONCLUSION

Connectivity within the motor cortex has been hypothesized to be affected in stroke, but the influence of post-stroke rehabilitation on connectivity in this system has not previously been studied. Our results demonstrate that rehabilitation improves connectivity among cortical structures responsible for motor function, providing the neurobiological basis for clinical improvement.

CLINICAL RELEVANCE/APPLICATION

Resting state functional MRI (rsfMRI) can be used as an objective biomarker to track improvement in motor function following stroke.

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NR380-SD-TUB2

The Impact of Injection Protocol on Blood Flow Calculations in 4D-DSA

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #2

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PURPOSE

During an intra-arterial injection of contrast medium there is an increase in total flow at the injection site. Measurements of blood flow downstream from the injection site will reflect this increased flow. Our purpose was to determine how baseline flow is altered by the injection protocol and to quantify the change as a function of injection rate (IR).

METHOD AND MATERIALS

A 3D printed patient specific model consisting of the internal carotid artery (ICA) and other distal arteries was connected to a closed-loop flow system driven by a positive displacement pulsatile pump (5.5 L/min, 60 beats/min). The system was configured to deliver 260 cc/min total flow to the model. A mixture of 60% glycerol and 40% distilled water was used as the working fluid. Contrast (Isovue 370 mg I/cc, 75% dilution) was injected through a 6F catheter positioned upstream from the ICA using a power injector. Two repeated 4D-DSA acquisitions (11.5 s, 304 projections) were performed for each of the following IRs: 1.5, 2.0, 2.5, 3.0 and 3.5 cc/sec for 8 seconds. Blood flow deviation from baseline flow (260 cc/min) for the ICA region of the phantom (diameter = 4.96 mm) was calculated with a validated in-house algorithm as a function of IR. The flow measurement algorithm calculated blood velocity by analyzing the temporal progression of image contrast as it moved along the vessel centerline. The calculated velocity was then multiplied by vessel lumen area to obtain flow.

RESULTS

The 1.5 cc/sec injection acquisitions were excluded from analysis as the images were unusable due to contrast streamlining. An IR of 2.0 cc/sec increased flow by 10% over baseline. An IR of 3.5 cc/sec increased flow by over 75% relative to baseline. In a separate phantom validation study of the flow measurement algorithm, 4D-DSA derived flow agreed with flow probe measurements to within 3% +/- 4% (mean difference +/- standard deviation).

CONCLUSION

The difference between 4D-DSA derived flow and baseline flow was calculated for a range of IRs. In this study the power injection of contrast medium at IRs above 2.0 cc/sec significantly altered the measured flow from baseline flow.

CLINICAL RELEVANCE/APPLICATION

The clinical utility of 4D-DSA is enhanced by accurate and reproducible flow quantification. Understanding the deviations caused by an injection protocol is important to ensure this.

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NR381-SD-TUB3

The Comprehensive Analysis of 4D Flow MRI Can Detect Cerebral Hemodynamic Impairment in the Patients with Internal Carotid Artery Stenotic Disease

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #3

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PURPOSE

To assess if the comprehensive assessment of time-resolved 3D phase-contrast (4D Flow) MRI could detect hemodynamic impairment in the patients with internal carotid artery stenosis (ICS) by comparing to single photon emission computed tomography (SPECT) date with acetazolamide challenge

METHOD AND MATERIALS

26 consecutive patients with unilateral ICS who underwent both 4D Flow MRI and an N-isopropyl-p-(123I)-iodoamphetamine (IMP) SPECT with acetazolamide challenge were recruited. 4D Flow MRI was performed using a 3.0-T MRI unit (Achieva; Philips Healthcare, Best, The Netherlands). The parameters were as follows: TR/TE 8.4/5.4 ms; velocity encoding (VENC) 100 cm/s (VENC range, 200cm/sec), 15 heart phase, voxel size 0.82×0.82×1.4mm3. The hemodynamic information regarding collateral flow via Willis ring and temporal mean flow volume rate (Net ml/sec) the pulsation such as pulsatile flow volume (ΔV ml), pulsatility index (PI) and resistance index (RI) were measured based on 4D Flow MRI by using GTFlow software (version 3.1.0, GyroTools, Zurich, Switzerland). The signal intensity (SI) of the MCA on time-of-flight (TOF)-MRA was measured and the ratio of affected side to contralateral side was calculated. The SI was also evaluated visually by using 4-point scale. Cerebral blood flow (CBF) was measured using the autoradiography method in SPECT study. From the CBF, the cerebral vascular reserve in the affected-side MCA territory (CVR) was calculated. The hemodynamic impairment (misery perfusion) were defined based on the previous large cohort study (CVR<10%).

RESULTS

Affected side ΔV, the ratio of affected side Net, ΔV to contralateral side Net, ΔV (rNet, rΔV) and MRA (qualitative assessment) significantly correlated to CVR (r=0.430, p=0.030; r=0.504, p=0.010; r=0.471, r=0.430, p=0.028, respectively). The absence of retrograde flow at Pcom was significantly observed in misery perfusion group (p=0.020). The combining cut-off values using affected side ΔV (cut-off value, 0.18 ml) and rNet, (cut-off value, 0.643) serve good diagnostic accuracy (Sensitivity 100%, specificity 77.8%).

CONCLUSION

4D Flow MRI can clearly detect misery perfusion by the comprehensive assessment of various blood flow information including blood flow volume, pulsation and the collateral flow.

CLINICAL RELEVANCE/APPLICATION

4D Flow MRI can detect hemodynamic impairment by measuring various blood flow information including blood flow volume, pulsation and the collateral flow.

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NR424-SD-TUB4

MR Fingerprinting Evaluation for the Early Changes of Relaxation Time in the Brain Tumor and Surrounding White Matter After Stereotactic Radiotherapy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #4

FDA Discussions may include off-label uses.

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PURPOSE

MR fingerprinting (MRF) is a newly developed quantitative method. MRF can provide the datasets of the voxels including T1 and T2 relaxation time simultaneously, which enables quantitative evaluation of tissue in the combination of T1 and T2 relaxation time. Stereotactic radiotherapy (SRT) can reduce the dose of the area outside of tumor, however, small dose of radiation is loaded also in the surrounding white matter. In most cases, the early changes in surrounding white matter are so slight that the alterations in the tissue are difficult to be observed. In the current study, we quantitatively evaluate the early changes in the tissues after SRT including tumor, peritumor area and surrounding white matter by using MRF for the evaluation of the T1 and T2 relaxation time.

METHOD AND MATERIALS

Twelve SRT cases of metastatic brain tumors are enrolled. T1 and T2 relaxation time were quantified by using prototype FISP-MRF on 3T scanner (MAGNETOM Skyra, Siemens) before and within a month after SRT. The sets of T1 and T2 relaxation time were obtained from tumor area (Dose: 25-62Gy), peritumor area (6-23Gy) and surrounding white matter (1-4Gy). Discriminant analysis were made and the Mahalanobis' distance (MD: statistical distance between distributions in multivariate space) of the sets of T1 and T2 relaxation time between pre and post radiation were evaluated, and also correlated with the duration after the start of SRT.

RESULTS

The mean MD between pre and post radiation were 0.77 for the tumor area, 0.81 for the peritumor area and 0.17 for the surrounding white matter. The correlation ratios between the duration after the start of radiotherapy and MD were 0.40 for the tumor area, 0.21 for the peritumor area and 0.53 for the surrounding white matter.

CONCLUSION

MRF could delineate the early changes in the relaxation time after stereotactic radiotherapy quantitatively. The discriminant analysis indicated that the relaxation time alters not only in the tumor or peritumor area but also in the surrounding white matter with low dose radiation. The correlation between the alteration of the relaxation time and the duration after radiation was also indicated.

CLINICAL RELEVANCE/APPLICATION

The measurement of the relaxation time by using MRF could be applied for the evaluation of the influence to the surrounding white matter of the tumor in the cases of stereotactic radiotherapy.

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NR425-SD-TUB5

Evaluation of White Matter Changes in Traumatic Brain Injury Using Track Density Imaging and Fractional Anisotropy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #5

FDA Discussions may include off-label uses.

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PURPOSE

To evaluate changes in the white matter following traumatic brain injury (TBI) using track density imaging (TDI) in constrained spherical convolution (CSD) and fractional anisotropy (FA). Additionally, we aimed to assess the sensitivity of TDI compared to FA for evaluating white matter changes following TBI.

METHOD AND MATERIALS

Diffusion tensor imaging (DTI) data were acquired from 5 healthy subjects and 6 TBI patients on a 3T (Philips, Achieva) MRI scanner. All images were preprocessed for motion and eddy current distortion. Whole brain tractography was performed using the MRtrix software package (https://www.mrtrix.org/) based on probabilistic tractography combined with the CSD. Streamlines were computed using the iFOD2 algorithm and filtered with the SIFT algorithm in the MRtrix package. Each tracogram was composed 5x106 streamlines. Tractograms were converted to track density maps with a 1 mm grid. DT fits were performed and FA maps were spatially normalized using the tract-based spatial statistic (TBSS) in FSL (https://www.fmrib.ox.ac.uk/fsl/). Track density maps and skeletonized FA maps were transformed to the average FA template in FSL using affine registration. Mean values of track density and skeletonized FA were extracted for 48 brain regions using Johns Hopkins University (JHU) white matter atlas. Statistical analysis was performed with independent sample t-test in SPSS (version 24).

RESULTS

There were significant differences in track density of the body of the fornix, right and left cerebral peduncles, right and left posterior limb of internal capsule, right external capsule and left fornix stria terminalis. However, FA showed significant differences in the body of the fornix only.

CONCLUSION

Our study shows that patients with TBI have multiple regions with reduced track density in the body of the fornix, right and left cerebral peduncles, right and left posterior limb of internal capsule, right external capsule and left fornix stria terminalis. However, FA reduced only in the body of the fornix in TBI patients. Our finding suggested that TDI can be more sensitive than skeletonized FA in detecting white matter changes following TBI quantitatively.

CLINICAL RELEVANCE/APPLICATION

TDI measurement, track density may be more sensitive than DTI metrics such as FA to detect white matter changes following TBI that can be useful for TBI research and improving our understanding of disease progression and treatments.

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NR426-SD-TUB6

Radio-Proteo-Genomic Differences in IDH1 Mutant versus Wild-Type Gliomas

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #6

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PURPOSE

To glean new clinical- and biological insights into the genetically-bifurcated IDH1 mutant (mt) vs. wildtype (wt) forms of glioma, we integrated multiplexed immunofluorescence single cell data, RNA expression, genomic sequencing and MRI, with clinical variables.

METHOD AND MATERIALS

We included 20 treatment-naïve gliomas (grades 2, 3, and 4) and 16 post-treatment recurrent glioblastoma (grade 4) subjects. Tissue microarrays underwent multiplex immunofluorescence staining using 43 markers. Molecular and spatial cellular heterogeneity measures were assessed using protein biomarker intensities evaluated at the nuclei and single cell levels. Whole-exome and tumor RNA-sequencing data was generated from bulk tissue samples. An expert neuroradiologist outlined the entire tumor, while a U-Net deep learning model (trained on the Brain Tumor Segmentation challenge data) delineated the enhancing and necrotic cores. The peritumoral edema region was obtained by subtracting the two cores from the whole tumor. We extracted first-order statistic features from T1 weighted post contrast MRI, ADC and FLAIR Images.

RESULTS

When investigating multimodal associations, we observed a consistent trend irrespective of prior treatment and tumor grade. IDH1 mutations were found in lower grade tumors, younger patients and had better overall survival. Also, IDH1mt tumors had smaller enhancing cores but more contrast uptake in the peritumoral edema regions and showed reduced expression levels of RNA and proteins representing the Inducing Angiogenesis hallmark. IDH1wt patients had larger enhancing cores but less contrast uptake in the peritumoral edema regions.

CONCLUSION

IDHmt tumors are poorly vascularized as a consequence of lower gene and protein expression of angiogenesis hallmarks and this is evident in MR imaging. Molecular and spatial heterogeneity scores, RNA and protein expression levels for angiogenesis differ between IDH mutant and wild type gliomas irrespective of prior treatment and tumor grade; these differences also persisted on MRI.

CLINICAL RELEVANCE/APPLICATION

Our study seeks to reveal correlations between MRI features, protein/RNA expression levels and spatial cellular heterogeneity to understand the mechanism of disease progression in relation to IDH1 mutational status in glioma. Such understanding may enable us to create predictive models on MRI of disease progression or treatment response without the need for an invasive biopsy.

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NR427-SD-TUB7

MRI Biomarkers Improve Disease Progression Modeling-Based Prediction of Cognitive Decline

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #7

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To investigate if volumetric MRI biomarkers help across both parametric and nonparametric Alzheimer's disease (AD) progression modeling using neuropsychological tests for decline prediction of mini-mental state examination (MMSE) score in converting and stable mild cognitive impairment (MCI) subjects.

METHOD AND MATERIALS

The study dataset consisted of yearly visits (2005-2016) for 372 Alzheimer's Disease Neuroimaging Initiative subjects with normal cognition, MCI, and AD, including the following measurements: FreeSurfer-based T1-weighted brain MRI volumes of ventricles, hippocampus, whole brain, fusiform, middle temporal gyrus, and entorhinal cortex, all normalized with intracranial volume, and cognitive tests of MMSE, CDR-SB, and ADAS-Cog. Two state-of-the-art disease progression modeling methods, a nonparametric [DOI:10.1016/j.media.2019.01.004] and a parametric [DOI:10.1016/j.neurobiolaging.2014.03.043], were trained on the data with and without MRI biomarkers using 336 subjects and were subsequently applied to predict month 24 to 60 MMSE scores for 36 independent test subjects based on only their baseline and month 12 visits.

RESULTS

The predictive power and prognostic capability of the AD progression modeling methods were assessed using the per-visit mean absolute error (MAE) and area under the ROC curve (AUC) of predicted MMSE scores for stable (MCI-to-MCI) and converting (MCI-to-AD) test subjects. The MAE results for month 24 to 60 were as follows: parametric-MRI 1.23 to 4.41 (stable), 1.54 to 11.57 (converting); parametric+MRI 1.09 to 4.39 (stable), 1.72 to 10.98 (converting); nonparametric-MRI 0.93 to 5.27 (stable), 1.62 to 8.28 (converting); nonparametric+MRI 0.23 to 0.46 (stable), 1.63 to 6.79 (converting). The AUC results for month 24 to 60 were as follows ($p < 0.01$): parametric-MRI 0.90 for all visits; parametric+MRI 0.89 to 0.91; nonparametric-MRI 0.86 to 0.89; nonparametric+MRI 0.85 to 0.95.

CONCLUSION

MRI measurements improve neuropsychological assessment-based disease progression modeling performance of both parametric and non-parametric methods in MMSE decline prediction. Predictions from both utilized methods can significantly discriminate between stable MCI and MCI converting to AD.

CLINICAL RELEVANCE/APPLICATION

Neuropsychological test-based disease progression modeling benefits from including volumetric MRI measurements. These types of models can be applied to predict cognitive decline and clinical status.

NR428-SD-TUB8

Sound the Alarm: The Dramatic Rise in CT Head Angiography Performed for Stroke in the Emergency Department

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #8

Participants
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PURPOSE

The purpose of this study it to examine the averall utilization trend in head CT angiography (CTA) studies performed before and after presentation of the DAWN trial in May and November 2017 as well as in the Emergency Department during the same time period.

METHOD AND MATERIALS

The total number of head CTAs performed at a tertiary care hospital were collected from January 2011 to January 2019. The average number of studies ordered per month prior to public presentation of the DAWN trial results at the ESOC in May 2017 were calculated (January 2011 to May 2017) and were compared to the average number of studies performed after the presentation of the DAWN trial (June 2017 to January 2019). The average number of head CTAs performed in the ED was also calculated for the same time frame. This data was compared to the number of ED stroke alerts for May to October 2017 and 2018.

RESULTS

The average number of head CTAs increased 1.9x from 79 scans/month to 147 scans/month in the nineteen months following initial presentation of the results of the DAWN trial in May 2017. During the same time interval, the number of head CTAs performed in the ED increased from and average of 10 scans/month to 35 scans/month, representing an overall increase of 3.5x.

CONCLUSION

After public presentation of the results of the DAWN trial, the overall rate of head CTAs and the rate of those performed in the ED increased 1.9-fold and 3.5-fold respectively. This increase in ED CTAs mirrors the increase in ED stroke alerts. This has resulted in increased utilization, increased radiation exposure, increased cost to payers and patients, increased scanner and increased time spent on post processing. ED head CTAs are time sensitive and this may affect radiologist workload.

CLINICAL RELEVANCE/APPLICATION

Since the presentation of the DAWN trial, there has been increased overall utilization of head CTAs, including a profound rise in the number of ED head CTAs. The need for creation, implementation, and adherece to best practice guidelines in EDs is paramount to manage increase imaging utilization and the increase in time sensitive workload demands on radiologists.

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NR429-SD-TUB9

New Non-Contrast Brain CT Reconstructions Could Help in Better Characterize Final Infarct Volume and Improve Patient Management in Acute Anterior Ischemic Stroke

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NR Community, Learning Center Station #9

Participants
Brieg Dissaux, MD, Brest, France (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate whether new iterative methods like model-based iterative reconstruction (MBIR) which have been reported to provide better image quality than filter back projection (FBP) could improve detectability of acute ischemic infarction for anterior ischemic stroke on non-contrast brain CT (NCCT).

METHOD AND MATERIALS

From April 2018 to Mars 2019, 422 patients underwent a NCCT with an MBIR and FBP reconstructions. 116 have been diagnosed for an anterior ischemic stroke and had an imaging control within 7 days (MRI or CT). Two experienced radiologist assessed ASPECT score for each reconstruction of each patient. Final ASPECT score was calculated by an other radiologist with imaging control.

RESULTS

The sensitivity of NCCT with MBIR and FBP reconstructions for the diagnostic accuracy of infarct lesions in acute ischemic stroke is evaluated using final ASPECT score as a reference standard. Interobserver reproductibility of MBIR versus FBP reconstructions was also calculated.

CONCLUSION

The present study showed improved detectability of ischemic infarct using MBIR rather than FBP reconstructions for acute anterior ischemic stroke.

CLINICAL RELEVANCE/APPLICATION

New iterative methods like model-based iterative reconstruction (MBIR) may help in better caracterise final infarct volume and improve patient management.

OB181-ED-TUB1

Nodules and Thickening of Uterosacral Ligament: An Underdiagnosed Feature of Deep Endometriosis (DE) on Endovaginal Sonography

Tuesday, Dec. 3 12:45PM - 1:15PM Room: OB Community, Learning Center Station #1

Awards
Cum Laude

Participants
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Nirvikar Dahiya, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

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TEACHING POINTS

1. Endometriosis is a benign condition with significant morbidity, including pain and infertility, affecting 6 to 10% of women during the reproductive period 2. A tailored transvaginal exam to identify deep endometriosis must include the assessment of the torus uterinus (posterior aspect of the cervix, close to the junction of the cervix and uterine body, where the uterosacral ligaments attach, forming a ridge) 3. Plaque like areas of thickening can be seen extending along the uterosacral ligaments. The finding is subtle but definitive for DE. Multiple illustrations and images will be displayed in the exhibit to enable learning with pattern recognition.

TABLE OF CONTENTS/OUTLINE

1. Introduction and Historical perspective of DE 2. Illustrative discussion of anatomy of the region with corresponding sonographic images. 3. Technique of endovaginal exam tailored to detect DE. 4. Brief synopsis of areas where DE can occur and representative images 5. Pictorial review of cases with findings of uterosacral disease with MR correlation. 6. A discussion of potential pitfalls. 7. Conclusions.

OB182-ED-TUB2

Mastering Complex Müllerian Duct Anomalies

Tuesday, Dec. 3 12:45PM - 1:15PM Room: OB Community, Learning Center Station #2

Participants
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Susan M. Ascher, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Shuchi K. Rodgers, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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Jessica B. Robbins, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Understand the embryologic development of the female reproductive tract. 2. Develop a universal framework for describing complex Müllerian duct anomalies (MDA). 3. Recognize complex MDA in a variety of imaging contexts. 4. Understand treatment options in patients with complex MDA.

TABLE OF CONTENTS/OUTLINE

A. Pathogenesis of anomalies of the female reproductive tract a. Impairment in development, fusion, or septal reabsorption of Müllerian ducts b. Clinical presentation includes amenorrhea, infertility, pain, sub- and infertility, poor obstetric outcomes B. Review imaging diagnosis of MDA a. Incidental detection on routine imaging (ultrasound) or workup of female infertility (hysterosalpingogram, hysterosonogram) b. Minimize errors in US diagnosis, next steps in evaluation c. Confirmation of suspected MDA, role of pelvic MRI and coronal 3D US C. Describe a systematic framework to describe complex MDA a. Overlap of traditional categories b. Universal context to describe MDA for successful communication with referring physicians D. Imaging appearance of anatomic variants and pathology commonly concomitant with MDA E. Surgical management a. Indications for treatment: symptom relief, improved fertility, reduction in maternal morbidity/mortality b. Specific features of MDA that are important to describe to referring surgeon

PD179-ED-TUB6

A Case-based Review of Pancreatic Lesions in Children

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PD Community, Learning Center Station #6

Awards
Certificate of Merit

Participants
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Sarah S. Milla, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
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Edward J. Richer, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The prevalence and type of pancreatic neoplasms in the pediatric population varies largely with age, resulting in an age-based differential diagnosis. Based on specific imaging characteristics, the differential diagnosis can be further narrowed. Therefore, understanding a variety of pediatric pancreatic lesions is essential to forming an accurate differential diagnosis and interpretations critical in providing optimal care to patients. At the end of this presentation, participants will be able to: Identify and discriminate between various types of pediatric pancreatic lesions. Describe characteristic imaging features of various pancreatic lesions. Discuss the differential diagnosis for pancreatic lesions in children. Recognize predisposing syndromes that will help narrow diagnosis.

TABLE OF CONTENTS/OUTLINE

The exhibit will: • Illustrate specific imaging features of pancreatic lesions in children. Some of the pathologies we will discuss will include Rhabdomyosarcoma, Lymphoma, Metastases, Solid pseudopapillary epithelial neoplasm, Neuro-endocrine tumors, Hematoma, Pancreatic cyst/pancreatoblastoma. • Review differentiating characteristics of various lesions. • Discuss best practices for imaging of these lesions to optimize efficient accurate diagnosis. • Address relevant management as applicable to the Radiologist to appropriately direct management.

PD180-ED-TUB7

Spectrum of Imaging Findings in Neonatal Chikungunya Encephalitis

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PD Community, Learning Center Station #7

Participants
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Kanika Gupta, MD, Chennai, India (*Abstract Co-Author*) Nothing to Disclose
Tushar Chandra, MD, Orlando, FL (*Presenter*) Nothing to Disclose

TEACHING POINTS

1. Chikungunya virus can spread by vertical transmission from mother to fetus 2. Encephalitis is the most common presentation in chikungunya infected neonates 3. Neuroimaging with MRI is important to assess for the exent of involvement and progonstication 4. Diffusion imaging is the key and demonstrates restricted diffusion involving deep gray matter as well as the white matter in a symmetric distribution 5. Diffusion changes precede findings on T2 and FLAIR images and resolve earlier. Diffusion changes in the neonatal period co-relate with prognosis in individual cases 6. Imaging differential diagnosis includes other causes of neonatal encephalopathy. Of the infective causes, west nile virus encephalitis can look similar on MRI 7. Follow up imaging after months/years shows cerbral parenchymal volume loss and ex-vacuo dilatation of ventricles

TABLE OF CONTENTS/OUTLINE

1. Epidemiology and Clinical presentation of neonates with chikungunya encephalitis 2. Mechanism of transmission of the virus - vertical transmission 3. Diagnostic tools - CSF analysis, blood picture and imaging 4. Role of Imaging modalities: cranial US, CT and MRI 5. Spectrum of Imaging findings in the neonatal period 6. Role of follow up imaging 7. Imaging differential diagnosis 8. Conclusion

PD216-SD-TUB2

Contrast-Enhanced Ultrasound-Guided Biopsy in Children: Pathologic Evaluation of Biopsy Specimens

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PD Community, Learning Center Station #2

Participants
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PURPOSE

The purpose of the study was to assess the usefulness of contrast-enhanced ultrasound (CEUS)-guided biopsy in children by pathological evaluation of biopsy specimens.

METHOD AND MATERIALS

From July 2017 to February 2019, all children who underwent a CEUS-guided biopsy for pathologic diagnosis were included in this study. All the specimens were obtained from the enhancing solid area on CEUS. Biopsy specimens were reviewed by one board-certified pathologist and the following tissue proportions were analyzed for the total tissue area; viable tumor cell proportion (%), stromal component (%), necrotic area (%), and lymphovascular density (%). If the CEUS-guided biopsy was a repeat biopsy after a conventional US-guided biopsy, the biopsy specimens of conventional US-guided biopsy were also analyzed in the same manner.

RESULTS

Six consecutive children (4 boys and 2 girls, median age 7yrs and range 3~18yrs) received CEUS-guided biopsy. Pathologic diagnoses were lymphoma (n=2), Wilms tumor (n=1), embryonal rhabdomyosarcoma (n=1), Ewing sarcoma (n=1) and uncertain type of carcinoma (n=1). Three of them underwent CEUS-guided biopsy only, while the remaining three received CEUS-guided biopsy as a repeat biopsy after conventional US-guided biopsy. The median viable tumor cell proportion was 67.7% (inter-quartile range (IQR) 13.75~95). The median stromal and necrotic areas were 20.4% (IQR 0~26.25) and 11.9% (IQR 0~30), respectively and the lymphovascular density was 12.3% (IQR 3~13) on specimens obtained by CEUS-guided biopsy. The specimens obtained by conventional US-guided biopsy revealed a median viable tumor cell proportion of 3.3%, a median stromal component of 25%, a median necrotic area of 71.7% and a median lymphovascular density of 1.7%.

CONCLUSION

CEUS-guided biopsy in children yielded a high proportion of viable tumor cells and a low proportion of necrosis on pathologic specimens, which could improve the diagnostic accuracy of US-guided biopsy.

CLINICAL RELEVANCE/APPLICATION

CEUS-guided biopsy in children improve the diagnostic accuracy of US-guided biopsy, especially in tumor with high proportion of necrosis and additional invasive procedures can be prevented in children.

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PD246-SD-TUB4

A Short-Term MRI Study of Acetabular Adaptation in Developmental Dysplasia of the Hip Treated by Open Reduction or Open Reduction Combined with Dega Osteotomy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PD Community, Learning Center Station #4

Participants
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PURPOSE

Patients with developmental dysplasia of the hip(DDH) treated by open reduction (OR)or open reduction combined with Dega osteotomy (ORCWDO) for the hip reconstruction underwent MR examination pre- and post-operation. Our aim is to study hip reconstruction for the patients treated by OR or ORCWDO with MRI and to evaluate MRI diagnostic value and to identify the most favorable clinical treatment between OR and ORCWDO.

METHOD AND MATERIALS

Fifteen patients (16 hips) with DDH treated by OR and 20 patients (21 hips) with DDH treated by ORCWDO underwent MRI analysis of hip joint morphology before and at the short-term follow-up after surgery. The mean age of the two groups was 19.90 months and 23.14 months respectively. The cartilage and osseous acetabular index, the cartilaginous and osseous centre-edge angle were measured before and after the last follow-up. Short-term treatment results were classified according to the Severin image class, with a classification of I/II considered good, and an outcome of III/IV considered poor.

RESULTS

Five hips in the simple OR group obtained satisfactory outcomes and 11 hips had a poor prognosis. In the ORCWDO, 14 hips had a good prognosis while the prognosis was poor in seven hips. The anterior cartilaginous acetabular index (ACAI) after operation was related to the prognosis of simple OR, and a value of ACAI of 40° after operation was found to separate good prognosis from poor prognosis. Postoperative cartilaginous center edge angle(CCE), Osseous center edge angle (OCE), Cartilage acetabular index(CAI), and Osseous acetabular index(OAI) were all correlated with the prognosis of ORCWDO. The critical values were 31°, 20.5°, 9.5° and 18.5° respectively.

CONCLUSION

In terms of acetabular remodeling ability in the treatment of DDH, open reduction combined with Dega osteotomy is a better choice than simple open reduction. When the MRI OAI of patients under 3 years with DDH is greater than 27.5 degrees(differ from 30 degree based on X-RAY measurement standard), open reduction combined with Dega osteotomy should be chosen and its prognosis will be good.

CLINICAL RELEVANCE/APPLICATION

With point-by-point image analyzing, MRI should be performed routinely for the DDH diagnosis and postoperative evaluation on acetabular remodeling ability, combine with the pelvic X-ray once as the only basis of diagnosis.

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PD247-SD-TUB5

Performance of Deep-Learning-Based Algorithm for the Detection of Ileocolic Intussusception on Abdominal Radiography of Young Children

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PD Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To evaluate the performance of deep learning-based algorithm to detect ileocolic intussusception using abdominal radiography in young children.

METHOD AND MATERIALS

Children (<= 5 years old) who underwent abdominal radiography and ultrasonography (US) in the suspicion of intussusception from March 2005 to December 2017 were retrospectively included. They were divided into control and intussusception groups according to the US results confirming presence of ileocolic intussusception. As a training set, their abdominal radiographies were used to develop an YOLOv3-based deep learning algorithm to automatically recognize the rectangular area of the right abdomen (from the right diaphragm to the right iliac crest) in which ileocolic intussusception is commonly observed, and to diagnose the intussusception in the rectangular areas. For the temporally independent validation set, children (<= 5 years old) who underwent both abdominal radiography and US from January to August 2018 in the suspicion of intussusception were included. Diagnostic performances of an algorithm and four radiologists with different experiences were compared using logistic regression with generalized estimating equation.

RESULTS

Total 681 children (439 children in control and 242 children in intussusception groups) were included in the training set and 75 children (50 children in control and 25 children in intussusception groups) were included in the validation set. From the validation set, the sensitivity of algorithm (0.76, 95% confidence interval [CI] 0.56-0.89) was significantly higher compared with radiologists (0.46, 95% CI 0.33-0.6) (p=0.013), while specificities were not significantly different between algorithm (0.96, 95% CI 0.85-0.99) and radiologists (0.92, 95% CI 0.94-0.96) (p=0.32).

CONCLUSION

Deep learning-based algorithm can aid the detection of ileocolic intussusception using abdominal radiography in young children with high sensitivity and comparable specificity.

CLINICAL RELEVANCE/APPLICATION

Ileocolic intussusception is one of the common causes of acute abdomen in young children. For the diagnosis of intussusception, emergency US is required for children when they have cyclic irritability or hematochezia. Therefore, when deep learning-based algorithm could aid the detection of ileocolic intussusception using abdominal radiography in young children, doctors could aid screening children who need emergency US or treatment for intussusception.

PH212-SD-TUB1

CT Radiation Dose in a Developing Nation: Justification, Acquisition, and Reconstruction Issues

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PH Community, Learning Center Station #1

Participants
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PURPOSE

The IAEA-led initiative on CT radiation dose optimization in the Republic of North Macedonia (RNM) uncovered several strengths and challenges. We assessed the CT dose-related issues related to justification, CT acquisition and reconstruction parameters in the RNM.

METHOD AND MATERIALS

With approval of the RNM Radiation Safety Directorate, we collected information pertaining to CT vendors, slice-profiles, acquisition and reconstruction parameters, patients' age and weight, and CT dose descriptors (CTDIvol and DLP) from several institutions located in different parts of the country. An EXCEL template was created for recording the information and sent to all 19 state CT sites. CT technologists filled out the requested information for head, chest, and abdomen-pelvis CT examinations performed for clinically-indicated reasons. Separately, we reviewed clinical indications for CT from an electronic ordering system (MyTerm). Descriptive statistical analyses were performed.

RESULTS

Iterative reconstructions were available on 2/35 CT in the RNM (13/35 were <=16-slice MDCT). Only 5/19 Institutions (26 %) returned the requested dose-related information. Frequently, the referring physicians did not provide relevant clinical indication for ordering CT (i.e. asthma, schizophrenia or weak heart as indications for abdomen-pelvis CT). Although AEC was applied, high image quality requirement and/or thin prospective sections maximized the applied tube current. Most institutions did not have indication-based protocols, and performed 2/3-phase routine chest CT (4/5: CTDIvol >10 mGy) and 3/4-phase routine abdomen-pelvis CT (5/5; CTDIvol > 15 mGy) at 120 or 140 kV. Non-contrast CT series were acquired at equal (3/5 sites) or higher (2/5 sites) radiation doses compared to post-contrast series.

CONCLUSION

Despite regulatory intervention collection of CT dose related information was not successful in RNM. We discovered serious issues related to inadequate clinical information and/or overuse of multiphase CT across all surveyed institutions.

CLINICAL RELEVANCE/APPLICATION

Developing nations face serious challenges to CT dose optimization without a strict regulatory oversight, robust order entry and dose monitoring software.

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PH213-SD-TUB2

Can We Estimate Metabolic Risk on Low-Dose Chest CT? A New Index of Pericardial and Intrathoracic Fat Depots Estimated from a Series of Low-Dose Screening Chest CT

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PH Community, Learning Center Station #2

Participants
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PURPOSE

Intrathoracic fat represent a useful marker for increased metabolic risk and visceral adiposity on thoracic imaging. This study aimed to develop an automated computerized scheme to estimate a new index of pericardial and intrathoracic fat depots (PIF) on a series of low-dose screening chest CT.

METHOD AND MATERIALS

The retrospective study included 730 general population aged 26-90 who underwent a low-dose chest CT, visceral fat scans, BMI (body-mass index), and waist circumference measurement during medical checkups between 2009 and 2012 at our health care center. The original low-dose CT was obtained with 20mAs, 120kV, and slice thickness of 5 mm. The 3D iso-voxel volume data was reconstructed from a series of chest CT images (512x512 matrix size). The PIF was defined as a number of voxels within CT values of -195 and -45 in cardiac region. The cardiac region was automatically segmented by using Deep Convolutional Neural Network. A new index of %PIF was defined as the volume ratio of PIF and cardiac region. As a reference standard, a cutoff point of visceral fat area of 100 cm2 was adopted for definition of visceral fat accumulation group in Japanese.

RESULTS

Among 730 cases (Females n=260), there were 405 cases (Females n=99) classified into a visceral fat accumulation group. Average %PIF values for a visceral fat accumulation group and the others were 21.1% and 14.8% ($p<0.001$), respectively. The Pearson correlation coefficient of the relationship between %PIF and an area of visceral fat was 0.754 ($p<0.001$). In addition, an ROC analysis for assessing the visceral fat accumulation revealed that the AUC of %PIF (0.865) was better than that of the BMI (0.786) ($p<0.001$) and the waist circumference (0.825) in Japanese female ($p<0.05$), respectively.

CONCLUSION

We developed a computerized scheme for estimating a new index of %PIF from a series of low-dose screening CT images. The %PIF was significantly correlated with visceral fat accumulation, suggesting a useful marker for visceral adiposity on thoracic imaging.

CLINICAL RELEVANCE/APPLICATION

On the basis of the data of low-dose chest CT, a new index of %PIF may represent a potential marker for increased metabolic risk, particularly when volumetric data on visceral fat is unavailable.

PH255-SD-TUB4

Direct Measurement of CT Scatter Distribution Using a Long Linear Array Detector

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PH Community, Learning Center Station #4

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CONCLUSION

Direct measurements of scatter spatial distribution and strength were feasible at locations important for shielding design yet are not available from the vendor scatter map. The high sensitivity, long span and small pixel size allowed the detector to perform very efficient and detailed evaluation of distant scattered radiation.

Background

CT vendors provide scattered radiation for a limited range (typically up to 3.35 or 3.8 meters from isocenter, based on sparse spatial sampling). But CT shielding needs scatter data at distant locations. This work was to directly measure scatter using a long linear array detector at room-boundary locations far beyond the vendor-provided stray radiation maps.

Evaluation

Preliminary measurements of scatter were done using a model 0.8f3-512 detector (640 pixels, 0.8mm pixel pitch) from Detection Technology Inc., Finland. The signal-to-dose calibration of all detector pixels was completed at four kVs (80, 100, 120, 140) using a GE lightspeed scanner. In the horizontal plane at the isocenter height inside a Siemens Force CT room, phantom scatter near wall locations close to the operator window were evaluated by the detector along a straight line that's perpendicular to the CT table, whose intersection with the table was four meters away from the CT isocenter.

Discussion

The calibration factors from the four kVs were highly consistent, suggesting insensitivity of the calibration process to CT beam quality variations. The final calibration of DT was done with the help of a survey meter at the center location of 4 meter.The long detector length of 51cm allowed efficient derivation of scatter maps with high spatial resolution (0.8mm), which greatly reduced the need to do repeated exposures. Our measurement at the 4m location yielded a smoothly-varying scatter map of 0.9 to 1.2 μGy per 100 mAs.

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PH257-SD-TUB6

Application of MT in Kidney: A Comparison Analysis with Physiological Features

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PH Community, Learning Center Station #6

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PURPOSE

To evaluate the correlation between parameters from magnetization transfer (MT) technique and physiological features in normal people.

METHOD AND MATERIALS

A total of 35 healthy volunteers without renal disease were enrolled in this study. The gender, age, BMI (Body Mass Index), WHR (Waist-to-Hip Ratio), family history of diabetes and hypertension of all subjects were recorded. All subjects underwent examination on a 3.0T MRI scanner (MAGNETOM Skyra, Siemens Healthcare, Erlangen, Germany) with an 18-channel body phased-array surface coil. A 3D fast low angle shot (FLASH) sequence was scanned for two times to acquire MT data, first time with a MT saturation pulse (MTon) and second time without (MToff). For MT quantification, the magnetization transfer rate (MTR) was calculated using following equation: MTR =(MToff-MTon)×100/MToff. MTR value was measured on the MT map of each subject using the region of interest method. Multiple regions of interest were drawn and averaged in the medullitary region of the upper kidney, renal hilum, and the lower pole. The Pearson correlation analysis was performed to determine the relationship between the age, BMI, WHR and blood pressure with the value of MTR. A two-sample t-test was used to compare the difference in MTR values between gender and family history.

RESULTS

The MTR value of the cortex was significantly higher with the increasing of systolic pressure ($p<0.05$) (Figure 1). Although there is no statistical difference the MTR values of the cortex and medulla were increased with the increasing of age, BMI, WHR and diastolic pressure, ($p>0.05$) (Figure 1, Figure 2); and the MTR values of the medulla were decreased with the increasing of systolic pressure ($p>0.05$) (Figure 1), and the MTR value from subjects who had family history of diabetes was higher than that without family history diabetes ($p>0.05$) (Figure 2) .

CONCLUSION

The MTR value of kidney was significantly correlated with of systolic pressure in normal people, and it may indicate early renal microvascular changes before hypertension.

CLINICAL RELEVANCE/APPLICATION

MT can reflect changes in microstructure of and provide a more scientific basis for clinical changes in the kidney.

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PH258-SD-TUB7

Principle Component Analysis (PCA) in Photon-Counting Spectral CT and Its Implementation in Projection Domain and Image Domain with Denoising

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PH Community, Learning Center Station #7

Participants
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PURPOSE

Photon-counting spectral CT has gained growing attention in research and development due to its clinical potential in material decomposition and virtual monochromatic analysis. The principal component analysis (PCA) technique provides a tool to extract valuable information from the multidimensional data acquired in photon-counting spectral CT. This work investigates the feasibility and compares the performance of PCA in projection and image domain, with the content-oriented sparse representation (COSR) based denoising as an enhancement approach.

METHOD AND MATERIALS

Two contrast agent phantoms consisting of targets of iodine and nanoparticulated gold and a small animal (mouse) are used to evaluate the feasibility and performance of PCA in photon-counting spectral CT. The PCA is carried out in both projection and image domains, in which either projection or image data are transformed into representation in an orthogonal coordinate system that maximizes the covariance and thus enhance the contrast between clustered data corresponding to various materials. Since the noise in photon-counting spectral CT data, especially in the high energy bins, may degrade PCA's performance, the COSR denoising is applied on the reconstructed images to investigate how denoising can benefit the PCA.

RESULTS

It is found that the first principle component (PC) images extract vast majority (more than 98.9%~99.8%) of the information (covariance) carried by the images corresponding to all energy bins. The PCA enhance image quality that is assessed as noise and contrast-to-noise ratio significantly while the data dimensionality is being reduced substantially. Moreover, with denoising in reconstructed images, the image quality can be further improved.

CONCLUSION

The preliminary results showed PCA's feasibility in extracting dominant contrasts between materials in photon-counting spectral CT, with a significant reduction of data dimensionality in photon-counting spectral CT, in either projection or image domain, especially in the image domain with proper denoising.

CLINICAL RELEVANCE/APPLICATION

The preliminary data presented in this study may provide information and reference for the technical and/or clinical community to better understand the feasibility and potential of PCA in photon-counting spectral CT.

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PH259-SD-TUB8

Weakly Supervised Learning for Classifying A Cardiomegaly Disease from Normal and Other Diseases on Chest Radiographs

Tuesday, Dec. 3 12:45PM - 1:15PM Room: PH Community, Learning Center Station #8

Participants
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PURPOSE

To develop a weakly supervised classification for screening of cardiomegaly disease with chest radiograph (CXR).

METHOD AND MATERIALS

We collected a total of 16,730 CXRs including normal (n = 6903), abnormal CXRs with cardiomegaly (n = 1184) and other five disease patterns including nodule, consolidation, pleural effusion, pneumothorax, interstitial opacity (n = 8619) from our institution. All CXRs were annotated by 5 - 10 years experienced thoracic radiologists. These datasets were randomly split into 70 percent for training, 10 percent for tuning, and 20 percent for final evaluation. To classify cardiomegaly, other disease patterns, and normal, we used densenet169 with convolutional neural network (CNN) for weakly supervised learning. When this algorithm was trained, normal and other disease patterns were randomly extracted from train datasets to balance the number of cardiomegaly. The performance of this classifier was evaluated with statistical analysis such as sensitivity, specificity, and accuracy.

RESULTS

In the test dataset, the algorithm showed 98.18% accuracy in classification of normal, cardiomegaly, and other diseases CXR. Sensitivity and specificity of CNN was measured at 81.85%, 93.06%, and 96.79%, and 95.45%, 94.35%, and 90.15% for cardiomegaly, other disease patterns, and normal CXRs, respectively.

CONCLUSION

Weakly supervised learning with deep CNN demonstrated high diagnostic performance in the classifying normal, cardiomegaly, and others disease patterns CXRs.

CLINICAL RELEVANCE/APPLICATION

Automated classifier with weakly supervision shows high diagnostic performance in classifying cardiomegaly from normal and others disease patterns CXRs, which could be used as a screening tool for cardiomegaly disease with CXR

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QI023-EB-TUB

Improving ED CT Patient Flow

Tuesday, Dec. 3 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

Awards
Quality Improvement Reports Award
Identified for RadioGraphics

Participants
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PURPOSE

Emergency Department (ED) visits have increased at twice the rate of the United States' population growth, while the number of ED facilities across the nation has declined, resulting in widespread ED overcrowding. Overcrowding leads to delays in patient care, raises costs and creates patient flow challenges across the hospital system. Approximately 60% of our ED visits involve imaging, with CT as the most common imaging modality. As part of improving overall flow of patients through the ED, our team attempted to improve CT turnaround times. The goal of this project is to improve CT exam order to exam complete turnaround time (TAT) from 61% to 71% by March 2019.

METHODS

A multidisciplinary team of leaders and frontline clinicians from Radiology and Emergency Medicine was formed, and the project was facilitated by the Radiology Process Improvement Manager. Project scope included all ED patients scanned on any of the three CT scanners at our hospital. Three 2-hour facilitated workshops were held from November thru December which included gemba walks, technologist workflow time studies, process maps, cause and effect analysis and brainstorming of counter measures. As part of baseline analysis, technologist workflow time studies and staffing ratios indicated demand (number of exams ordered) and capacity (available technologists) mismatch occurred at around 11am during ED surge, and around 6pm when technologist transporter left for the day. Cause and affect analysis revealed broad categories: Barriers to first pass yield (challenges that result in technologists fixing orders before fetching patient), Communication challenges (when and how to request for help from ED nurses for difficult intravenous lines or moving help), Exam Prioritization challenges (optimize clinical acuity versus ED length of stay), System challenges (variation in patient volume). Based on these categories our team brainstormed solutions and grouped them into three categories: Just-Do-It's, Requires Planning and Parking Lot ideas. Some of the Just-Do-It's included updating electronic medical record orders to match radiology protocols thereby preventing tech rework of canceling and reordering exams, walkie-talkies for improved communication between ED nurses and Radiology technologists, and bi-annual ED and radiology faculty collaboration meetings to optimize exam orders and utilization. Require Planning interventions included: 1.) Complete redesign of the CT contrast screening form with subsequent policy change, 2.) Development of CT Passport (document completed by ED physician at order which serves as a patient education tool and also as a checklist for downstream clinicians), 3.) Completion of CT contrast screening form while patients are waiting for their exam, 4.) Revision of CT Stroke workflow to minimize stroke standby time (time between stroke notification and patient arrival) and, 5.) Reconfiguration of CT head without contrast patient flow by seating patients closer to ED scanner.

RESULTS

At baseline (August thru December 2018), CT exam order to complete TAT less than 120 minutes averaged 61%. Several tests of change were incrementally introduced from January thru March 2019 of which CT passport and patient completed CT contrast screening form were widely adapted by staff and were effective in reducing exam TAT. Reconfiguration of CT head without contrast patient flow test of change led to patient and staff dissatisfaction, and was abandoned after a few weeks of testing. Post-implementation data (January thru March 2019) showed on average 65% of CT exams were completed in less than 120 minutes (see Figure 1). In addition, median exam TAT decreased from a range of 130- 150 minutes pre-implementation to 93 minutes in February and 87 minutes March 2019 (see Figure 2). Though our goal of 71% for CT exam order to complete less than 120 minutes by March 2019 was not met, in the short three months of testing changes, post-implementation data indicate we are moving in the right direction.

CONCLUSION

ED patient flow is very complex and involves various value streams. Multidisciplinary teamwork is critical for improving processes. Some interventions did not work as planned and team learned from them. Technologist workflow time studies and staffing analysis determined need to reallocate technologist resources to better meet exam surge and lunch time coverage. We are sharing our findings with hospital leadership about better resource allocation during time of high ED patient volumes and technologist lunch hours, and exploring hiring medical assistants to help with non-value added essential tasks such as transporting patients, taking patients on and off the scanner, and placement of IVs. As next steps, we aim to continue refining standard work processes for CT passport and stroke patient flow.

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QI024-EB-TUB

Know It to Fix It: A Quality Improvement Evaluation to Improve Turnaround Times in the Interventional Radiology Suite

Tuesday, Dec. 3 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

Process mapping can be used to identify workflow issues and implement actionable changes. We created a process map of pediatric interventional radiology (IR) workflow for inpatients undergoing procedures with general anesthesia to identify delays in patient care and improve turnaround times.

METHODS

A fourth-year medical student was assigned to observe and record key events during coordination of inpatient IR procedures at a tertiary care children's hospital. This observation was set as an initial 2-week observation followed by a 1-week observation 6 months after implementation of changes. We restricted our study to inpatient procedures using general anesthesia. The medical student began following a single patient at initiation of transfer from the inpatient floor until the patient exited the IR suite. Predetermined variables were recorded for each patient observation. Following the initial observation, data was reviewed to identify areas of improvement with immediate implementation of changes. The impact of these changes was measured after the second observation.

RESULTS

In the initial and second observations, 14 and 10 inpatient procedures were fully tracked, respectively. Initially, we found notable intervals in patient transport times (mean 38 mins, range 22-68 mins, n=9) and patient preparation (mean 22 mins, range 13-31 mins). Preoperative/PACU space availability was also identified to cause delays in 2 cases (14%). Estimated time for procedure duration in the IR suite (mean 68.5 mins, range 60-120 mins) was shown to be an underestimate when compared to the measured procedure duration (mean 77 mins, range 31-181 mins). With all members of the IR team, including IR nurses and radiology technologists, a process map was created to map the roles of each team member. We found our team to be efficient in preparing the patient for the procedure with most of our delays being attributable to PACU bed availability and the patient not being present in the pre-operative evaluation area when needed. Results from the observation were discussed at a team meeting to implement the following actionable changes: 1) standardizing the time for initiation of patient transport; 2) increasing the time allotted per procedure; 3) primary IR nurse transport for patient transfer, and 4) utilization of other spaces in the radiology department for pre-operative evaluation. After the 2nd observation, we noted the following: improved transport times from 38 minutes to 30 minutes ($p=0.32$), increased time for pre-operative evaluation from 31 to 64 minutes ($p<0.05$), and stable intraprocedural intervals. No delays due to PACU space were noted during the 2nd observation.

CONCLUSION

By analyzing our workflow, causes of delays in coordination of patient care were identified and improved. Implementation of targeted changes at our institution lead to improved efficiency. This process can be used by other IR departments to improve their workflow.

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QI118-ED-TUB1

Implementation of Measuring and Monitoring of Patient Safety Framework to Improve Peritoneal Dialysis Catheter Failure Rate: Lessons Learned from the Clinical Improvement Team

Tuesday, Dec. 3 12:45PM - 1:15PM Room: QR Community, Learning Center Station #1

Participants
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PURPOSE

As part of the Saskatchewan Health Authority's sustainability plan, Kidney Health and Medical Imaging/Interventional Radiology (IR) collaborated to achieve best practice for peritoneal dialysis (PD) catheter insertions by providing a minimally invasive and timelier alternative to current surgical PD catheter means of insertion. Current pressures for operating time have created wait times for peritoneal catheter insertion. A more responsive IR program promotes greater patient access, provides a less invasive procedure, and reduces the need for temporary vascular access and hemodialysis. Nationally, the target for primary failure (inability of the PD catheter to support adequate inflow and/or outflow, patient not able to train) for PD catheter insertions is <10% at 3 months. PD catheter failure rates are associated with significant burden and hardship to the patient, and an overall increase in cost to the health system due to additional procedures/tests to diagnose and correct complications. Current methods of PD catheter insertion have resulted in high failure rates (surgical and interventional radiology (IR) combined, insertions within 3 months): 2016 1° and 2° failure rate 31/62 (50.0%); 2017 1° and 2° failure rate 23/71 (32.4%), and 2018 1° and 2° failure rate 11/50 (22.0%). Although a 28.0% reduction in PD catheter failure rate has been achieved, current efforts are focused on closing this performance gap.

METHODS

The interdisciplinary clinical improvement team (CIT) participated in the Canadian Patient Safety Institute Measuring and Monitoring for Patient Safety Framework (MMSF) national collaborative. The team was challenged to improve the quality and safety of patient care with clinical pathways, overcome traditional 'department' boundaries, and better capture and understand the patient and family care experience. The CIT oversees the development, monitoring, and continuous improvement of clinical pathways drawing upon evidence based best practice. This team employed a holistic approach and involves staff, clinicians, and patients and families at all levels. The MMSF served to translate real time data so it is useful to take action, gap analysis for process improvement, identifying strengths and weaknesses, and promoting a culture of safety and continuous improvement: PD patient flow (from selection criteria, referral, procedure, training, home); PD catheter failure rate; mapping of PD patient safety indicators by dimension to determine core data set; and cultural appropriateness (staff level).

RESULTS

Through focused efforts, the CIT has reduced PD catheter failure rate by from 31/62 (50.0%) in 2016, to 11/50 (22.0%) in 2018. Process improvements implemented were standard workflow and PD assessment, exit site marking for interventional radiology only, standard room set up, patient safety questionnaire, quarterly review of metrics and reporting, ongoing case reviews, and lead time reduction (time to referral, assessment, PD insertion, and PD train). Single centre experience, with a single Interventional Radiologist has allowed for standardization of technique, but also poses challenges in terms of peer-to-peer support and enhancing insertion technique learning. The CIT was awarded a leading practice from the Health Standards Organization and Accreditation Canada, for excellence in patient and family engagement.

CONCLUSION

Peritoneal dialysis is an important model of home based therapies to avert or delay the need for hemodialysis. Strategies to increase uptake of home based therapies to date are not well documented. It is important to identify best practice, implement solutions to ameliorate cause-specific technique failure, and optimize clinical practice. Extending technique survival on PD and home hemodialysis remains a major challenge to optimizing outcomes for patients while increasing utilization.

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QI119-ED-TUB2

Decreasing Time to Report Critical Results at a Singe, Urban, County Hospital

Tuesday, Dec. 3 12:45PM - 1:15PM Room: QR Community, Learning Center Station #2

Participants
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PURPOSE

Diagnostic radiology aims to report all critical findings within 60 minutes of exam completion. Critical results are defined as results which mandate immediate physician to physician verbal communication with documentation of the time, content, and participants of the communication in the final report. In the calendar year of 2017, 68% of critical results were reported with documentation within 60 minutes of exam completion. The purpose of this project was to increase rates for communicating critical results within 60 minutes to 80% by July 1, 2019.

METHODS

At our county hospital, critical findings are tracked based on the radiologists' discretion. At the time of final signing of the report, the radiologists are directed to categorize each report as 'critical', 'new and reportable finding(s)', or 'no new or reportable finding(s)'. Prior to the start of this project, all reports flagged with 'critical' findings within six consecutive months prior to intervention (November 2017 - April 2018) were retrospectively reviewed. Data including time of study completion, time of communication, report content, and responsible participants were recorded. Based on this data, three targeted interventions were developed. The first action required education amongst the radiology residents and attendings. A short power point presentation outlined the process for tracking a 'critical' finding from preliminary read to final sign. This material was presented at the monthly resident meeting at the beginning of the year and then posted onto a resident webpage for reference. The second action was to revise and update a concise list of critical findings which could be displayed at all radiology workstations. From the review of data from months past, it was clear the radiologists did not refer to a universal list of critical findings. An updated list of critical findings with input from current radiology section chiefs was compiled and sent for approval by the emergency department section chief. A finalized list of 'critical' findings was then laminated and posted at each radiology workstation for reference. The third action was to streamline the process of correctly documenting the time, content, and participants in all reports with critical findings. A 'Macro' in Powerscribe was distributed to all radiologists and used as the official method for documenting verbal communication with the ordering providers. In order to accurately track the progress of our targeted interventions, a more comprehensive dataset was collected, including: patient location at time of imaging order (emergency room, inpatient, or outpatient), time of day the study was completed (8AM-12PM, 12PM-5PM, 5PM-10PM, 10PM-2AM, 2AM-8AM), and imaging modality.

RESULTS

From the months of November 2017 to April 2017, prior to any intervention, there were a total of 868 reports flagged as critical, of which 591 (68%) were communicated with correct documentation to the ordering provider within 60 minutes of study completion. Of the 277 critical results that were not compliant, 221 (80%) lacked correct documentation, and 56 (20%) contained proper documentation but was communicated to the ordering provider >60 minutes after study completion. Due to the high rate of incomplete documentations, three targeted interventions were initiated in June 2018. From the months of July 2018 to November 2018, there were 477 critical results. 81% of which were reported with documentation within 60 minutes of study completion. 56% were either emergency room or urgent care patients, 40% were inpatients, and 4% were outpatients. Critical results communicated with documentation within one hour was highest in the ED/urgent care patients (84.9%), and inpatients (78.1%). Of note: only 4 cases were communicated within 60 minutes but lacked proper documentation of the communication. 70 (19%) reports with critical findings were not communicated with documentation within 60 minutes. Of these, 30 (43%) were reported within 61-120 minutes after exam completion, 19 (27%) were reported within 121-240 minutes, and 21 (30%) took longer than 240 minutes to report. Of the 21 reports which were reported more than 240 minutes after study completion, 9 (42%) were examination completed between the hours of 5 PM and 10 PM.

CONCLUSION

Compliance rates for reporting and documenting critical findings within 60 minutes of imaging study completion was improved from 68% to 81% with directed resident education, development of a concise listing of critical findings, and by distributing a universal 'macro' in Powerscribe to all radiologists for documentation of a critical finding. Follow-up data suggests that potential areas for continued improvement at our county hospital are with patients scanned during the hours of 5 PM and 10 PM and for patients outside of the ED.

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QI120-ED-TUB3

Implementation of AI Structured Reporting to Smooth Workflow in Radiology Department Daily Practice

Tuesday, Dec. 3 12:45PM - 1:15PM Room: QR Community, Learning Center Station #3

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PURPOSE

To evaluate the workflow of structured reporting with integration of AI in routine radiology practice.

METHODS

1. Workflow of structured reporting Since Sep. 2016, structured reporting has been used in radiology department. During reporting, the radiologists performed the following procedures to complete a report: 1) Open the structured reporting software interface from the Patient List of RIS. 2) Click to choose the icons for a finding, or select from a drop-down menu to define the image features that was detected. 3) Type in the editing boxes to input the measurements of the observation, such as diameters and CT values. 4) Capture a screen snapshot for the significant finding and save it as the key image. 5) Input the final diagnosis and submit the report. 2. Workflow of structured reporting + AI Since April 2018, AI algorithms were integrated to the workflow of structured reporting, some reporting sections were generated automatically by AI, including selection of the findings, input of the measurements and capture of the key images. Sometimes the final diagnosis will be concluded by predefined logic script. During reporting, the radiologists performed the following procedures to complete a report: 1) Open the structured reporting software interface from the Patient List of RIS. 2) Check the contents that had already completed by AI, revise it when needed. 3) Check the final diagnosis and submit the report. 3. Study of the quality improvement by the AI workflow The acceptance rate of AI results was evaluated from the log file of the software. The average interpretation and reporting time was calculated for the whole institute. Questionnaire survey was collected to evaluate the experiences of the radiologists in the new workflow.

RESULTS

The following reports were almost fully automatically generated by AI: chest X ray, plain head CT and prostate mpMRI. The following reports were partially automatically generated by AI: LI-RADS reports of CT and MR, BI-RADS report of mammography, TNM report of RCC, renal stone, and renal cyst. The acceptance rate of AI results was 84.3%-100% for detection the image features and the key images, 93.5%-100% for measurements of diameters and CT values, and 40.1-78.3% for the final diagnosis. Specifically, in 15.4-36.8% cases, the reports were totally generated by AI and accepted by the radiology without change of one word. The average interpretation and reporting time reduced 8.9%-56.1%. In questionnaire survey, 96.9% radiologists considered the workflow of structured reporting with integration of AI was better than the traditional reporting workflow.

CONCLUSION

The workflow of structured reporting with integration of AI in routine practice can be well accpted by the radiologist.

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QI121-ED-TUB4

Keeping it Real: The Benefits of Using Standardized Patients and High Fidelity Stimulations in In-situ Simulations in Contrast Reaction Management Training

Tuesday, Dec. 3 12:45PM - 1:15PM Room: QR Community, Learning Center Station #4

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PURPOSE

To assess the feasibility and effectiveness of using standardized patients and high fidelity simulations in in-situ simulations to train radiology residents and fellows in contrast reactions and extravasations management.

METHODS

23 radiology residents and 6 radiology fellows participated in a contrast reaction management program. The participants attended a didactic lecture on managing contrast reactions and extravastions by an attending physician. This was followed by standardized simulations of 4 different commonly encountered contrast related scenarios: mild, moderate, and severe contrast reactions as well as mild contrast extravasation. Each simulation was proctored by an attending radiologist, an attending anesthesiologist and a CT technologist. These simulations took place in situ within the patient holding area, patient treatment room or CT scanner areas utilizing standardized patients. The standardized patients were given a script to follow and the observing attendings adjusted vital signs during the simulation using a simulation monitor. This allowed the standardized patients to interact with the participants and give real-time simulated clinical responses in response to the trainees' interventions. The severe contrast reaction scenario utilized a high fidelity mannequin, which allowed adjustments in vital signs that the participants would have to immediately act on. An individual debrief occurred at the end of each simulation with feedback from the observing attending physicians, the CT technologists and the standardized patient. Simulation topics of discussion included, but were not limited to, appropriate patient communication, medication dosages, proper EpiPen administration, and institutional/ACR management guidelines. A group debrief with all participants occurred at the end of all four scenarios. Additionally, a survey was sent to all participants 6 months following training to gauge perceived effectiveness of the training.

RESULTS

The most frequently observed deficits were in patient communication and institution specific knowledge. The majority of residents selected an appropriate treatment regimen in the clinical scenarios. However, the standardized patients communicated that in more than half of the simulations, the resident did not communicate effectively with them. Also, in a significant portion of the simulations, the trainees were not familiar with all the resources available to them in the scanner (i.e. location of monitor, stethoscope and medication box). Additionally, there were deficits in communication to the treating team and underutilization of the CT technologist as a member of the treating team.6 months following the training, participants were surveyed as to whether or not they had participated in the treatment of a contrast reaction or extravasation and to ask about their perception of the training and its relative value to their education, specifically regarding the role of didactic lectures, standardize patients, use of mannequins and in situ simulations. Of the 29 participants, 27 responded to the survey. 97% of respondents agreed or strongly agreed that in situ training was an effective training tool and 93% agreed or strongly agreed that standardized patients were an effective training tool, as opposed to 81% for mannequins and 70% for didactic lectures.When asked to rank the four components of training from most helpful to least helpful, 38% ranked standardized patients as most helpful, 38% ranked in situ training as most helpful, 19% ranked mannequins as most helpful and only 15% ranked didactic lectures as most helpful. An ordinal logistic regression was applied and found that the ratings by group for standardized patients was higher than didactic lectures (OR = 5.075, p = 0.0015). There was not evidence for a difference in ratings between the other measured metrics (in situ simulations or high fidelity mannequins). Most importantly, 68% and 75% of respondents had participated in the treatment of an actual contrast reaction and contrast extravasation, respectively, at the time of the survey.

CONCLUSION

Utilizing standardized patients in an in-situ training scenario can be a feasible strategy for teaching these important contrast reaction and extravastion management skills and is an effective realistic training tool when used in conjunction with other educational modalities. Specifically, the benefits of this type of training being performed with standardized patients and in clinically used areas over high-fidelity mannequin training in simulation labs include the ability to develop effective patient communication, gaining familiarity with staff and environment, and the discovery of both general and institutional-specific knowledge gaps. Additionally, a survey of participants following training demonstrated that in situ training and use of standardized patients are perceived as valuable and effective ways to learn how to treat contrast reactions and extravasations.

RO208-SD-TUB1

Relationship Between Spleen Dose and Lymphocyte Loss Rates During Radiation Therapy in Patients with Pancreaticobiliary and Gastroesophageal Tumors

Tuesday, Dec. 3 12:45PM - 1:15PM Room: RO Community, Learning Center Station #1

Participants
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PURPOSE

Radiation (RT)-induced lymphopenia (RIL) is associated with worse survival in patients with esophageal and pancreaticobiliary cancers. We hypothesized that higher spleen doses are associated with higher lymphocyte loss rates and % change in absolute lymphocyte counts (ALC) during RT.

METHOD AND MATERIALS

This registry-based study included 140 patients who received conventionally fractionated RT for pancreaticobiliary (n=79) or gastroesophageal (n=61) tumors. Loss rates were determined using a previously described method in which patients' serial ALCs are fit to the equation ALC(x) = ae-bx. Percent per fraction lymphocyte loss (FLL) was then calculated as FLL = (1-e-b)*100. Comparisons between individuals who developed >=grade 3 RIL (ALC<500) and those who did not were done with the Mann-Whitney U Test. The relationship between spleen volumes receiving anywhere from 5 Gy (V5) to 25 Gy (V25) and mean spleen dose (MSD) with total % change in ALC and the risk of developing >=grade 3 or grade 4 RIL (ALC<200) during treatment were analyzed using Spearman's correlation and multiple variable logistic regression respectively.

RESULTS

119 patients developed >=grade 3 lymphopenia. Median FLL (11.8%, 7.6%), %ALC loss (87.5%, 70.83%), planning treatment volume (PTV; 614 cm3, 533.8 cm3), MSD (11.1 Gy, 7.0 Gy), and spleen V5-V25 were all higher for patients with severe lymphopenia vs those without (all $p < 0.007$). Larger MSD was associated with larger % decrease in ALC ($rs = -0.380$, $p < 0.001$) and larger loss rates ($rs = 0.401$, $p < 0.001$). Similar relationships were seen with the other spleen dose parameters. After controlling for baseline ALC and PTV, MSD and V5-V25 were all significant predictors of developing >=grade 3. Furthermore, V5 was a significant predictor for grade 4 lymphopenia (OR = 1.004 for each additional cm3 of V5, $p = 0.023$).

CONCLUSION

Higher spleen doses lead to higher lymphocyte loss rates and total % change in ALC during RT. Additionally, high spleen doses are associated with increased odds of severe lymphopenia, suggesting that limiting spleen dose is a promising strategy to decrease the risk and severity of RIL in patients with abdominal cancers.

CLINICAL RELEVANCE/APPLICATION

Limiting spleen dose could decrease the risk and severity of radiation induced lymphopenia in patients with abdominal cancers.

UR186-ED-TUB7

Practical Guide to Enhancing Radiologist Role in the Diagnosis of Diseases: Case Studies in Genitourinary Imaging

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #7

Participants

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TEACHING POINTS

In an era of increasing healthcare provider accountability for patient outcomes, there are revived opportunities for radiologists to enhance their roles in achieving timely and accurate diagnosis of diseases. This exhibit highlights the value radiologists can bring to the table in the diagnosis and management of diseases. Case studies highlighting the process of rendering high-value diagnosis in acute emergency setting are presented. Lessons glimpsed from this analysis can provide a path for radiologists to sustain a meaningful role of being a 'doctor', and avoid burnout from ever increasing RVU-driven workload. Teaching points highlighting the fullest utilization of electronic medical record are presented.

TABLE OF CONTENTS/OUTLINE

Discussion of each genitourinary case follows the patient course through the healthcare system from presentation, initial clinical assessment (H&P), laboratory and radiologic workup, pathologic diagnosis, and final patient outcomes. Examples include: Acute presentation of flank pain, discussion of common etiologies, and differential diagnosis radiologists render on this case. Pyelonephritis, and discussion of spectrum of renal infection. Workup of palpable lump in the groin. Incidentally found renal mass during workup of back pain and its implications. Literature review of incidentaloma and nephrectomy rate.

UR187-ED-TUB8

Infiltrative Renal Lesions: Imaging Findings, Differential Considerations, and Mimickers

Tuesday, Dec. 3 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #8

Awards
Certificate of Merit
Identified for RadioGraphics

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Steven C. Campbell, MD,PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. Infiltrative renal lesions represent a discrete subset of renal tumors and inflammatory processes. 2. These lesions are characterized by replacement of or invasion into the renal parenchyma and often cause renal enlargement with preservation of the renal shape. 3. While nonspecific, these features, when combined with clinical history and laboratory data, can help suggest the correct diagnosis.

TABLE OF CONTENTS/OUTLINE

1. Expansile vs. Infiltrative Lesions - Imaging Features 2. Renal Cortical Tumors a. Atypical Renal Cell Carcinoma (RCC) b. Sarcomatoid and Rhabdoid Differentiation c. Tumor Thrombus 3. Renal Medullary Tumors a. Renal Medullary Carcinoma b. Collecting Duct Carcinoma 4. Renal Pelvis Tumors a. Urothelial Carcinoma (UCC) b. Metachronous UCC c. Squamous Cell Carcinoma 5. Lymphoproliferative Disorders a. Renal Lymphoma b. Renal Leukemia c. Renal Plasmacytoma 6. Renal Metastases a. Primary Lung Cancer b. Primary Breast Cancer c. Primary Thyroid Cancer d. Rare Primary Neoplasms 7. Pediatric Renal Tumors a. Wilms Tumor b. Mesonephric Blastoma c. Rhabdoid Tumor 8. Inflammatory Mimickers a. Acute Pyelonephritis b. Xanthrogranulomatous Pyelonephritis

VI137-ED-TUB8

Pelvic Congestion Syndrome: Normal Anatomy and Multimodality Imaging Evaluation of an Underdiagnosed Disease

Tuesday, Dec. 3 12:45PM - 1:15PM Room: VI Community, Learning Center Station #8

Awards
Cum Laude

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TEACHING POINTS

Pelvic congestion syndrome (PCS) is an underdiagnosed etiology of chronic pelvic pain in a large portion of female patients. While the etiology of primary pelvic congestion syndrome is attributed to incompetent venous valves in the gonadal veins or internal iliac veins, secondary causes of increased hydrostatic pressure and reflux may be due to extrinsic compression or intrinsic narrowing of central inflow or outflow veins. Clinical diagnosis of PCS can pose as a challenge for many general practitioners and women's health providers, delaying diagnosis and ultimately treatment. Familiarity with the diagnostic features of pelvic congestion syndrome may aid in timely diagnosis and guide patients to the appropriate treatment.

TABLE OF CONTENTS/OUTLINE

1. Clinical significance of pelvic congestion syndrome 2. Normal female pelvic venous anatomy 3. Common anatomic variants 4. Etiology of Pelvic Congestion Syndrome a. Primary Etiology b. Secondary Etiologies 5. Noninvasive Preprocedural Imaging a. Ultrasound b. Computed Tomography c. Magnetic Resonance Imaging 6. Intraprocedural Imaging a. Angiography b. Intravascular Ultrasound 7. Treatment options and considerations

VI138-ED-TUB9

Don't Ever Go with the Flow, Be the Flow: A Comprehensive Pictorial Review of B-Flow Ultrasonography

Tuesday, Dec. 3 12:45PM - 1:15PM Room: VI Community, Learning Center Station #9

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TEACHING POINTS

- • B-flow ultrasonography (US) is an ultrasound technology which can be used during the evaluation of vascular diseases. - • B-flow US is superior for the depiction of complex hemodynamics in the blood spaces. - • This technique allows an easier discrimination between flowing blood and surrounding stationary structures (vessel wall, thrombus, hematoma, intimal flap, venous valve). - •The use of digitally encoded ultrasound technology provides direct visualization of flowing blood cells. - • The advantages of B-flow ultrasonography are: simultaneous visualization of flowing blood and surrounding stationary structures, higher frame rate for hemodynamic imaging, and higher spatial resolution for vascular anatomy. - • In this pictorial essay, we demonstrate the B-flow in different vascular diseases.

TABLE OF CONTENTS/OUTLINE

• Introduction. • Technical considerations of B-flow ultrasonography. • Advantages of B-flow US over other ultrasound modalities (B-mode, color Doppler and power Doppler). • Pictorial reviewof the clinical applications of B-flow US in vascular diseases. • Conclusions.

VI209-SD-TUB1

Clinical Utility of Time Resolved MRA in Characterizing Complex Vascular Malformations: Correlation with Digital Subtraction Catheter Angiography and High Spatial Resolved MRA

Tuesday, Dec. 3 12:45PM - 1:15PM Room: VI Community, Learning Center Station #1

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PURPOSE

High spatial resolution single phase Magnetic Resonance Angiography (CE-MRA) is useful in determining fine vascular details but limited in reliably evaluating high flow vs slow flow vascular malformations (VMs) due to poor temporal resolution. Therefore, catheter-based angiography (DSA) would still be necessary to determine functional flow characteristics. Our aim is to evaluate the diagnostic utility of Time Resolved Magnetic Resonance Angiography (TR-MRA) to differentiate high-flow and slow-flow lesions of complex VMs.

METHOD AND MATERIALS

Retrospective search utilizing Nuance Dictation Powerscribe Software (M-Power) for MRA studies (from 2009 to 2018) with TR-MRA and CE-MRA sequences for VM evaluation were obtained after IRB approval. All studies were performed at 3T (Trio, Siemens). Cases with VMs that involved the brain and spine were excluded. An experienced cardiovascular radiologist was asked to identify high-flow and slow-flow VMs based on TR-MRA and other characteristics such as feeding vessels, draining vessels, size and extent. The findings were then compared to the CE-MRA and also DSA for the patients who had catheter angiogram for treatment.

RESULTS

The M-Power search resulted in a total of 69 patients (24 males, 45 females; age range 11 days to 74 years). There were 19 high-flow VMs, 47 slow-flow VMs, 2 lymphatic malformations and 1 no-flow VM. TR-MRA was able to determine VM size, type (53 venous cases, 12 arteriovenous cases and 4 arterial cases), feeding vessels (18 cases), and draining vessels (40 cases). Of the total 69 patients, there were 25 that had confirmatory DSA performed for treatment. Of those with DSA, there was 100% concordance with the MRA for high-flow vs slow-flow lesions.

CONCLUSION

TR-MRA is comparable to DSA by providing real time contrast flow dynamics that confidently diffentiates vascular malformations as high vs slow/no flow lesions. However, high spatial resolution single phase CE-MRA is a supplimentary technique to TR-MRA to depict fine anatomical details in complex VMs.

CLINICAL RELEVANCE/APPLICATION

TR-MRA would provide functional data of contrast flow dynamics to differentiate VMs as high-flow or slow/no flow lesions for appropriate treatment planning.

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VI210-SD-TUB2

Comparative Outcomes of IVC Filters Placed at Bedside Using Digital Radiography versus Conventional Fluoroscopy

Tuesday, Dec. 3 12:45PM - 1:15PM Room: VI Community, Learning Center Station #2

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PURPOSE

Inferior Vena Cava filters (IVCF) are commonly used in the prevention of pulmonary embolism. IVCFs traditionally are placed using fluoroscopy, however, bedside placement is an acceptable safe alternative for critically ill patients1,2. Outcomes for bedside placed IVCF with US guidance are available, however, outcomes using digital radiography (DR) as guidance are lacking. The purpose of this study is to assess the outcomes of IVCFs placed at bedside using DR compared to IVCFs placed by conventional fluoroscopy (CF).

METHOD AND MATERIALS

This is an IRB approved retrospective study spanning a period from 7/2/2015 to 9/30/2016 in which all IVC filters placed by the IR department were assessed for inclusion. Multiple procedures at time of IVCF placement resulted in study exclusion. Our institution follows SIR guidelines for IVCF indications. For critically ill patients deemed high transfer risk, beside placements were performed at the operator's discretion. For analysis, placements were grouped by bedside with DR or by CF. Patient demographics, indication, radiation exposures, access site, procedural duration, dwell time, and complications were identified by the EMR. Filter positioning with measurements of tip to renal vein distance and lateral filter tilt were performed when cavograms or post placement CTs were available for review. Statistical analysis was performed using Stata IC 11.2.

RESULTS

Among 161 filter placements identified, 32 were excluded, providing a sampling of 81 placed by CF and 48 at the bedside. Patient's were statistically younger among the bedside group with a mean age of 49 +/- 18 vs 56 +/- 17 years (p=0.027). Procedural duration was longer at the bedside lasting 14.5 +/- 10.2 versus 6.7 +/- 6.0 minutes (p<0.0001). The CF group had mean radiation exposure of 256.94mGy +/- 158.6 and bedside group had a median number of KUBs of 5 (3-7) estimating an average of dose of 25mGy. There was no significant difference in distance of IVC tip to renal vein (p=0.31), misplacements (p=0.57), degree of filter tilt (p=0.33), or rate of complications (p=0.65) between the bedside group and the fluoroscopy group.

CONCLUSION

IVCF placement at the bedside using DR is comparable to CF with no statistical difference in outcomes based on IVCF positioning, degree of lateral tilt or removal issues, with a tradeoff of decreased dose with increased time.

CLINICAL RELEVANCE/APPLICATION

IVCFs can be placed safely at the bedside using DR.

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VI211-SD-TUB3

Impact of Tissue Vascularity on the Outcome of High-Intensity Focused Ultrasound (HIFU) Treatment of Adenomyosis

Tuesday, Dec. 3 12:45PM - 1:15PM Room: VI Community, Learning Center Station #3

FDA Discussions may include off-label uses.

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PURPOSE

To comparatively evaluate the therapeutic efficacy of the magnetic resonance imaging (MRI)-guided high-intensity focused ultrasound (HIFU) ablation of adenomyosis based on T1-perfusion and T2 signal intensity (SI)-based classifications.

METHOD AND MATERIALS

50 women (age, 40.3 ± 6.0 years; range) who underwent HIFU treatment were classified according to (i) T2 SI-based classification as group I (focal adenomyosis, n = 32), group II (diffuse adenomyosis, n = 18,), and (ii) T1 perfusion-based classification as group A (if the time-signal intensity (SI) curve of lesion is lower than that of myometrium, n = 28) and group B (if the time-SI curve of lesion is equal to or higher than that of myometrium, n = 22). The adenomyosis volume, non-perfused volume (NPV) ratios immediately after treatment and volume reduction ratios and transformed symptom severity scores (tSSS) at the 6-month follow-up were retrospectively assessed.

RESULTS

The mean adenomyosis volume of group I, II, A, and B was 99.8ml and 126.5ml ($p>0.05$), 108.8ml and 110.2ml ($p>0.05$), respectively. The mean NPV ratio was significantly higher in group A than in group B (88.6% and 41.1%, respectively; $p<0.05$). No statistically significant difference was noted in the immediate NPV ratio among patients with the group I and II (64.9% and 72.6%, respectively; $p>0.05$). In group A, the mean NPV ratio was 89.6% (n = 16) for patients with focal adenomyosis and 87.3% (n = 12; $p>0.05$) for patients with diffuse adenomyosis. In group B, the mean NPV ratio was 41.1% (n = 22) for patients with focal adenomyosis and 40.3% (n = 6; $p>0.05$) for patients with diffuse adenomyosis. The 6-month adenomyosis volume reduction ratio in group A was significantly greater compared to that in group B (30.3% and 7.6%, respectively; $p<0.05$) whereas there was no statistically significant difference among the group I and II (19.5% and 21.7%, respectively; $p>0.05$). The tSSS improvement ratio was 46.4% and 47.3% in group I and II, and 72.2% and 14.3% in group A and B, respectively.

CONCLUSION

The preliminary results of this study revealed that T1-perfusion based classification method could play an important role in classifying the adenomyosis and predicting the treatment outcome of MRI-guided HIFU ablation

CLINICAL RELEVANCE/APPLICATION

T1 perfusion-based classification is an important predictor of MRI-guided HIFU treatment outcome of adenomyosis and should be considered by the treating physician in the screening phase.

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VI259-SD-TUB6

The Diagnostic Performance of Dual-Layer Computed Tomography for Deep-Vein Thrombosis in Indirect Computed Tomography Venography

Tuesday, Dec. 3 12:45PM - 1:15PM Room: VI Community, Learning Center Station #6

Participants
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PURPOSE

Early diagnosis of deep vein thrombosis (DVT) is important for prevention of pulmonary embolism (PE). A phantom study suggested the usefulness of dual-energy computed tomography (DECT) for decreasing image noise and improving conspicuity and diagnostic accuracy of DVT. DECT can generate virtual monochromatic images (VMIs) at different monochromatic X-ray energies (keV) based on two different energy datasets. VMIs at low keV can increase both contrast enhancement and venous attenuation compared to conventional images, but they also markedly increase image noise. Dual-layer DECT (DL-DECT) can overcome the disadvantage of increased image noise at low energy levels. The purpose of this study was to evaluate the image quality and diagnostic performance of VMIs obtained with DL-DECT during indirect CT venography (CTV) for deep vein thrombosis.

METHOD AND MATERIALS

This retrospective study was approved by the Institutional Review Board, which waived the requirement for informed consent from patients. We retrospectively enrolled 45 patients who underwent CTV using DL-DECT, and VMIs (40-200 keV) were retrospectively generated. We compared the venous attenuation, image noise, contrast, and contrast-to-noise ratio (CNR) between the VMIs with the highest CNR and conventional CT images using a paired t-test. Furthermore, we compared the pooled area under the receiver-operating characteristic curve (AUC) of each technique with Delong's test in 34 patients who underwent color Doppler ultrasonography.

RESULTS

The 40-keV VMIs exhibited the best CNR. The image noise was significantly lower in 40-keV images (9.7 ± 2.5 HU) than in 120-kVp images (10.5 ± 2.5 HU) ($p < 0.01$). The contrast (120 kVp: 38.2 ± 15.3 HU vs. 40 keV: 131.6 ± 43.6 HU) and CNR (120 kVp: 3.8 ± 1.7 vs. 40 keV: 14.4 ± 6.1) were significantly higher in 40-keV images than in 120-kVp images ($p < 0.01$). Furthermore, the pooled AUC was significantly higher for 40-keV images (0.84) than for 120-kVp images (0.78) ($p = 0.03$).

CONCLUSION

In indirect CT venography, 40-keV VMIs obtained with DL-DECT offer better image quality and diagnostic performance for deep vein thrombosis than conventional CT images.

CLINICAL RELEVANCE/APPLICATION

We proved the following findings using ROC techniques by 9 reviewers. In indirect CTV, VMI at 40 keV with DL-DECT offers better image quality and diagnostic performance of DVT than conventional CT.

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VI260-SD-TUB7

False Lumen Enhancement Characteristics on Computed Tomography Angiography Predict Risk of Aneurysm Formation Among Acute Type B Aortic Dissection Patients

Tuesday, Dec. 3 12:45PM - 1:15PM Room: VI Community, Learning Center Station #7

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PURPOSE

Patients with type B aortic dissection are prone to aneurysmal degeneration of the false lumen (FL). Imbalance in FL outflow (re-entry tears) relative to inflow (entry tears) leads to FL pressurization, lower FL flow rates, and may be a significant driver of FL aneurysm formation. Imaging features (i.e., decreased FL contrast filling) that suggest FL pressurization may improve patient risk stratification and inform timing of surgical repair. The purpose of this study was to examine the association between baseline CTA luminal enhancement properties and delayed aneurysm formation in acute type B aortic dissection.

METHOD AND MATERIALS

Baseline CTAs of patients with acute type B aortic dissections between 2007-2016 (n=50) were analyzed using 3D software (double-oblique technique) at multiple sites along the descending thoracoabdominal aorta. At each location, we measured contrast density in TL & FL (HU), maximal diameter (cm) and circumferential FL extent (degrees). Clinical and outcome data were collected via chart review. We used multivariate logistic regression to determine the association between TL-FL differential luminal enhancement and aneurysm formation (maximal diameter >=55mm).

RESULTS

Patients were male (76%), 52.9 ± 13.1 years old at diagnosis, with mean BMI 32.3 ± 6.6 kg/m2. Mean follow-up was 4.3 ± 2.9 y, and 34% (n=17) patients were diagnosed with thoracoabdominal aortic aneurysm during follow-up. Baseline anatomical means were: 3.9 ± 0.6 cm aortic diameter, 1.0 ± 0.5 cm primary entry tear, 237 ± 28O FL circumferential extent, 33.8 ± 6.2 cm dissection length, and 4.2 ± 5.3 cm distance from the LSC. The baseline absolute difference in FL and TL (TL-FLabs) contrast density at 2 cm distal to primary entry tear was significantly higher among patients who developed aneurysm (36 ± 27 HU vs. 22 ± 27 HU, p=0.01). Aneurysm formation was predicted by TL-FLabs (OR 1.05, 95% CI: 1.01-1.11, p=0.04), baseline maximal aortic diameter (OR 1.81, 95% CI: 1.21-2.72, p=0.004), age at diagnosis (OR 0.84, 95% CI: 0.71-0.99, p=0.04) and CT follow-up interval (OR 1.01, 95% CI: 1.002-1.0003, p=0.02).

CONCLUSION

Differential luminal enhancement is a novel predictor of aneurysm formation among patients with type B aortic dissection.

CLINICAL RELEVANCE/APPLICATION

Luminal contrast density is easily measured from baseline CTA and decreased FL enhancement may help identify patients with acute type B aortic dissections at risk of aneurysm formation.

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VI261-SD-TUB5

Antitumor Effects of Transarterial Embolization and Simultaneous Treatment with Lenvatinib and Transarterial Embolization in a Rabbit VX2 Liver Tumor Model

Tuesday, Dec. 3 12:45PM - 1:15PM Room: VI Community, Learning Center Station #5

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PURPOSE

To evaluate the antitumor effects of transarterial embolization (TAE) and simultaneous treatment with lenvatinib and TAE in a rabbit VX2 liver tumor model.

METHOD AND MATERIALS

All experimental protocols were approved by our institutional animal experimentation committee. Fifteen Japanese white rabbits underwent VX2 tumor transplantation to the liver, and were randomly divided into three groups of five. Two weeks later, we performed magnetic resonance imaging (MRI) examinations and then treatments as follows: Group 1 (TAE and lenvatinib administration for 7 days started at the same time as TAE), Group 2 (TAE only), Group 3 (non-treatment). Two weeks after starting treatment, MRI was performed, and the rabbits were painlessly sacrificed, after which their livers were removed. Immunohistochemical staining (CD34) was also performed. Tumor growth rates were assessed by MRI examinations and the densities of intratumoral vessels were determined by immunohistochemical staining to evaluate the antitumor effects.

RESULTS

Tumor growth rates were 544 ± 141% in Group 1, 218 ± 88% in Group 2, and 1086 ±171% in Group 3. The tumor growth rate was significantly lower in Group 2 than in Group 1 and Group 3, and the difference between Group 1 and Group 3 was also significant. The ratio of CD34-positive regions to viable tumor areas was 4.58 ± 0.58% in Group 1, 4.59± 1.01% in Group 2, and 4.97 ±1.36% in Group 3. There was no statistically significant difference among the groups.

CONCLUSION

We think that TAE alone in a rabbit VX2 liver tumor model results in a decrease of tumor growth rate compared with simultaneous treatment with lenvatinib and TAE.

CLINICAL RELEVANCE/APPLICATION

In terms of antitumor effects, simultaneous treatment with lenvatinib and TAE might not be a recommended treatment for hepatocellular carcinoma.

AI005-EC-WEA

Creating Annotated Image Datasets to Support Deep Learning Training and Validation

Wednesday, Dec. 4 12:15PM - 12:45PM Room: AI Community, Learning Center Custom Application Computer Demonstration

Participants
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CONCLUSION

We have created a multimedia structured reporting solution that can efficiently create proven annotated image datasets that are required to train and validate DL systems. When DL systems are capable of producing meaningful results, those results can be input into the structured report for radiologist approval.

Background

Deep learning (DL) for image analysis requires large numbers of proven annotated image datasets for training and validation, but this data is not readily available. Images stored in a PACS are often disconnected from radiologists' narrative reports describing findings. Furthermore, narrative reports are plagued by disorganized content, variable terminology, and missing data. Developers often employ radiologists to reinterpret images to create the necessary datasets but with added costs and certain limitations (e.g., annotation of only targeted findings). We have created a multimedia structured reporting solution that generates annotated image datasets to meet the needs of DL systems.

Evaluation

We developed a multimedia structured reporting system that interfaces to a PACS to capture DICOM images and presentation states (e.g., arrows, distance metrics, regions-of-interest) during a radiologist's image analysis. This data is tagged with terminology using natural language processing of the dictation referenced to an ontology which is used to create the annotated datasets that are stored in a SQL database and linked to other medical information including pathology and outcomes to establish the ground truth. As a radiologist uses the system to create clinical reports it simultaneously creates structured data.

Discussion

The structured reporting system is capable of being used to report on a broad array of radiological exams from multiple modalities. The structured data linked to pathology and outcomes allows for data mining to identify cohorts with a particular disease and/or outcomes which can be used in DL initiatives. The system is designed to input image findings identified by man or machine, thus when DL systems are capable of producing meaningful results, this reporting system could provide a platform to integrate those results into the clinical workflow.

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AI006-EC-WEA

Continuous Improvement of LSTM Deep Learning NLP Algorithm to Predict Post-Procedure Exams for Worklist Prioritization Using API for Retraining and Redeployment

Wednesday, Dec. 4 12:15PM - 12:45PM Room: AI Community, Learning Center Custom Application Computer Demonstration

Participants
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CONCLUSION

Continuous learning and improvement of DL algorithms using a flexible API for retraining and redeployment, will likely lead to improved medical AI for patient care.

Background

Deep learning (DL) algorithms hold the promise of continuously improving on larger datasets, although most medical DL algorithms today are rarely updated on a regular basis, due to a lack of an efficient retraining and redeployment process. We describe a clinically deployed NLP algorithm using LSTM, which predicts which chest x-rays which are post-procedure x-rays based on clinical history from the order (eg, "s/p NGT"), for which we have a 90 minute service level agreement for them to be read, and moves them higher on our radiologist worklist for prioritization. In addition to initial training the DL algorithm (100 Unit LSTM - 2623 negative cases, 374 positive post-procedure cases - average 4-fold validation F1-score of 0.54), we describe a useful API to provide additional training data, either based on corrections by radiologists (web-based form for feedback for an incorrect inference from the algorithm) or if we provide additional annotated data.

Evaluation

Our DL algorithm pipeline consists of HL7 integration system which queries orders feeds them to the LSTM system/API. The inference results are fed through a commercial worklist engine which adds a 'post-procedure' modifier that prioritizes these exams on a radiologist worklist. In a retraining update of LSTM, from 2997 examples to 4147 examples, we see an increase in performance related to an average 4-fold cross validation F1 score of 0.54 to 0.72.

Discussion

We implemented a retrain method that accepts a .csv file with fields required by our LSTM model and an example of a call would be: `curl -F 'data=@PORT_CHEST-annotations.csv' https://dl-server:8686/retrain`. Any new and/or corrective data is concatenated with the previous data before retraining occurs. We also determine possible conflicting data which could be problematic in the learning process. Although we retrain on the entire concatenated dataset, we plan to implement optional incremental retraining associated with the new data added.

AI012-EB-WEA

Unsupervised Anomaly Detection on Medical Images with Generative Adversarial Networks: Strengths and Weaknesses

Wednesday, Dec. 4 12:15PM - 12:45PM Room: AI Community, Learning Center Hardcopy Backboard

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TEACHING POINTS

The purpose of this exhibit is: 1. To overview the methodologies of unsupervised anomaly detection with generative adversarial networks (AnoGANs) 2. To present the examples of unsupervised anomaly detection on medical images (X-ray and head/chest/abdomen CT) 3. To discuss the limitations and the future direction of AnoGANs in medical imaging

TABLE OF CONTENTS/OUTLINE

- Generative adversarial networks (GANs) - Unsupervised anomaly detection with GANs (AnoGANs) - Examples of unsupervised anomaly detection on medical images Chest X-ray Head CT Chest CT Abdominopelvic CT - Discussion: Strengths and Weaknesses - Future direction and Summary

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AI025-EB-WEA

Knowledge Distillation for U-Net on Medical Images

Wednesday, Dec. 4 12:15PM - 12:45PM Room: AI Community, Learning Center Hardcopy Backboard

Participants
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Conclusion

We successfully demonstrate a possibility of knowledge distillation for 2D U-net on aorta segmentation task and achieved high accuracy with faster model with no tuning hyper parameters.

Background

Many segmentation and classification tasks with medical image data have been recently performed by Deep learning (DL). While these tasks require prompt clinical decision, the increasing depth and complexity of DL, which are expected to perform better, and dealing with complex data such as 3D data, results significant latency and restricts the deployability on hardware devices without GPUs. Hence, we apply and evaluate a compression technique, known as knowledge distillation, that allows us to train with a significantly smaller model that has similar architecture to the original model so that the smaller model achieves performance similar to the original one and we overcome the above challenges.

Evaluation

We trained 2D U-net model for aorta segmentation on 6300 image patches cropped from 760 CT volumes as an original model and results 0.95 dice coefficient for other 700 image patches. We also trained 3 times smaller and 3 times faster (on Intel(R) Xeon(R) W-2133 CPU) 2D U-net model with the same train data set, which performs slightly worse than the original model by 0.03 dice coefficient for the same validation data set. Importantly, all hyper parameters used in knowledge distillation are the same as we used for the training of the original model except for loss to evaluate this technique impartially. We employed logits data which are produced from logits layer of original model inferring the train data set as a train data for teacher-student learning. As logits are employed, we also introduced soft loss between teacher's logits and student's logits with softmax temperature. After we applied knowledge distillation to the smaller model using the soft loss and logits data, the smaller model achieved 0.95 dice coefficient, which is similar to the performance of the original model.

Discussion

This result shows that knowledge distillation can be applied to the aorta segmentation task with U-net structure. This technique ought to be evaluated on other models that tends to be slower such as 3D U-net.

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AI201-SD-WEA2

Automatic Prediction of Optimal MRI Protocols Using Encoder-Decoder Model

Wednesday, Dec. 4 12:15PM - 12:45PM Room: AI Community, Learning Center Station #2

Participants
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PURPOSE

The decision of MRI sequences is usually made by radiologists and is based on the patient's clinical presentations. Deep learning techniques have potential for yielding clinical decision-making support tools. The purpose of our study was to evaluate the accuracy of prediction of optimal MRI protocols using encoder-decoder model considering patient's clinical presentations.

METHOD AND MATERIALS

We collected 6,831 application forms of brain contrast-enhancement MRI in Japanese from Hokkaido University Hospital (from Jan 2010 to Dec 2017). These data included descriptions regarding the purpose of MRI, clinical findings and treatment progresses, and the MRI sequence protocols ordered by radiologists. The MRI protocol consisted of the name of MRI sequences, slice orientation and thickness (e.g. axial T1WI, axial T2WI, sagittal GdT1WI 3mm thick). We then created bi-gram tokens in the description. Next, we applied the encoder-decoder model to predict the optimal MRI protocol from the descriptions. The learning parameters were as follows: iteration, 100; embedding, 100 dimensions. We performed 10-fold cross validation using each of the ten ordered versions of our dataset. We used 'match,' 'overpredict,' 'underpredict,' 'partial match,' 'mismatch' as the performance index.

RESULTS

The results of 'match,' 'overpredict,' 'underpredict,' 'partial match' and 'mismatch' were 13.0%, 39.3%, 2.3%, 41.4% and 4.0%, respectively. 96.0% of protocols were included all or part of the correct protocols. The prediction accuracy of frequent imaging MRI protocols, such a routine protocol related to screening for metastasis, tended to show high value, on the other hand, the accuracy of infrequent protocols showed low. We intend to further improve the accuracy by adjusting the hyperparameters of the model and increasing the number of application forms.

CONCLUSION

96.0% of protocols were included all or part of correct protocols using encoder-decoder model, and 13.0% completely matched the protocols ordered by radiologists.

CLINICAL RELEVANCE/APPLICATION

MRI protocols can be automatically predicted by encoder-decoder model, which may be helpful in decision making and standardization of MRI protocols.

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AI207-SD-WEA3

Engaging High-Risk Patients to Attend MRI Appointments Using a Scripted Phone Call: A Pilot Trial

Wednesday, Dec. 4 12:15PM - 12:45PM Room: AI Community, Learning Center Station #3

Participants
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PURPOSE

To investigate feasibility and operational acceptability of a reminder phone calls protocol designed to reduce no-show rates in MRI appointments.

METHOD AND MATERIALS

Appointments were classified as high risk from August to October 2018 using a tree-based ensemble learning algorithm (Random Forrest), which had the best performance for identifying patients more likely to miss appointments in a previous study (AUC 0.80; cumulative gain of 40% to reach 75% of missed appointments). The predictive model incorporates both patient and practice factors. At REDACTED INSTITUTION NAME, the usual care includes a reminder SMS message 3 days before the scheduled MRI appointment. In this randomized study (2:1 allocation ratio), the intervention arm received an additional phone call using an implementation intentions prompts in the mailing to engage the patient (1-day before the SMS and by a trained patient service coordinator) (Figure 1). Primary outcomes were feasibility and acceptability of the mailing in the Radiology workflow. No-show rate reduction was a secondary outcome.

RESULTS

Over this 12-weeks period study, 648 patients were assigned to the intervention arm and 389 to the control group. Of those assigned to receive phone calls, 460 (71%) confirmed, 123 (19%) did not receive the intervention, 46 (7%) canceled and 19 (3%) rescheduled the MRI appointment. The no-show rate in the intervention arm was lower than in the control arm (17.3% vs 22.4%, p=0.04). Of note, patients not reachable in the phone call presented a no-show rate of 22%.

CONCLUSION

The reminder phone calls protocol prior to MRI appointments was feasible and reduced no-show rate among patients at high risk.

CLINICAL RELEVANCE/APPLICATION

Combined interventions to patients at high risk may increase engagement for MRI appointments, reducing no-shows, delays, financial losses and health outcomes.

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AI221-SD-WEA1

A Machine Learning Approach of Support Vector Machine for Preoperative Prediction of Lymph Node Status in Intrahepatic Cholangiocarcinoma

Wednesday, Dec. 4 12:15PM - 12:45PM Room: AI Community, Learning Center Station #1

Participants
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PURPOSE

Accurate lymph node (LN) status evaluation for intrahepatic cholangiocarcinoma (ICC) patients was essential for surgical planning. This study aimed to develop and validate a prediction model to non-invasively evaluate LN status in ICC patients preoperatively.

METHOD AND MATERIALS

A total of 148 ICC patients diagnosed from 2011 to 2017 were included in this study: 106 patients (2011-2016) as a training set; 42 patients (2016-2017) as a validation set. Image features were extracted from T1-weighted contrast-enhanced MR images. A support vector machine (SVM) model was built by using the optimal features selected with the maximum relevance minimum redundancy (mRMR) algorithm. An SVM score was calculated for each patient to reflect the LN metastasis (LNM) probability using the SVM model. Then, a combination nomogram was constructed by incorporating the SVM score and clinical factors.

RESULTS

A feature pool of 491 features was extracted for each patient, including histogram features, geometry features, texture features and wavelet features. The SVM model was constructed based on five image features selected by mRMR. Significant differences were found between patients with LNM and non-LNM in SVM scores in both sets (the training set: 0.5466 (interquartile range (IQR), 0.4059-0.6985) vs. 0.3226 (IQR, 0.0527-0.4659), P<0.0001; the validation set: 0.5831 (IQR, 0.3641-0.8162) vs. 0.3101 (IQR, 0.1029-0.4661), P=0.0015). The nomogram based on the SVM score, the CA 19-9 level, and the MR-reported LNM factor showed better discrimination in separating patients with LNM and non-LNM than the SVM model alone (AUC: the training set: 0.842 (95% CI, 0.758-0.906) vs. 0.788 (95% CI, 0.698-0.862); the validation set: 0.870 (95%CI, 0.730-0.953) vs. 0.787 (95% CI, 0.634-0.898)).

CONCLUSION

The nomogram, incorporating the SVM score, CA 19-9 level and the MR-reported LNM factor, provided a novel approach to preoperatively evaluate LN status in a non-invasive way.

CLINICAL RELEVANCE/APPLICATION

The accurate individual LN status evaluation could help clinicians guide the surgical decisions.

AI269-SD-WEA4

An Interpretable Generative Model for Chest X-Ray Decomposition via Synthesizing Radio-Realistic Normal Chest X-Rays and Separating Abnormalities

Wednesday, Dec. 4 12:15PM - 12:45PM Room: AI Community, Learning Center Station #4

Participants
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PURPOSE

An automatic chest X-ray (CXR) diagnosis system with good interpretability will enable clinical adoption. To achieve this goal, we propose an interpretable generative model (IGM) for simultaneous radio-realistic normal CXR synthesis and abnormality separation.

METHOD AND MATERIALS

IGM contains three encoder-decoder network branches. The first branch is proposed for normal CXR image synthesis and contains a discriminator so that an adversarial loss is introduced to make the generated normal CXR radio-realistic (i.e. a synthesized radiograph that appears anatomically realistic). The second branch is presented for abnormality separation and can generate a residue map to delineate the underlying abnormal region. A self-reconstruction loss is adopted in these first two branches to enforce the generated normal CXR image to preserve similar visual structures as the original CXR. The third branch includes two encoders from the first two branches and one decoder, and is designed as an autoencoder to facilitate the training. IGM is weakly-supervisedly trained without requiring paired normal and abnormal CXRs. We use IGM for three important clinical tasks including normal and abnormal classification (NAC), and lung opacity classification (LOC) and detection (LOD). The experiments are conducted on a large-scale challenging CXR dataset with 26,684 frontal-view CXR images labeled into three categories: normal (8,851), lung opacity (6,012, including pneumonia, infiltrate and consolidation) and no lung opacity but not normal (11,821). 1,000 images are used for testing, the rest for training (95%) and validation (5%).

RESULTS

The visual results show that the generated normal CXRs are radio-realistic and the residue maps well indicate the abnormalities. With the help of IGM, the area under the receiver operating characteristic, sensitivity and specificity of NAC are 96.76%, 92.05%, and 92.08%. Their values of LOC are 91.97%, 84.7% and 84.7%. The mean average precision (mAP) of LOD is 23.92%, ranked third in the RSNA pneumonia detection challenge (the best team's mAP is 25.48%). The whole process takes less than 1 second of computation time using a GPU.

CONCLUSION

IGM provides interpretable CXR diagnosis and quantitatively boosts the performance for several important clinical tasks.

CLINICAL RELEVANCE/APPLICATION

IGM provides interpretability information that helps to explain its diagnoses and may improve clinical utility.

BR209-ED-WEA8

An Unusual Package From Amazon: Atypical Breast Cancers

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #8

Participants
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TEACHING POINTS

The major teaching points of the exhibit are: Illustrate mammographic and sonographic features of rare breast cancer types. Review imaging appearance and histopathologic correlation of unusual and rare breast cancers. Emphasize diagnostic difficulties, potential pitfalls and differential diagnoses of these entities.

TABLE OF CONTENTS/OUTLINE

The goals of this exhibit are to: Provide a pictorial review of diverse imaging appearances of rare breast neoplasms. Discuss specific imaging and pathological characteristics of several rare and unusual primary breast cancers. Familiarize the audience with rare breast neoplasms, thereby helping in formulation of complete differential diagnosis. Subtypes of Ductal Carcinoma illustrated in this exhibit: Medullary carcinoma of the breast Papillary carcinoma of the breast Mucinous carcinoma of the breast Tubular carcinoma of the breast Malignant Neoplasms of Stromal Origin illustrated in this exhibit: Breast angiosarcoma Breast rhabdomyosarcoma Phyllodes tumor

BR210-ED-WEA9

Breast Cancer Imaging and Risk Profiles in Women with Moderate Risk Genetic Mutations: A Case-Based Review

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #9

Participants
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Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Advances in multi-gene panel testing have resulted in identification of populations at higher-than-average risk for breast cancer. As a result, some updated guidelines recommend more intensive screening regimens, including MRI. However, few imaging based studies describe features of lesions associated with these moderate risk groups. In this case based review, we will consider more commonly encountered moderate genetic risk mutations, discuss screening and diagnostic breast imaging scenarios in these individuals, and explore breast cancer risk and breast cancer detection in this population.

TABLE OF CONTENTS/OUTLINE

1. Define "moderate risk genetic mutation" 2. Review clinical manifestations of moderate risk genetic mutations 3. Discuss breast cancer risk 4. Detail guidelines for breast cancer screening in populations with moderate risk genetic mutations 5. Case based evaluation of multi-modality breast imaging in women with moderate risk genetic mutations (ATM, CHEK2, Neurofibromatosis 1, PALB2, NBN). i. Mutation types and breast cancer risk ii. Imaging based literature iii. Breast imaging pearls/pitfalls iv. Specific imaging considerations 1. NF1 and radiation exposure 2. NF1 and confounding lesions (i.e., neurofibromas) 3. ATM and common benign confounders (fibroadenomas)

BR211-ED-WEA10

Test Yourself! MR Evaluation of Response to Neoadjuvant Therapy

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #10

Awards
Identified for RadioGraphics

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TEACHING POINTS

Causes of over-estimation of residual disease: Fibrosis or post treatment change may enhance and be mistaken for residual tumor Mucinous or necrotic tumors may appear as residual masses although there is no viable tumor Causes of under-estimation of residual disease Cancers manifesting as nonmass enhancement may be underestimated due to their nonconcentric shrinkage pattern Residual disease may be seen only on late phases of contrast-enhanced MRI Lobular cancers are more likely to be underestimated due to their growth pattern Taxane-containing chemotherapy regimens decrease overall vascularity and may cause decrease or resolution in enhancement despite residual disease

TABLE OF CONTENTS/OUTLINE

Brief intro: Rationale and indications for neoadjuvant chemo and endocrine therapies Self-test: MR imaging response to therapy with pathology correlation Causes of over- and under-estimation of residual tumor Paradigm change: can surgery be avoided in patients with excellent response to neoadjuvant therapy? Ongoing trials predicting pathologic response by imaging and/or needle biopsy.

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BR239-SD-WEA1

Utility and Outcomes of Digital Mammography for Imaging Asymptomatic Autologous Flap Reconstructions after Mastectomy

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #1

Participants
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PURPOSE

Literature on mammography for detection of asymptomatic malignancy after mastectomy with autologous flap reconstruction is limited with the two largest studies to date finding variable cancer detection rates of 1.5/1000 and 0/1000. The aim of this study is to evaluate the utility of digital mammography for detecting asymptomatic malignancy within an autologous flap reconstruction after mastectomy.

METHOD AND MATERIALS

An IRB-approved retrospective database review was performed of all digital mammograms performed on autologous flap reconstructions at our academic breast imaging facility between 1/1/2009 and 9/1/2017. Exclusion criteria included implant reconstruction, clinical signs or symptoms within the reconstructed breast, diagnostic work-up or follow-up of a previously identified lesion within the reconstructed breast, or less than 1 year of clinical or imaging follow-up. Radiology reports with a negative examination were defined as BI-RADS 1 or 2 and a positive examination as BI-RADS 0, 4, or 5. Malignant outcomes were determined by pathology results. Interval cancers were defined as malignant diagnoses within one year of a negative mammogram.

RESULTS

Final study cohort comprised of 600 digital mammograms performed in 193 flap reconstructions. Mean patient age was 59 years (range 36-84 years). Majority of exams (98.1%; 589) were negative, assigned a BI-RADS 1 or 2 on the mastectomy side. Eleven exams (1.8%) were positive, assigned a BI-RADS 0, 4, or 5. After diagnostic work-up of all BI-RADS 0 exams, 9 cases had a final recommendation for biopsy, 3 of which yielded malignant pathology. Among the negative mammograms, one interval cancer was identified, which was a recurrence in the deep axilla detected on PET-CT and not within the field of view of mammography. Overall, digital mammography yielded a cancer detection rate of 0.5%, NPV of 99.8%, PPV2 of 33.3%, sensitivity of 75% and specificity of 98.6%.

CONCLUSION

Asymptomatic recurrence in the flap reconstruction does occur, with mammography demonstrating a cancer detection rate of 0.5% (5 per 1000 exams). This is comparable to current national benchmarks for cancer detection from mammographic screening in the general U.S. population.

CLINICAL RELEVANCE/APPLICATION

Some women status post autologous reconstruction may benefit from routine imaging of the flap but larger studies may better inform which subset of women would benefit most from routine screening.

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BR240-SD-WEA2

Breast Invasive Ductal Carcinoma: Preoperative Predictive Ki-67 Index Based on Radiomics of MRI

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #2

Participants
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Yan Jia, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yue Dai, Dalian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to develop a radiomics model for predicting the Ki-67 proliferation index in patients with invasive ductal breast cancer through magnetic resonance imaging (MRI) preoperatively.

METHOD AND MATERIALS

128 patients who were clinicopathologically diagnosed with invasive ductal breast cancer were recruited. This cohort included 32 negative Ki67 expression (Ki67 proliferation index <14%) and 96 cases with positive Ki67 expression (Ki67 proliferation index >/=14%). All patients had undergone diffusion-weighted imaging (DWI) MRI before surgery on a 3.0T MRI scanner. Radiomics features were extracted from apparent diffusion coefficient (ADC) maps which were obtained by DWI-MRI from patients with invasive ductal breast cancer. 80% of the patients were divided into training set to train radiomics model, and the rest into test set to evaluate its performance. The least absolute shrinkage and selection operator (LASSO) was used to select radiomics features, then the Logistic Regression (LR) model was established using 5-fold cross-validation to predict of the Ki-67 index.

RESULTS

Quantitative imaging features (n=1029) were extracted from ADC maps, and 11 features were selected to construct the LR model. Good identification ability was exhibited by the ADC-based radiomics model, with areas under the receiver operating characteristic curves (AUC) values of 0.75±0.08, accuracy of 0.71 in training set and 0.72, 0.70 in test set.

CONCLUSION

The ADC-based radiomics model is a feasible predictor for the Ki-67 index in patients with invasive ductal breast cancer. Therefore, we proposed that three-dimensional imaging features from ADC maps could be used as candidate biomarker for preoperative prediction the Ki-67 index noninvasively.

CLINICAL RELEVANCE/APPLICATION

The MRI-based radiomics model is a feasible predictor for Ki-67 index in patients with invasive ductal breast carcinoma and is recommended in the preoperative prediction of Ki-67 index.

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BR241-SD-WEA3

Using Generative Adversarial Networks (GANs) to Synthesize and Remove Lesions in X-Ray Mammograms Improves AI-Based Cancer Detection

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Machine learning has shown great promise in cancer detection in x-ray mammography; however, these approaches are typically dependent on large numbers of malignant and normal examples. Data collection is challenging in screening applications, where the amount of normal examples greatly outnumber abnormals, which can cause overfitting and under-utilization of the available data, and thus hindering ultimate performance. Here, we explore using the machine learning approach known as generative adversarial networks (GANs) as a data augmentation strategy for synthesizing and removing lesions in mammogram images to supplement the original training set.

METHOD AND MATERIALS

We started with the Optimam Mammography Image Database, a publically available FFDM x-ray mammography dataset from the UK. We use 16000 images for training (800 with cancer ROIs), 2400 for validation (120 with cancer ROIs), and 6000 for testing (800 with cancer ROIs). We created a custom GAN model to synthesize lesions (5000 masses and 5000 calcifications) or remove lesions (5000 normals) onto random patches cropped from mammograms. We then trained a ResNet-50 neural network model using a sampling proportion of 50% synthetic data and 50% real data, and evaluated performance on entirely real data from the testing dataset. Performance is quantified using the area under a receiver operating characteristic curve (AUROC). To determine whether the synthetic data affected performance, we compared this new model trained on both real and synthetic data to a baseline model trained only on real data.

RESULTS

The classifier trained on the GAN-augmented dataset achieved an AUROC of 0.853 on the test set of real data, compared to 0.829 AUROC for the model trained on only real data, for a difference of 0.024 ($p < 1e-8$). Visual inspection of the GAN outputs suggests that the GAN is indeed capable of realistically inserting and removing lesions in the mammogram patches.

CONCLUSION

Synthetically generated data using GANs improved the performance of a model trained on both real and synthetic data over a model trained only on real data. This suggests that data augmentation with appropriately designed GANs could be a valuable method for improving the performance of AI-based cancer detection in mammograms.

CLINICAL RELEVANCE/APPLICATION

Improved classification accuracy of machine learning models applied to mammography increases their potential for effective clinical deployment.

BR273-SD-WEA4

3D Printing of Whole Breast and Individual Breast Tissue Types based on Transmission Ultrasound

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #4

Participants
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PURPOSE

Studies demonstrate that the use of 3D printed models can improve preoperative surgical planning and enhance patient-provider communication. We present a pilot program of a 3D printed breast anatomy using transmission ultrasound (TU). Our 3D printed models allow for differentiation of normal breast tissue, including the skin, fat, and fibroglandular tissues, as well as delineation of underlying masses in selected cases.

METHOD AND MATERIALS

We have performed non-invasive 3D TU imaging of whole in vivo breasts immersed in a water bath, with patients imaged in the prone position. The image reconstruction of the projection data results in co-registered 3D reflection, speed-of-sound, and attenuation images. We use machine learning at a voxel level to quantitively differentiate and segment breast tissues types. These tissue types are then 3D printed into respective anatomy models.

RESULTS

We have developed a fully-automated breast segmentation algorithm using reflection, speed-of-sound, and attenuation tissue characteristics that operate on transmission ultrasound images. The machine learning algorithm employs image voxel values from the co-registered images to classify breast tissue types: skin, fat, and fibroglandular tissues. We have validated this classifier on whole-breast TU images to provide a color-coded classification of the breast tissue volume and outline the presence of breast masses in selected cases, followed by 3D printing of individual tissue types.

CONCLUSION

Transmission ultrasound can generate whole-breast image volumes that can be objectively segmented and color-coded by tissue type. This unique ability to individually image 3D segmented breast tissue volumes provides a potentially clinically useful technology for 3D printed models.

CLINICAL RELEVANCE/APPLICATION

3D printing of individual breast tissue types based on TU imaging has a wide range of potential clinical benefits, including preoperative surgical planning and improved patient-provider communication.

Printed on: 10/29/20

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BR274-SD-WEA5

Low Dose Molecular Breast Imaging (MBI) in Multidisciplinary Patient Care: Initial Clinical Experience

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #5

Participants
Conellia Ha, MD, Rockville Centre, NY (*Presenter*) Nothing to Disclose

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PURPOSE

The aim of this study was to retrospectively evaluate the potential benefits of low dose molecular breast imaging (MBI) in the context of the diagnostic surgical setting to evaluate women with a prior history of breast cancer and/or equivocal mammography finding or positive mammography finding.

METHOD AND MATERIALS

MBI was performed on 93 patients at our center between March 2017 and June 2018. Patients ranged in age from 30-79 years with an average age of 57.9 years. All of the patients underwent bilateral MBI scanning after intravenous injection of 8mCi Tc-99m-sestamibi. Imaging acquisition was initiated within 5 minutes using the LumaGEM dual head, planar, solid state digital system with cadmium zinc telluride (CZT) technology. Standard cranio-caudal and medio-lateral oblique views of each breast were obtained.

RESULTS

We are reporting on 63 patients, 64 at the breast level (1 bilateral case). Thirty patients were excluded from this analysis because they do not yet have reference standard. Twenty two subjects (35%) had a prior history of breast cancer. Breast density was reported by interpreting radiologist as C or D in 66.7% (42/63). Nineteen subjects (30.1%) had histologic confirmation of current breast cancer, 6 of these had biopsy prior to MBI. MBI was used to evaluate extent of disease in these patients. MBI was positive in 100% of pre-biopsy histologic confirmed cancers (13/13) Mammography was positive in 91.7% (11/13), and equivocal in 16.7% (2/13). MBI downgraded BIRADS in 10 cases (15.8%).

CONCLUSION

Low dose MBI is an effective adjunct imaging modality in the surgical setting to evaluate patients who present with prior history of breast cancer or current mammographic findings. It is also a valuable tool to evaluate disease extent in newly diagnosed patients.

CLINICAL RELEVANCE/APPLICATION

Metabolic information about breast cancer can be a critical and integral part of clinical care for patients as part of an individualized, multidisciplinary breast care approach.

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BR275-SD-WEA6

Morbidity of Breast Cancer as a Function of Screening Interval: Annual versus Biennial

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #6

Participants
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PURPOSE

To compare breast cancer tumor characteristics and treatment regimens among women undergoing annual vs biennial screening mammography.

METHOD AND MATERIALS

This IRB-approved, HIPAA compliant retrospective study was performed at an NCI-Designated Cancer Center. Query of a breast imaging database yielded 490 consecutive patients diagnosed with breast cancer during 2016 and 2017. Of these, 232 were women aged 40-84 years undergoing annual or biennial screening with mammographically or clinically detected cancer. Annual screening was defined as 9-15 months; biennial screening as 21-27 months. Records were reviewed for patient demographics, tumor characteristics, and treatment regimens. Comparison between annual and biennial screening cohorts was conducted using t-tests or Wilcoxon rank-sum test for continuous variables and chi square or Fisher's exact tests for categorical variables.

RESULTS

Mean age at cancer diagnosis among 232 patients was 62 + 10 years. 171/232 (74%) cancers were invasive. Screening frequency was annual in 200/232 (86%) patients and biennial in 32/232 (14%). There were no significant differences in baseline characteristics between annual and biennial groups, including age, menopausal status, hormone replacement use, high risk status, family history, or race. Annual screening resulted in fewer late stage presentations (AJCC Stage 2, 3, or 4) than biennial [annual 48/200 (24%) vs biennial 14/32 (44%); p=0.02] and fewer interval cancers [annual 21/200 (11%) vs biennial 12/32 (38%); p<0.001]. Biennial screening was associated with larger mean tumor size at presentation (annual 1.4 + 1.2 cm vs biennial 1.8 + 1.6 cm; p=0.04). There was a trend towards larger median tumor size in the biennial group (annual 1.1 cm, SD 1.2 cm; biennial 1.2 cm, SD 1.6 cm; p=0.09). Compared with annual screening, biennial screening showed a trend for greater use of ALND [annual 24/200 (12%) vs biennial 6/32 (19%)] and chemotherapy [annual 55/200 (28%) vs biennial 12/32 (38%)].

CONCLUSION

Most women received annual rather than biennial screening. Biennial mammographic screening was associated with greater frequency of advanced stage disease and interval cancer.

CLINICAL RELEVANCE/APPLICATION

Biennial screening was associated with advanced stage breast cancer compared with annual screening. These results may be helpful in decision-making regarding frequency of breast cancer screening.

BR276-SD-WEA7

Comparative Radiomics Analysis of Contrast-Enhanced Mammography and Magnetic Resonance Imaging for Differentiation of Tumor Invasiveness, Hormone Receptor Status, and Tumor Grade in Breast Cancer Patients

Wednesday, Dec. 4 12:15PM - 12:45PM Room: BR Community, Learning Center Station #7

Participants
Maria Adele Marino, MD, Messina, Italy (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate and compare the potential of radiomics analysis of contrast-enhanced mammography (CEM) and magnetic resonance imaging (MRI) of the breast for the differentiation of invasive vs non-invasive cancer, hormone receptor status and tumor grade.

METHOD AND MATERIALS

In this IRB-approved HIPAA compliant retrospective data analysis 48 female patients with 49 histopathologically proven breast cancers who underwent pre-treatment CEM and breast MRI were analyzed. There were 45 invasive and 4 ductal carcinoma in situ. Among the invasive cancers: 40 were hormone-receptor positive (HR+) and 5 hormone-receptor negative (HR-). There were 5 Grade (G) 1 (DCIS=1; invasive cancers=4); twenty-three G2 (DCIS=2; invasive cancers=21) and twenty-one G3 (DCIS=1; invasive cancers=20). Radiomics analysis was performed using MaZda software (Technical University of Lodz, Poland). Lesions were manually segmented and radiomic features were derived from the first-order histogram (HIS). Fisher, probability of error and average correlation (POE+ACC), and mutual information (MI) coefficients were used for feature selection. Linear discriminant analysis followed by k-nearest neighbor classification (with leave-one-out cross-validation) was used for pairwise texture-based separation of subtypes/hormonal status.

RESULTS

MRI radiomics analysis yielded the following classification accuracies for differentiation of invasive/non-invasive breast cancers: Fisher: 90% (COM); POE: 88% (COM), MI: 88% (COM), of HR+ vs. HR- breast cancers: Fisher: 76.1%; POE: 80.4% ; MI: 82.6% , and of low grade (G1+G2) vs. G3 invasive cancers: Fisher: 77.8% (RUN); POE: 71.1% (pred. COM); MI: 73.3% (COM). CEM achieved the following accuracies for differentiation of invasive versus non-invasive breast cancers: Fisher: 92% (RUN); POE: 90% (COM); MI: 88% (COM), of Low grade (G1+G2) vs. G3 invasive cancers: 75.6% (WAV+RUN+COM); POE: 77.8% (RUN); MI: 64.4% (WAV+COM). For differentiate HRpos vs. HRneg: Fisher: 76.1% (COM); POE: 80.4% (pred. COM); MI: 82.6% (COM).

CONCLUSION

Radiomics analysis of MRI has the potential for non-invasive differentiation of invasive vs non-invasive cancer, hormone receptor status and grade with similar accuracies being achieved with CEM.

CLINICAL RELEVANCE/APPLICATION

Radiomics analysis with CEM and MRI achieve similar results

CA167-ED-WEA8

Coronary FFR-CT: Future or Fad?

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CA Community, Learning Center Station #8

Participants
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TEACHING POINTS

1. Fractional flow reserve (FFR) is a conventional angiographic technique that evaluates the decrease in flow distal to a coronary artery stenosis compared to the aorta. Coronary lesions with an FFR value of 0.80 or less are considered hemodynamically significant and patients will often have improved clinical outcomes following revascularization. 2. FFR-CT is an image post-processing technique applied to CT angiographic data to approximate the physiologic significance of a stenosis similar to FFR obtained during catheterization. 3. FFR-CT is beneficial in the evaluation of indeterminate stenoses (30-69%) and heavily calcified plaque to help guide need for invasive cardiac catheterization.

TABLE OF CONTENTS/OUTLINE

1. Invasive FFR, literature supporting decision-making using functional data rather than subjective anatomic stenosis evaluation. 2. FFR-CT trials - Concordance with invasive FFR and improved specificity over CTA. 3. Case examples: Triaging an intermediate stenosis between invasive angiography and medical management; Heavily calcified coronary artery disease; Tandem lesions; False positives and non-interpretable examinations. 4. Limitations: Post-processing time; Metallic artifact; Non-native coronary arteries; Motion artifact; patient body habitus; Cost & insurance reimbursement. 5. Future directions

CA220-SD-WEA3

Different Patterns of CMR in Fabry's Cardiovascular Disease

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CA Community, Learning Center Station #3

Participants
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PURPOSE

Importance of cardiac magnetic resonance(CMR) in the evaluation of different presentations in Fabry disease(FD) according to sex and age. FD is an X-linked genetic disease, resulting from alpha-galactosidase A(a-Gal A) deficiency. Fabry's cardiomyopathy disease (FCD) is a major cause of mobility and early mortality in these patients. The Left ventricular hypertrophy (LVH) is the most prominent feature. The presence of fibrosis has a key role in the progression of the disease, which has a specific pattern of distribution localized in the inferolateral and basal walls, leading to arrhythmias, heart failure and sudden cardiac death.

METHOD AND MATERIALS

We retrospectively described CMR features of 86 Fabry´s patients in Buenos Aires studied between 2005 and 2018, in order to highlight different types of cardiac involvement. Diagnosis of FD was confirmed by measurement of a-Gal A activity (males) and genetic testing (females). CMR was performed on a 1.5T Scanner (Siemens-Erlangen®, Germany), ECG triggering with morphology, cine and IR sequences after a bolus of gadolinium-DTPA (0.2mmol/kg) for Late Gadolinium Enhancement (LGE) to see the fibrosis. In order to evaluate LVH and Fibrosis (by LGE) we separate patients into 4 groups according to sex and age, considering young patients from 20 to 40y and adults to those over 40y.

RESULTS

FCD patients were identified in 4 patterns: Pattern 1: young women (n= 34). CMR: 32 pts showed septum thickness below pathological values (cut off value <= 12 mm) (media 9.42 mm) and 28 patients were negative for LGE. Pattern2 : young men (n=20). CMR: 9 patients showed a mild LVH (media: 14 mm) with preserved left ventricule function and volumes. Positive LGE was observed in 9 patients (45%). Pattern 3: adult women (n=18). CMR: LVH is observed in 12 patients (media 15.75 mm). Positive LGE was present in 9 patients (50%). Pattern 4: adult men (n=14). CMR: The main characteristic was the increased septum thickness observed in all patients (media 21.5 mm) and positive LGE in 9 patients nearly the whole myocardium (64%). Typically, older men present more advanced features that lead to complications like arrhythmias and sudden death.

CONCLUSION

CMR is a useful for the evaluation of CFD. We describe the presence of 4 cardiac patterns, which increases in relation to age and sex

CLINICAL RELEVANCE/APPLICATION

CMR is useful in monitoring FD and helps to identify the different forms of cardiac involvement.

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CA252-SD-WEA6

Myocardial Strain Analysis with Feature-Tracking Magnetic Resonance in Patients with Cardiac Amyloidosis

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CA Community, Learning Center Station #6

Participants
Paola M. Cannao, MD, San Donato Milanese, Italy (*Presenter*) Nothing to Disclose
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PURPOSE

To assess strain parameters in patients with cardiac amyloidosis and appraise whether there are correlations between strain parameters and left ventricular volumes and function.

METHOD AND MATERIALS

Patients with cardiac amyloidosis who had undergone cardiac magnetic resonance at our centre were retrospectively analysed. Short-axis cine sequences were segmented at end-systole and end-diastole to calculate left ventricular volumes indexed to body surface area (end-diastolic EDVi, and end-systolic ESVi), stroke volume (SV), ejection fraction (EF) and mass index (Mi). Wall thickness (WT) was measured in the septum at mid-level. Short-axis cine segmentations were used for the calculation of global circumferential strain (GCS), while long-axis cine sequences were segmented for the calculation of global longitudinal (GLS) and radial strain (GRS).

RESULTS

21 patients were analysed, with a median age of 71 years (interquartile range (IQR) 64-78 years), 15 of which were men (71%). EDVi was 63 ml/m2 (IQR 58-70 ml/m2), ESVi 32 ml/m2 (IQR 25-39 ml/m2), SV 58 ml (IQR 45-71 ml), EF 51% (IQR 42-57%), Mi 139 g/m2 (IQR 112-169 ml/m2), and WT 17 mm (IQR 13-22 mm). GLS was impaired (-12% IQR -14%--10%) in amyloidosis patients compared to healthy controls reference values, while GCS (-17% (-19--13%) and GRS (41% IQR 30-46%) were within normal range. Moreover, GLS had significant negative correlations with both SV (ρ=-0.551, P=0.014) and EF (ρ=0.765, P<0.001).

CONCLUSION

Amyloidosis patients show impaired cardiac contractility, especially related to shortening of the left ventricle.

CLINICAL RELEVANCE/APPLICATION

Global circumferential strain should be used as an early indicator of LV dysfunction in patients with amyloidosis.

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CA253-SD-WEA7

Fabry's Disease without Changes in T1 Mapping Can Be Differentiated from Healthy Volunteers by Feature Tracking Strain Imaging

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CA Community, Learning Center Station #7

Participants
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PURPOSE

Myocardial involvement in Fabry disease is a common manifestation and leads in higher stages to begin of an enzyme replacement therapy (ERT). The extent of hypertrophy and fibrosis of the heart is commonly acquired in cardiac magnetic resonance (CMR) with late gadolinium enhancement and T1 mapping. In early disease stages, CMR can be normal regarding left ventricular hypertrophy, T1 Mapping and presence of fibrosis. The aim of this retrospective study was to evaluate the diagnostic value of strain imaging in Fabry's disease without obvious cardiac involvement in CMR.

METHOD AND MATERIALS

In our study, 57 healthy volunteers with no history of cardiac events and 61 patients with a diagnosis of Fabry's disease underwent CMR imaging at 3T. We identified 20 patients without phenotypic cardiac involvement in CMR. Using a semi-automatic tissue tracking software (CVI Circle®), we measured global strains for both ventricles from multiple axes. The strain parameters acquired from this group were compared with healthy volunteers.

RESULTS

All common parameters in CMR as ejection fraction, end-diastolic volume, myocardial mass, LGE or T1 relaxation time showed no significant difference between healthy volunteers and Fabry patients in the early accumulation phase. In contrary, all feature tracking strain parameters differed significantly between both groups. The most powerful parameter was left ventricular longitudinal strain with a mean of 20.6% (± 2.6) for healthy volunteers and 16.3% (± 4.1) for Fabry's disease in early accumulation phase ($p<0.0001$).

CONCLUSION

Feature tracking strain parameters perceive subclinical changes in Fabry's disease.

CLINICAL RELEVANCE/APPLICATION

Accumulation of sphingolipids in Fabry's disease is a lifelong process. Cardiac involvement seems to begin earlier than anticipated. We recommend adding strain imaging as a parameter to evaluate cardiac involvement in early disease stages. Implications on initiation of ERT have to be determined.

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CA254-SD-WEA5

Deep Learning-Based Automated CT Coronary Artery Calcium Scoring

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CA Community, Learning Center Station #5

Participants
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PURPOSE

As the determination of coronary artery calcium scores (CACS) is labor-intensive and time-consuming, a more automated workflow is desirable to reduce the need for human interaction. The purpose of this study was to evaluate an artificial intelligence (AI)-based automated coronary artery calcium scoring application for electrocardiogram (ECG)-gated non-contrast cardiac computed tomography (CT).

METHOD AND MATERIALS

We analyzed a fully automated calcium scoring application that is composed of multiple deep learning models, including voxel segmentation and computing the likelihood of a voxel being coronary calcium. The software automatically identifies the coronaries and calcified lesions, whereas aortic plaques are excluded from the calculations using a model for aorta segmentation. This algorithm was trained on about 2000 annotated ECG-gated cardiac CT scans. Then, the application was evaluated on 511 consecutive patients (mean age, 56.4±10.2 years; 211 men) undergoing dedicated calcium scoring CT. Results were compared to CACS obtained via standard manual assessment by independent cardiovascular imagers.

RESULTS

CACS values revealed no significant differences between the automated algorithm and the reference standard (P=0.282). CACS using the automated application showed an excellent correlation with the reference standard (Pearson, r=0.97). In addition, the fully automated software classified 476 of 511 (93.2%) patients into the same risk category (0, 1-10, 11-100, 101-400, or >400) as the human observers, whereas 35 (6.8%) patients were misclassified into a different category. Overall, 15 (2.9%) patients were downgraded to a lower category and 20 (3.9%) patients were upgraded to a higher category.

CONCLUSION

AI-based automated calcium scoring for non-contrast ECG-triggered cardiac CT shows high accuracy when compared to manually obtained reference scores. The use of this fully automated software application may reduce the need for human user interaction and interpretation time.

CLINICAL RELEVANCE/APPLICATION

The use of this AI-based fully automated software application may reduce the need for manual input and interpretation time and thus enhance workflow efficiencies for this growing CT application.

CA255-SD-WEA4

ECG-Gated Multislice Computed Tomography in Aortic Perivalvular Abscess: Comparison with Transthoracic Echocardiography, Transesophageal Echocardiography, and Intraoperative Findings

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CA Community, Learning Center Station #4

Participants
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PURPOSE

To compare the feasibility and diagnostic accuracy of electrocardiogram-gated multislice computed tomography (ECG-gated MSCT), transthoracic echocardiography (TTE) and transeosophageal echocardiography (TEE) in patients complicated with aortic perivalvular abscesses

METHOD AND MATERIALS

Between January 1, 2011 and July 31, 2015, the imaging records of ECG-gated MSCT, TTE and TEE of 56 patients with surgically confirmed aortic perivalvular abscesses, if present, were reviewed for presence of aortic perivalvular abscesses, extension, fistulization, vegetations, congenital valvular anomalies and valvular destruction, with surgical findings as the reference standard. To calculate the diagnostic performance of each imaging modality, another 56 cases of infective endocarditis without perivalvular abscesses were included.

RESULTS

When calculated with respective patients in each imaging modality, the per-patient-based diagnostic performance for detecting aortic perivalvular abscess was sensitivity (Sn) 92.3%, specificity (Sp) 95.5% in MSCT, Sn 66.1%, Sp 90.9% in TTE, Sn 90.9%, Sp 100% in TEE; the per-patient-based diagnostic performance for extension of abscesses was Sn 88.7%, Sp 96.2% in MSCT, Sn 61.2%, Sp 98.1% in TTE, Sn 88%, Sp 97.9% in TEE; the per-patient-based diagnostic performance for fistulization was Sn 95%, Sp 97.7% in MSCT, Sn 81.5%, Sp 98.6% in TTE, Sn 70%, Sp 98.3% in TEE; the per-patient-based diagnostic performance for congenital valvular anomaly and valvular destruction was Sn 86.4%, Sp 89.6% and Sn 76.3%, Sp 46.7%in MSCT, Sn 79.4%, Sp 79.5% and Sn 66.1%, Sp 81.1% in TTE, Sn 76.5%, Sp 88.9% and Sn 76.5%, Sp 76.5% in TEE.

CONCLUSION

ECG-gated MSCT is more sensitive in detecting aortic perivalvular abscesses, their extension, fistulization and congenital valvular anomalies but is inferior in demonstration of vegetations and valvular destruction when compared with TTE and TEE.

CLINICAL RELEVANCE/APPLICATION

ECG-gated MSCT is more sensitive in detecting aortic perivalvular abscesses, their extension, fistulization and congenital valvular anomalies but is inferior in demonstration of vegetations and valvular destruction when compared with TTE and TEE.

CH230-ED-WEA7

A Resident's Guide to Understanding the New 2018 ACR White Paper for the Management of Incidental Mediastinal and Cardiovascular Findings on Thoracic CT

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CH Community, Learning Center Station #7

Participants
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TEACHING POINTS

1. Review the new ACR White Paper recommendations on the Management of Incidental Mediastinal and Cardiovascular Findings on Thoracic CT. 2. Review the ACR White Paper Algorithm with case based examples. 3. Understand the features of common benign mediastinal and cardiovascular findings and when further evaluation is appropriate. 4. Understand the limitations of the ACR recommendations and to which scenarios they do not apply.

TABLE OF CONTENTS/OUTLINE

I. Introduction a. Nature and scope of the problem i. Mediastinum ii. Cardiovascular b. Define an incidentally detected finding c. Describe the implications of imaging and clinical features of incidentally detected findings d. When to apply the algorithm II. Algorithm with case-based examples a. Basic principles b. Review most commonly encountered benign findings c. Case-based examples i. Incidental, Asymptomatic Mediastinal Lymph Node ii. Incidental, Asymptomatic Mediastinal Mass iii. Incidental, Asymptomatic Pericardial Abnormality iv. Thoracic Aortic Dilation and Aneurysm v. Coronary Artery Calcification vi. Pulmonary Artery III. Protocol optimization IV. Report considerations V. Summary VI. References

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CH231-ED-WEA8

Brief Report on Radiological Changes Following Radiofrequency Ablation of Lung Metastasis: A Pictorial Essay

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CH Community, Learning Center Station #8

Participants
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TEACHING POINTS

Radiological changes following radiofrequency ablation (RFA) of Lung metastasis may present different forms on computed tomography (CT) scan: (1) acute radiological changes (diffuse consolidation, patchy consolidation, diffuse ground glass opacity (GGO), and patchy GGO); (2) late radiological changes (fibrosis, scar-like fibrosis and mass-like fibrosis); (3) high-risk radiological features of residual or recurrent disease (increasing contrast material uptake in the ablation zone, nodular enhancement measuring more than 10 mm, any central enhancement greater than 15 HU; growth of the RFA zone after 3 months and definitely after 6 months, peripheral nodular growth and change from ground-glass opacity to solid opacity, regional or distant lymph node enlargement, and new intrathoracic or extrathoracic disease). The purpose of essay is to review the different radiological changes seen after radiofrequency ablation (RFA) in metastasis to lung and how to distinguish it from residual or recurrent disease.

TABLE OF CONTENTS/OUTLINE

Illustrative cases from our department were collected and classified according to these different pattern types. Radiology presentations, differential diagnosis and teaching points were also described.

CH232-ED-WEA9

Crossing and Filling the Pleural Space: Pitfalls in Post Thoracic Surgery CT Interpretation

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CH Community, Learning Center Station #9

Awards
Certificate of Merit

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TEACHING POINTS

1. Review of space fillers used in thoracic surgeries. 2. Review of their imaging features. 3. Case wise demonstration of their utility in thoracic surgeries

TABLE OF CONTENTS/OUTLINE

1. To give a brief overview of surgical procedures where space fillers are used such as • Pleurectomy • Pneumonectomy • Empyema drainage • Lobectomy • Bronchopleural fistula closure 2. To describe different space fillers used in thoracic surgeries • Muscle flaps- intercostal, pectoralis, serratus anterior and latissmus dorsi muscle flaps • Omental flaps • Breast prosthesis. 3. Imaging features with emphasis on CT but also including other modalities such as plain radiographs and MRI 4. Case based demonstration of their utility in thoracic surgeries with examples • Post pneumonectomy for bronchial stump closure • Persistent bronchopleural fistula. • Empyema drainage • Space fillers in post pneumonectomy syndrome • Space fillers following mesothelioma resection

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CH260-SD-WEA1

Effects of the First Deep Learning CT Reconstruction Technique (AiCE) Using Thinner Slices Versus State-of-the-Art Adaptive Dose Reduction 3D (AIDR 3D) on Image Quality and Dose Management in CT Pulmonary Angiography

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CH Community, Learning Center Station #1

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PURPOSE

This study aimed to compare the effectiveness of the first deep learning CT reconstruction technique (AiCE) versus the current gold-standard iterative reconstruction technique (AIDR 3D Enhanced) in improving the image quality and reducing the radiation dose on thin slice reconstruction for CT pulmonary angiography.

METHOD AND MATERIALS

140 consecutives patients who underwent CT pulmonary angiography (CTPA) for suspected pulmonary embolism between November 2018 and January 2019 were retrospectively reviewed. 70 (50%) CTPA images were obtained using 1mm thick AIDR 3D reconstructions, and 70 (50%) CTPA images were reconstructed using 0.5mm thick AiCE reconstructions. Image quality was both assessed objectively (image noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR)) and subjectively by three independent radiologists. Radiation dose (CTDI and DLP) were recorded.

RESULTS

AiCE significantly reduced image noise compared with AIDR 3D (P?

CONCLUSION

AiCE reconstruction significantly improves image quality and offers an additional radiation dose reduction while allowing slices that are twice as thin compared to the AIDR 3D reconstruction in pulmonary CT angiography examinations.

CLINICAL RELEVANCE/APPLICATION

This study reveals that AiCE (based on Deep Learning Reconstruction) significantly improves image quality and offers an additional radiation dose reduction. DLR allows submillimetric slices for routine CTPA for the evaluation of pulmonary embolism and without additional reconstruction time.

CH262-SD-WEA3

Clinical Value of Ultra-HRCT in Pulmonary Nodules: Comparison of 0.5-mm 512-Matrix HRCT with 2-mm 1024-Matrix HRCT

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CH Community, Learning Center Station #3

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PURPOSE

To elucidate the clinical value of the ultra-high-resolution CT (U-HRCT) scanner that provides superior image quality of pulmonary nodules without increasing the amount of data.

METHOD AND MATERIALS

Eighty-nine pulmonary nodules examined by U-HRCT scanner from December 2017 to April 2018, which were < 30 mm and > 6 mm, were included. All examinations were performed with U-HRCT scanner in super-high-resolution (SHR) mode; the number of channels and detector rows was 1792 and 0.25 mm × 160, and focus size was 0.6×0.6 mm.Each nodule was reconstructed into two types of high-resolution CT (HRCT); 0.5-mm thickness, 512×512 matrix, 34.5-cm field of view (FOV) (0.5-mm 512-matrix HRCT) and 2 -mm thickness, 1024×1024 matrix, 34.5-cm FOV (2-mm 1024-matrix HRCT). When the extent of the coverage is the same, these two types of HRCT produce the same amount of data. Three chest radiologists independently evaluated HRCT findings of the nodules (margin, lobulation, pleural indentation, spiculation, linear margin, ground-glass opacity, solid component, air bronchogram), peripheral structures (vessels and bronchioles), noise, and overall image quality using a 5-point scale (1 = worst, 5 = best).

RESULTS

All HRCT findings of 2-mm 1024-matrix HRCT scored statistically higher than those of 0.5-mm 512-matrix HRCT (for example, margin 4.1 ± 0.5, 3.0 ± 0.2, lobulataion 4.1 ± 0.5, 3.0 ± 0.1, pleural indentation 3.7 ± 0.8, 3.0 ± 0.1 spiculation 4.0 ± 0.6, 3.0 ± 0.1, air bronchogram 4.0 ± 0.6, 3.0 ± 0.1, overall image quality 4.1 ± 0.6, 3.0 ± 0.1, respectively) ($p<0.0001$), with the exception of noise (2-mm 1024-matrix HRCT, 2.9 ± 0.9), which scored significantly lower than that of 0.5-mm 512-matrix HRCT (3.0 ± 0.1) ($p=0.036$).

CONCLUSION

2-mm 1024-matrix HRCT images were superior than 0.5-mm 512-matrix HRCT images in evaluating the findings of pulmonary nodules except for noise. Using the advantage of a 1024×1024 matrix, U-HRCT can provide superior images of pulmonary nodules without increasing the amount of data, in spite of an increase in image thickness.

CLINICAL RELEVANCE/APPLICATION

Using 2 -mm 1024-matrix HRCT images, Ultra-high-resolution CT scanner can result in improved image quality without increasing the amount of data in evaluating the HRCT findings of pulmonary nodular lesions.

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CH289-SD-WEA5

Natural Courses of Stable Subsolid Nodules for the Initial 5-Years: How Many Fractions of the Nodules Have Grown Since Then and Do These Growths Have an Impact on the Patients' Outcome?

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CH Community, Learning Center Station #5

Participants
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PURPOSE

To investigate subsequent natural course of subsolid nodules (SSNs) after being stable during initial 5-years of follow-ups and outcome of the individuals with these SSNs.

METHOD AND MATERIALS

After searching for all SSNs which were stable during initial 5-years and reviewing their all available chest CT which were taken between January 2002 and December 2018, we selected total 320 SSNs of 235 individuals (male, n=103; female, n=132; mean age, 64.2 ± 9.5 years) as the study population. Various clinical and radiological characteristics including growth of SSNs were evaluated. Thereafter, both nodule-based and patient-based analyses were performed for growth rates of SSNs after 5-years and predictors for growth, using Kaplan-Meier analyses with the log-rank test and Cox proportional hazard regression analysis. Finally, clinical stage shift of SSNs on their follow-ups and survival analysis of the study population were evaluated as well.

RESULTS

During median follow-up duration of 112 months (range, 84 - 208 months; IQR, 96 -135 months), seven (pure ground-glass nodule, n=5; part-solid nodule, n=2) of 320 (2.2%) was adjudicated to grow during their follow-ups (84, 86, 90, 97, 99, 107, and 146 months) in nodule-based analysis. Their growth patterns included increase of entire nodule (n=4), increase of solid part size (n=2) and new occurrence of solid part (n=1). For patient-based analysis, 4 of 235 (1.7%) SSNs were judged to have growth. Bubble lucency (hazard ratio [HR], 6.753; 95% confidence interval [CI], 1.309 - 34.830; p=0.023) and average diameter of 10mm or larger (HR, 9.075; 95% CI, 1.275 - 64.6; p=0.028) were significant predictors for growth in nodule-based and patient-based analyses, respectively. Although three SSNs had clinical stage shifts after growth (Tis to T1 mi, n=1; T1 mi to T1a, n=2), there was no death (p=0.657) or metastasis among the individuals whose SSNs grew.

CONCLUSION

For SSNs being stable for initial 5-years, very small proportion of them (2.2% of nodules and 1.7% of these patients) showed subsequent growth, of which clinical significance might not be substantial.

CLINICAL RELEVANCE/APPLICATION

For SSNs being stable for initial 5-years, subsequent growth is rare and their clinical significance might not be substantial.

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CH290-SD-WEA6

Radiomic Machine Interpretations Can Improve Lung Nodule Diagnostic Sensitivity for Human Readers: Preliminary Findings in a Multi-Site Multi-Reader Study

Wednesday, Dec. 4 12:15PM - 12:45PM Room: CH Community, Learning Center Station #6

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PURPOSE

Distinguishing pulmonary granulomas from adenocarcinomas is amongst the most challenging clinical problems for thoracic radiologists. Approximately 19% of these benign nodules undergo intensive evaluation to rule out malignancy. The purpose of this study was to investigate if sub-visual quantitative imaging information (radiomic features) mined from CT using a Radiomic Machine Interpreter (RMI) could help radiologists correctly diagnose 'indeterminate' or 'suspicious' cases.

METHOD AND MATERIALS

The dataset included N=205 non-contrast lung CT scans with histopathologic confirmation of nodule status, collected from two sites. A set of 1776 radiomic textural patterns (Haralick, Laws energy, Histogram of Gradients, Gabor) were extracted from within, and 3 cm outside the expert-annotated lesions. After selecting the top 12 features, a support vector machine based RMI was trained on randomly chosen N=145 and tested on N=60 studies. The RMI assigned probability scores for each test case. Independently, two board-certified cardiothoracic radiologists with 9- and 11-years of experience, assigned each scan in the test set a value of 0=benign, 0.25=probably benign, 0.5 = suspicious/uncertain, 0.75=probably malignant, and 1=malignant. Following a washout period of 1 week, the readers regraded studies that had values=0.5 for both readers during the first read. They were provided with the confidence of RMI but blinded to the pathology reports. A majority voting scheme (MVS) was used which combined RMI's confidence and the readers' confidence before (MVS_before) and after re-grading (MVS_after).

RESULTS

The sensitivity and specificity for the RMI (0.73, 0.63) was higher than both readers (0.63, 0.5 and 0.63, 0.17). Sensitivity for MVS_before was 0.8, but 0.9 for MVS_after. Of the 9 indeterminate cases where re-grading was possible, reader 1 concurred with the RMI on all the cases, while reader 2 did so on 5/9 cases.

CONCLUSION

Our results suggest that reassessment of tumor diagnosis, in presence of supporting radiomic information, can potentially mitigate uncertainty associated with expert visual diagnosis.

CLINICAL RELEVANCE/APPLICATION

RMIs could help reduce the number of resections, biopsies, bronchoscopies, and repeat imaging scans ordered on account of benign nodules currently identified as indeterminate or suspicious on CT.

ER169-ED-WEA6

Splenic Trauma: New 2018 AAST Injury Grading Scale for an Evolving Landscape towards Non-Operative Management

Wednesday, Dec. 4 12:15PM - 12:45PM Room: ER Community, Learning Center Station #6

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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TEACHING POINTS

Evaluation with computed tomography (CT) allows for the diagnosis and stratification of splenic injuries according to the American Association for the Surgery of Trauma (AAST) splenic injury scale. This scale was revised in 2018, primarily to include splenic vascular injuries, to address increasing clinical preference towards non-operative management and angioembolization. The purpose of this exhibit is to: • Illustrate the new 2018 AAST splenic injury grading system, highlighting changes that are new to this revision. • Describe the appearance of splenic parenchymal and vascular injuries on multimodality (including CT and angiography) imaging. • Review the recent evolution in management of splenic injuries. • Discuss the implications of imaging findings and radiologic AAST grading on treatment and prognosis.

TABLE OF CONTENTS/OUTLINE

• Trends in management strategies for splenic trauma • Normal splenic anatomy, with an emphasis on splenic vascular anatomy and implications for injury and management • Overview of the new 2018 AAST splenic injury grading system • Pictorial review of the spectrum of splenic parenchymal and vascular injuries • Case Illustrations of splenic injuries and subsequent management, stratified according to the new AAST splenic injury scale

ER170-ED-WEA7

Perilous Pipe Problems: Review of Abdominopelvic Arterial Emergencies

Wednesday, Dec. 4 12:15PM - 12:45PM Room: ER Community, Learning Center Station #7

Participants
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TEACHING POINTS

1. Become familiar with the spectrum of acute abdominal aortic aneurysm findings, including differentiating between different stages of rupture (impending and acute/contained rupture) and aneurysm subtypes necessitating urgent repair (enlarging, inflammatory and mycotic). 2. Learn to identify clinically relevant findings of type B aortic dissection involving the abdominal aorta, including evaluating for the potential of dynamic obstruction. 3. Review high yield common anatomic variants which are susceptible to iatrogenic and traumatic injury. 4. Learn to optimize imaging protocols to expedite accurate diagnosis of vascular pathologies.

TABLE OF CONTENTS/OUTLINE

I. Introduction a. Key anatomy b. Technical tips II. Abdominal aorta a. Aneurysm i. Impending rupture ii. Rupture 1. Aortoenteric fistula 2. Aortocaval fistula iii. Contained rupture b. Dissection i. Malperfusion due to dynamic obstruction ii. Malperfusion due to static obstruction III. Mesenteric arteries a. Vasculitis b. Thrombosis c. Aneurysm/Pseudoaneurysm IV. Anatomic variants a. Corona mortis b. Persistent sciatic artery V. Trauma a. Visceral arterial injury b. Mesenteric arterial injury VI. Pitfalls a. Protocol Optimization VII. Conclusion

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ER215-SD-WEA1

Feasibility of Point-of-Care Knee Ultrasonography for Diagnosing Anterior Cruciate and Posterior Cruciate Ligament Tears in the Emergency Department

Wednesday, Dec. 4 12:15PM - 12:45PM Room: ER Community, Learning Center Station #1

Participants
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PURPOSE

To evaluate the feasibility of point-of-care knee ultrasonography (POCUS) compared with knee magnetic resonance imaging (MRI) for diagnosing anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) tears in patients with acute knee trauma.

METHOD AND MATERIALS

A prospective study was conducted in a tertiary hospital emergency department; acute (within 1-week) knee trauma patients with suspected ACL or PCL tear were recruited. Two POCUS performers (a board-certified emergency physician and a musculoskeletal radiologist) independently evaluated the ACL and PCL using POCUS. Findings were classified as normal appearance or ligament tear. Final radiology reports of knee MRI were used as the reference standard. We compared the diagnostic values for POCUS obtained by both POCUS performers using DeLong's test. Receiver operating characteristic (ROC) curve analysis was performed for calculation of areas under the ROC curves (AUCs). Kappa values (k) were calculated for agreement between each POCUS performer and the reference standard, and directly between the two POCUS performers.

RESULTS

Sixty-two patients were enrolled. Compared with the reference standard, POCUS showed acceptable sensitivity (90.6-100%), specificity (90.0-97.7%), accuracy (91.9-96.8%), and AUC (0.919-0.977); these diagnostic performance values did not differ significantly between reviewers (p=0.18-1.0). Agreement between each reviewer and the reference standard was excellent (k = 0.839-0.926), as was the inter-observer agreement (k = 0.853-0.903).

CONCLUSION

POCUS demonstrates excellent precision as compared to MRI in the diagnosis of ACL and PCL tears.

CLINICAL RELEVANCE/APPLICATION

The findings of POCUS could be used for immediate diagnosis and further pre-operative imaging in patients with acute knee trauma.

ER216-SD-WEA2

Defining CT Based Imaging Variables that Correlate with Angiographic Findings and Clinical Outcome in Trauma Patients

Wednesday, Dec. 4 12:15PM - 12:45PM Room: ER Community, Learning Center Station #2

Participants
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PURPOSE

CT is the imaging modality of choice for trauma assessment. CT findings do not always correlate with angiographic or clinical outcome. This study aims to better define the key findings on CT that can predict these outcomes.

METHOD AND MATERIALS

Retrospective longitudinal cohort study in an academic center from September 2005 to August 2016 with ethics approval. Trauma patients with CT evidence of extravasation or pseudoaneurysm who then went to angiography were identified. Patients with incomplete data were excluded. Data was reviewed by three reviewers. This data included, among other things: CT-phases of contrast, anomaly specific findings such as number, location, edge sharpness, size of touching vessel, volume change between CT-phases, Houndsfield Units (HU), HU changes between CT-phases, volume change of associated hematoma between CT-phases, characterization on angiography, angiographic treatment, and mortality data. 100 patients fit the criteria. Statistics were performed using logistic regression and odds ratios.

RESULTS

76% males. 50 y.o. mean age. Cause of trauma: 38% MVA, 46% fall, 13% weapon. Average injury severity score: 25.4. Injury location: 31% spleen, 20% intrapelvic, 15% kidney, 12% liver, 22% other. Among other things, mortality correlated significantly with CT diagnosis of extravasation over pseudoaneurysm ($p=0.02$) and with angiographic treatment ($p=0.04$). CT diagnosis of pseudoaneurysm was confirmed by angiography in only 61%. CT findings that predicted correlation included early arterial phase ($p=0.0001$), # of pseudoaneurysms ($p<0.0001$), anomaly located in solid organs ($p=0.0002$), single organ injury ($p=0.03$), sharp edges ($p=0.0005$), vessel the touching anomaly ($p=0.0005$), stable size of anomaly between CT phases ($p<0.0001$), ratio of HU in anomaly versus aorta ($p=0.05$), drop in anomaly HU similar to aorta between CT phases ($p=0.01$). Using these variables increases significantly accuracy in identifying a pseudoaneurysm on CT ($R=0.96$).

CONCLUSION

Defining extravasation from pseudoaneurysm on a trauma CT is often based on gestalt. Our data demonstrates that correct characterization can impact mortality and that specific findings can help significantly increase accuracy.

CLINICAL RELEVANCE/APPLICATION

Specific findings on trauma CTs should be discussed in the report as these findings can help accurately differentiate active extravasation from pseudoaneurysms which can impact angiographic treatment and mortality.

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ER217-SD-WEA3

Diagnostic Accuracy of Three-Dimensional Surface Rendering Reconstruction Images in Detection of Cervical Spine Injuries Using Multi-Planar Computed Tomography as Reference Standard

Wednesday, Dec. 4 12:15PM - 12:45PM Room: ER Community, Learning Center Station #3

Participants
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PURPOSE

Road traffic accidents are a leading cause of spinal trauma, which most commonly affects cervical spine. Cervical spine may also be injured in fall from height, sports injury and violence. C-Spine injuries are frightening as these may be associated with significant neurological damage, paralysis or even death. CT is the initial modality of choice in acute spinal trauma. CT is superior due to its wider availability, rapid scan time and excellent diagnostic performance in evaluation of fractures or dislocation. 3D reconstruction is a newer advancement which has become popular likely due to a better visual display of anatomic spatial relationships. The purpose of study is to assess diagnostic accuracy of three dimensional surface rendering reconstruction images in detection of cervical spine injuries in symptomatic post-trauma patients using multiplanar computed tomography (MPCT) as reference standard.

METHOD AND MATERIALS

The study was conducted at Department of Radiology, Aga Khan University Hospital from Jan 2017 to Dec 2017. All patients referred for CT from ER fulfilling the inclusion criteria were included. The final study population consisted of 205 patients. An experienced senior radiologist having more than 5 years of experience evaluated the 3-D reconstructions and 640 slice Multiplanar CT (MPCT) images separately to identify cervical spine injuries.

RESULTS

Three-dimensional CT scan for fractures in the cervical spine was found to have sensitivity of 71%, specificity of 100%, positive predictive value of 100% and negative predictive value of 96.8% with an overall diagnostic accuracy of 97%. On the other hand, three-dimensional CT scan for dislocations in the cervical spine was found to have sensitivity of 83.34%, specificity of 100%, positive predictive value of 100% and negative predictive value of 99.5% and diagnostic accuracy of 99.5%.

CONCLUSION

Three-dimensional CT scan has good sensitivity as a diagnostic tool in the detection of cervical spine injuries but to improve the overall patient care three-dimensional images and multiplanar CT images must be reviewed simultaneously.

CLINICAL RELEVANCE/APPLICATION

Three dimensional CT scan is equal to multiplanar CT in assessment of fracture or dislocation in cervical spine following trauma and may be a useful adjunct.

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ER237-SD-WEA4

A 2019 International Survey to Assess Trends in Follow-Up Imaging of Blunt Splenic Trauma

Wednesday, Dec. 4 12:15PM - 12:45PM Room: ER Community, Learning Center Station #4

Participants
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PURPOSE

There are no published societal guidelines on the follow-up imaging of conservatively managed blunt splenic trauma. Our goal was to survey emergency radiologists across North America and abroad to determine the patient population, time period and technique for follow-up imaging of blunt splenic trauma.

METHOD AND MATERIALS

With IRB approval, an anonymous 10-question online survey was distributed via email to 34 emergency radiologists around the world. The survey was open for a 2-week period in March 2019. A commercially available website (SurveyMonkey®) was used for survey generation and data acquisition.

RESULTS

We received 27 responses (79% response rate) primarily from USA, Canada and Europe (56%, 22% and 22% respectively). Majority of the institutions handled over 1000 trauma cases with over 500 blunt traumas per year (67% and 63% respectively). The initial trauma protocol consisted of arterial and portal venous phases in 78% of cases. Fifty nine percent of the institutions did not have a routine protocol for follow-up of patients with blunt splenic trauma. There was no consensus on which patients received follow-up imaging but most frequent responses had been case-per-case basis or injuries above a set AAST grade (42% and 37% respectively). Majority of the centres did not have a standard time-period for follow-up imaging of blunt splenic trauma but most often performed follow-up MDCT at 24-48 hours. The protocol of choice for follow-up imaging was most commonly arterial and portal venous phase (PVP) (69%) followed by PVP only (31%). Majority of the institutions (88%) utilized catheter angiography and embolization for hemodynamically stable patients with contained vascular injury or active extravasation.

CONCLUSION

There is no consensus on the optimal patient population or time period for follow-up imaging of blunt splenic trauma. Dual arterial and PVP follow-up MDCT is used for follow-up by majority of institutions. Catheter angiography with embolization is the most common method of treatment in hemodynamically stable patients.

CLINICAL RELEVANCE/APPLICATION

No consensus exists for the imaging of blunt splenic trauma and the decision most often rests in the hands of the clinical team.

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ER238-SD-WEA5

Can Pulmonary Embolism Rule-Out Criteria Replace the Need for D-Dimer Testing Among Patients with Low Clinical Probability in the Emergency Department?

Wednesday, Dec. 4 12:15PM - 12:45PM Room: ER Community, Learning Center Station #5

Participants
Ahmed Al Lawati, MD, Muscat , Oman (*Presenter*) Nothing to Disclose
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PURPOSE

The Pulmonary Embolism Rule-Out Criteria (PERC) rule has been suggested as an alternative to D-dimer testing in patients with low riisk in pretest Pretest probability clinical scoring systems. This study looked at whether the PERC rule could safely replace the use of D-dimer in patients suspected of PE.

METHOD AND MATERIALS

Retrospectively we reviewed 350 patients with a suspected pulmonary embolism and had computed tomography pulmonary angiography (PCTA) and a blood sample for D-dimer level taken. PERC was retrospectively calculated for all patients and the diagnostic performance of the PERC rule was compared with a standard D-dimer level in the detection of PE

RESULTS

Of the 350 patients, 56 had positive CTPA and 294 had a negative scan. In these patients, the sensitivity of the PERC rule for detecting PE was 98.2% [95% confidence interval (CI): 90.45% to 99.95%], with a negative likelihood ratio of 0.16 (95% CI: 0.02 to 1.18). However, the negative predictive value of the PERC rule was 96.97 % % (95% CI: 81.70% to 99.57%). In comparison, the sensitivity for the standard D-dimer test was 98.21%% (95% CI: 90.45% to 99.95%), with a negative likelihood ratio of 0.24 (95% CI: 0.03 to 1.73). The negative predictive value for the standard D-dimer test was 95.65 % (95% CI: 75.17% to 99.38%).

CONCLUSION

The PERC rule has a high negative predictive value for excluding PE in patients presenting with suspected PE to the emergency department.

CLINICAL RELEVANCE/APPLICATION

Pulmonary embolism (PE) is a common and potentially fatal cardiovascular emergency. Pretest probability clinical scoring systems are used to stratify patients a suspicion of pulmonary embolism into low risk and high risk for PE. Patients with low risk for PE usually undergo D-dimer testing. A negative D-dimer in this low-risk group rules out PE with a high degree of certainty because of its high sensitivity. The D-dimer is, however, a poorly specific test and positive results often lead to unnecessary radiological imaging.

GI307-ED-WEA14

Spectrum of Rectus Abdominis Masses: What, When, and Why

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #14

Participants
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TEACHING POINTS

To classify masses of rectus abdominis according to their pathologic and clinical aspects (inflammation/tumor-like lesion/benign and malignant tumor, focal lesion/part of a systemic disease, with/without history of rectus abdominis incision surgery). To review the typical CT and MRI findings of rectus abdominis masses and learn the imaging mimics. To emphasize the key points in addition to imaging for differentiation, including the history of a systemic disease, surgery (if yes, when), sex (female) and other specific symptoms related (4S). To realize the underlying etiology of the masses and avoid missed and mis-diagnoses of related lesions out of rectus abdominis. To discuss the diagnostic strategy based on both clinical aspects and imaging features.

TABLE OF CONTENTS/OUTLINE

Anatomical features of rectus abdominis and clinical relevance. Classification of masses of rectus abdominis according to their pathologic and clinical aspects. Imaging findings of sample cases and the corresponding key clinical features for differentiation. a) Sample cases with different pathologic natures (inflammation/tumor-like lesion/benign and malignant tumor). b) More complicated cases with history of surgery at different time points and systemic diseases. Summary of key points in differentiation and diagnostic strategy.

GI308-ED-WEA15

Pancreatic Transplantation: A Multimodality Pictorial Review

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #15

Awards
Certificate of Merit

Participants
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Christopher J. Harvey, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

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TEACHING POINTS

Become familiar with the common anatomical appearances of pancreatic grafts and their normal post-operative appearances across a range of imaging modalities (ultrasound, CT, MRI, conventional angiography) Be able to recognise the spectrum of early and late post-operative complications related to pancreatic transplant; i) vascular, ii) enteric and iii) parenchymal 'What the transplant surgeon wants to know'

TABLE OF CONTENTS/OUTLINE

Background to whole organ pancreatic transplant and the role of radiologists Illustrations of pancreatic transplant anatomy (arterial supply, venous and exocrine drainage), including common surgical variations Normal graft post-operative appearances across a range of imaging modalities Vascular complications i) venous thrombosis, ii) arterial (Y graft stenosis/occlusion), iii) pseudoaneurysm, iv) arteriovenous fistula Parenchymal complications i) peripancreatic collections (duct disruption, haematoma, pseudocyst, seroma and abscesses), ii) pancreatitis Enteric complications i) enteric leak and bleeding, ii) fistula, iii) bowel obstruction 'What the transplant surgeon wants to know' Top tips for graft ultrasound Imaging findings are a combination of US (including contrast-enhanced), CT, MRI, conventional angiography (including post-intervention)

GI309-ED-WEA12

Intestinal Ostomies: What Radiologists Need to Know

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #12

Participants
Sara Khanipour Roshan, MD , Darby, PA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Review of different types of ostomies, their definitions and indications. Pictorial review of normal postoperative changes. Pictorial review of postoperative complications. Differentiate expected postoperative findings from postsurgical complications.

TABLE OF CONTENTS/OUTLINE

1. Types of ostomies, their definitions and indications Ileostomies Loop ileostomy End ileostomy End ileostomy with rectal stump Colostomies Loop colostomy End colostomy End colostomy with rectal stump (Hartman Procedure) End colostomy with mucus fistula (Double-barrel colostomy) 2. Normal anatomy of ostomies 3. Early and late postoperative complications Obstruction Parastomal hernia Peristomal fistula Peristomal varices Ileostomy Enteroliths Stomal recurrence of Crohn's disease

GI310-ED-WEA13

Cinematic Rendering in Abdominopelvic Pathologies: How This Novel Tool Can Help

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #13

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TEACHING POINTS

Cinematic rendering (CR) is a new 3D rendering technique that generates images based on a new lighting model, much more complex than traditional Volume Rendering (VR), being able to produce photorealistic images that have potential to illustrate more details of a complex anatomy This exhibit aims to: - Describe the Cinematic Rendering technique for 3D visualization of Computed Tomography (CT) image data compared to traditional VR method; - Illustrate challenging cases of abdominopelvic pathologies using CR images; - Describe the potential role of CR in abdominopelvic imaging; - Describe current limitations and future opportunities for CR.

TABLE OF CONTENTS/OUTLINE

1. Introduction a. Physics b. Literature Review c. Applications 2. Cases a. Pancreatic Lesions b. Abdominal Wall Hernias c. Vascular d. Bones e. Miscellaneous 3. Conclusion

GI312-ED-WEA16

Extranodal Extension Grading Atlas to Decide the Multimodal Treatment Strategy for Esophageal Squamous Cell Carcinoma

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #16

Awards
Cum Laude

Participants
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TEACHING POINTS

The importance of the extranodal extension (ENE) of metastatic lymph nodes on the prognosis of esophageal squamous cell carcinoma (ESCC) is emerging, same as the head and neck squamous cell carcinoma. The accurate clinical diagnosis of ENE is important to plan the adequate multimodality treatment, to predict not only prognosis but also difficulty of operative procedure during the lymph node dissection. In this education exhibit, 1.To show the correlation between three-dimensional computed tomography (3D-CT) imaging findings and pathological findings with the information of surgical findings. 2.To familiarize the audience with the representative ENE case series and to understand key imaging findings suggesting the presence of ENE; that is, "largest diameter >10 mm", "Infiltration of adjacent planes", "irregular border", "heterogeneity", and "radiologist's impressions".

TABLE OF CONTENTS/OUTLINE

1. The histologic definition of ENE.2. Review of the imaging findings of metastatic lymph nodes to suggest the presence of ENE.3. ENE grading atlas using the imaging correlation with surgical and pathological findings. 4. To show the case series with the cervical, the mediastinal, and the upper abdominal metastatic lymph nodes, showing the correlation among 3D-CT imaging, pathological findings, and endoscopic surgical view.

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GI351-SD-WEA1

Prediction of Pancreatic Atrophy after Steroid Therapy in Autoimmune Pancreatitis Using Extracellular Volume Fraction in Contrast-Enhanced Computed Tomography

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #1

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PURPOSE

In autoimmune pancreatitis (AIP), pancreatic atrophy after steroid therapy is related to deterioration of glucose tolerance. The purpose of this study was to examine whether extracellular volume fraction (fECV) in contrast-enhanced computed tomography (CE-CT) can predict pancreatic atrophy after steroid therapy in AIP.

METHOD AND MATERIALS

This IRB-approved retrospective study included 45 patients (35 men, 10 women; mean age, 64 years) with AIP who underwent CE-CT pre- and post-steroid therapy. Absolute enhancements (in Hounsfield units, HU) of the pancreatic parenchyma (ΔHUpanc) and aorta (ΔHUaorta) were measured on between precontrast and equilibrium phase images. The fECV was calculated using the following formula: fECV (%) = ΔHUpanc/ΔHUaorta × (100 - hematocrit [%]). Pancreatic volume was also measured in CE-CT before (Volpre) and after (Volpost) treatment, and atrophy rate was calculated. The fECV was correlated with rate of atrophy using the Spearman's rank correlation. The Mann-Whitney's U test was used to compare the volumetric values of the pancreas between patients with deterioration of glucose tolerance and those without. Diagnostic performance of the Volpost for the prediction of deterioration of glucose tolerance was evaluated by using receiver operating characteristic (ROC) curve analysis. Sensitivity and specificity were calculated using estimated optimal cutoff values.

RESULTS

The fECV ranged from 19.6 to 61.0% (mean, 41.4±10.4%). The mean Volpre was significantly larger than the Volpost (53.1±18.5 cm3 vs. 30.9±14.2 cm3, $P<.001$). The fECV was moderately correlated with atrophy rate ($\rho=0.586$, $P<.001$). The patients with deterioration of glucose tolerance had significantly smaller amount of the Volpost ($P=.001$) and higher atrophy rate ($P=.002$) than those without, whereas no difference was observed with regard to the Volpre ($P=.146$). Area under the ROC curve showed 0.834 for the diagnosis of deterioration of glucose tolerance, and the Volpost of 22.7 cm3 yielded 81.8% sensitivity (9/11) and 85.3% specificity (29/34).

CONCLUSION

The fECV measured from CE-CT can predict pancreatic atrophy after steroid therapy and post-treatment pancreatic volume is associated with deterioration of glucose tolerance.

CLINICAL RELEVANCE/APPLICATION

Extracellular volume fraction can predict pancreatic atrophy after steroid therapy in AIP, which can be used to consider early treatment for diabetes or alternative use of immunomodulatory agent.

GI352-SD-WEA2

Multiparametric Assessment of Microvascular Invasion in Hepatocellular Carcinoma Using Gadoxetic Acid-Enhanced MRI

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #2

Participants
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PURPOSE

Microvascular invasion (MVI) is one of the important prognostic factors in hepatocellular carcinoma (HCC). Only a single MR finding suggestive of MVI is insufficient to predict it preoperatively. The purpose of this study was to elucidate how precisely MVI can be predicted using multiparametric assessment of gadoxetic acid-enhanced MRI.

METHOD AND MATERIALS

Three hundred and three patients with 311 hypervascular HCCs (>= 1cm) who underwent surgery and preoperative gadoxetic acid-enhanced MRI were enrolled. Group A (Training set) consists of 162 HCCs in 158 patients who underwent MRI at 1.5T (including 48 HCCs with MVI), while Group B (Validation set) 149 HCCs in 145 patients at 3.0T (including 38 HCCs with MVI). Using Group A, nine kinds of MR findings for predicting MVI including tumor diameter were compared between HCCs with and without MVI by univariate analysis, followed by multiple logistic regression analysis when limited to significant MR findings for univariate analysis. Using significant MR findings by multiple logistic regression analysis a predictive formula for diagnosing MVI was obtained. For Group B, the diagnostic performance of this predictive formula was again investigated.

RESULTS

Three MR findings were significantly associated with MVI after multivariate analysis. They included tumor diameter (D), tumor hypointensity on the portal phase (THP) and peritumoral hypointensity in the hepatobiliary phase (PHH). The probability of MVI (p) = 1 / {1+exp (4.1869 - 0.1937 x D - 2.0601 x THP - 2.3423 x PHH)}, where 1 or 0 was substituted in THP and PHH according to the presence of them. When (p) was more than 0.5, the tumor was defined as positive MVI. Diagnostic performance of this formula for Group A was sensitivity 66.7%, specificity 91.2%, and accuracy 84.0%, while that for Group B was sensitivity 65.8%, specificity 88.3%, and accuracy 82.6%.

CONCLUSION

MVI may be predicted by multiparametric assessment of gadoxetic acid-enhanced MRI quite precisely and with good reproducibility.

CLINICAL RELEVANCE/APPLICATION

(dealing with clinical practice of HCC) The MR prediction of MVI contributes to clinical decision of treatment and follow-up strategies and may enable preoperative prediction of a patient's prognosis.

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GI353-SD-WEA3

Metabolic Alterations Associated with Development of Hepatocellular Carcinoma in Patients with Hepatitis-Induce Liver Cirrhosis: Effect of Aging and Enzymatic Activity

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #3

Participants
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PURPOSE

To quantify the hepatic metabolites of normal control (NC), liver cirrhosis (LC), cirrhotic liver with hepatocellular carcinoma (CLH) and hepatocellular carcinoma (HCC) using in vivo proton magnetic resonance spectroscopy (1H-MRS) with a long echo-time (TE) and asses their associations with aging and enzymatic activity.

METHOD AND MATERIALS

Thirty patients with LC, 30 cirrhotic patients with HCC, and 30 NCs were included in this study. Liver cirrhosis in all patients were attributable to hepatitis B and C virus. 1H-MRS measurements were performed on a localized voxel of liver parenchyma and HCC using a 3-T MR scanner to compare the differences in hepatic metabolites among four groups. The differential metabolite levels and values of serum biochemistry among the four groups were analyzed using analysis of covariance (ANCOVA) with adjustments for age and gender with Tukey's post-hoc test at $P < 0.05$. A mediation analysis was used to assess the association between ages and cellular metabolite levels with the mediation effect of serum enzymatic activities. In addition, a receiver operating characteristics (ROC) curve analysis was conducted to evaluate the diagnostic performance of 1H-MRS to predict the development of HCC in patients with hepatitis-induced cirrhotic liver.

RESULTS

The levels of lactate+triglyceride (Lac+TG) and choline (Cho) were significantly different between LC and HCC, and between CLH and HCC. Also, Lac+TG and Cho levels were positively correlated with serum lactate dehydrogenase (LDH) and alkaline phosphatase (ALP) activities, respectively. The total effect of patients' age on Lac+TG alteration was significant, and was fully mediated by LDH levels in LC, CLH, and HCC groups. In cirrhotic patients, the AUC to distinguish HCC from LC was 1.00 (95% CI; 0.94-1.00) for Lac+TG, and 0.88 (95% CI; 0.76-0.95) for Cho, respectively Cho ($P < 0.001$). In addition, the AUC to distinguish HCC from CLH was 1.00 (95% CI; 0.94-1.00) for Lac+TG and 0.87 (95% CI; 0.76-0.94) for Cho ($P < 0.001$).

CONCLUSION

In vivo 1H-MRS was useful to quantify hepatic Lac+TG and Cho levels in both cirrhotic liver and HCC, where higher Lac+TG and Cho values may be more likely related to development of HCC in the cirrhotic liver.

CLINICAL RELEVANCE/APPLICATION

In vivo 1H-MRS might be potentially useful for noninvasive diagnosis and monitoring of patients with LC regarding the development of HCC by hepatic metabolite quantification.

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GI354-SD-WEA4

Performance of Gadoxetic-Acid MRI and Diffusion-Weighted Imaging for the Diagnosis of Early Recurrence of Hepatocellular Carcinoma

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #4

Participants
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PURPOSE

To determine the value of hepatobiliary phase of gadoxetic-acid (Gd-EOB-DTPA) liver MRI and diffusion-weighted imaging (DWI) for determining whether arterial-phase-enhancing foci on extracellular-contrast MRI (EC-MRI) represent the recurrence of hepatocellular carcinoma (HCC) in cirrhotic patients previously treated with ablation or surgery.

METHOD AND MATERIALS

We prospectively included 40 cirrhotic patients with complete response to resection and/or ablation of early HCC in whom a new focal lesion enhancing in the arterial phase without washout was detected during follow-up with EC-MRI. All patients underwent DWI and Gd-EOB-DTPA MRI; two readers subjectively analyzed signal intensities of arterial-phase-enhancing foci. The final diagnosis was established by histology or follow-up EC-MRI. We used cross-tabulation to calculate indices of diagnostic accuracy.

RESULTS

We evaluated 34 patients (7 women; 73.5% with hepatitis C virus) with a total of 53 new arterial-phase-enhancing foci (median size, 10 [IQR 9-14] mm). The final diagnosis, reached by histopathology in 15 (35.7%) lesions and EC-MR follow-up in 27 (64.3%), was HCC in 42 (79.2%) and benign conditions in 11 (21.8%). Hepatobiliary-phase hypointensity on Gd-EOB-DTPA MRI plus hyperintensity on DWI yielded 54.8% sensitivity, 90.9% specificity, 95.8% positive predictive value, and 34.5% negative predictive value for diagnosing HCC recurrence.

CONCLUSION

Combined findings on hepatobiliary-phase Gd-EOB-DTPA MRI and DWI have the highest specificity and positive predictive value to optimally detect HCC recurrence prior to confident diagnosis by conventional imaging criteria on MRI in cirrhotic liver.

CLINICAL RELEVANCE/APPLICATION

Combined findings on hepatobiliary-phase gadoxetic-acid-enhanced liver MRI and DWI had the highest specificity and positive predictive value for early hypervascular HCC recurrence.

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GI404-SD-WEA5

CT in Differentiating Complicated from Uncomplicated Appendicitis: Any-of-10 CT Features versus Radiologists' Gestalt Assessment

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #5

Participants
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PURPOSE

To propose sensitive CT criteria (any-of-10-feature) for complicated appendicitis that could be utilized in non-operative management of appendicitis, and to compare diagnostic performance using any-of-10-feature criteria vs. gestalt assessment.

METHOD AND MATERIALS

This retrospective study, which was conducted in a tertiary teaching hospital, included 100 patients with suspected appendicitis on CT. Complicated appendicitis, defined as gangrenous or perforated appendicitis, was pathologically or surgically confirmed in 32 patients. Six readers independently determined the presence of previously reported 10 CT features of complicated appendicitis (contrast-enhancement defect of the appendiceal wall, abscess, extraluminal air, intraluminal air, extraluminal appendicolith, intraluminal appendicolith, moderate to severe periappendiceal fat stranding, periappendiceal fluid, ileus, and ascites) and rated the likelihood score for complicated appendicitis using gestalt assessment. Sensitivity and specificity of CT for complicated appendicitis was measured by regarding the presence of any one of the 10 features as positive diagnosis (any-of-10-feature criteria) and by using radiologists' gestalt assessment. Pooled sensitivity and specificity were compared using generalized linear mixed model.

RESULTS

Pooled sensitivity of any-of-10-feature criteria was higher than that of gestalt assessment (92% vs. 64%; difference, 28% [95% CI, 10%-46%]; $P < 0.001$), although pooled specificity was lower (43% vs. 76%; difference, -33% [-48%--17%]; $P < 0.001$).

CONCLUSION

Without any diagnostic criteria provided, radiologists' CT assessment for complicated appendicitis was not sensitive. Pooled sensitivity of any-of-10-feature criteria was higher than that of gestalt assessment, at the cost of lower specificity.

CLINICAL RELEVANCE/APPLICATION

Multiple recent randomized controlled trials attempted treating uncomplicated appendicitis with antibiotics. Thus, it has become clinically important that CT differentiates complicated from uncomplicated appendicitis. For prudent selection of patients for the non-operative treatment of appendicitis, our diagnostic criteria can be used to diagnose complicated appendicitis sensitively and thereby minimize treatment failure associated with false negative diagnosis of complication.

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GI406-SD-WEA7

Utility of Half-Dose of Iodinated-Intravenous Contrast in Dual-Energy Computed Tomography: Qualitative and Quantitative Evaluation of Image Quality and Diagnostic Acceptability

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #7

Participants
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PURPOSE

To assess the quality of dual-energy-computed-tomography (DECT) imaging in patients receiving half-dose of recommended iodinated-contrast.

METHOD AND MATERIALS

46 oncologic-patients were imaged on a Discovery CT 750 HD dual energy computed assisted (DECT) scanner. Patients received 60-75 ml (half-dose-weight based) of intravenous low osmolar iohexol 350 mg/ml Omnipaque 350, DECT imaging vs 120 -150 ml (ful-dose-weight based) injection on conventional imaging on the portal venous (PV) phase at an injection rate of 3-4 ml/sec . Monochromatic energy images were processed at 60 and 70 keV and 140 kVp. The images were scored by three radiologists independently for image quality and diagnostic acceptability for celiac axis, SMA, aorta, renal artery, kidney, liver, spleen, pancreas and diagnostic acceptability. The 5-point score assigned was 1-Superior; 2-Mildlly inferior; 3-Mild-to-moderately inferior; 4-Moderately inferior (probably influence on diagnosis);5-Markedly inferior (impairing diagnosis). For statistical analysis scores 1 was combined with score 2; score 3 unchanged; score 4 combined with score 5. Regions of interest were drawn on PV, aorta, liver and fat. Contrast to noise ratio (CNR) and singnal to noise ratio (SNR) were calculated. A multivariate ordinal GEE model was used to assess the image quality score, adjusting for reader. Comparisons among series for CNR and SNR were performed based on a linear mixed model. Tukey-Kramer method was used for multiple testing adjustment.

RESULTS

For the qualitative scores for all categories 120 kVp >70keV=60keV>140kVp, except for noise where 120kVp >70keV>60keV=140kVp images. CNR of the portal vein; 60kev = 70kev>120kVp= 140kVp, $p<0.0001$, CNR aorta and liver had no statistically significant difference was noted between series $p=0.22$. SNR liver 70keV>60keV=120kVp>140kVp, $p<0.0001$.

CONCLUSION

All imaging series were considered diagnostically acceptable. 120kVp images were considered slightly better qualitatively. No statistically significant difference was noted in CNR of liver on different series. SNR was better on 70keV images.

CLINICAL RELEVANCE/APPLICATION

DECT images were diagnostically acceptable with half-dose compared to full-dose contrast and can be used specially in patients who have renal insufficiency or low-eGFR <30 and may help protect renal function.

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GI407-SD-WEA8

Impact of Dual-Energy 50 keV Virtual Monoenergetic Images on Radiologist Detection and Diagnostic Confidence of Small Hepatocellular Carcinomas Using Multiphase Liver CT

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #8

Participants
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PURPOSE

To determine the effect of dual energy (DE) 50 keV virtual monoenergetic images on radiologist detection and diagnostic confidence for small (<= 2 cm) hepatocellular carcinomas in patients with chronic liver disease compared to routine, contrast-enhanced multiphase hepatic CT.

METHOD AND MATERIALS

Patients with chronic liver disease underwent DE multiphase CT imaging using a standardized DE HCC protocol, with 50 keV images reconstructed for the late arterial and delayed phases. Patients with HCC > 2 cm were excluded. Reference standard was established by an independent GI radiologist, with HCC documented by explant, correlative angio, growth, MRI, other histopathology, with this radiologist also noting LI-RADs 3 and LI-RADs 4 lesions that were confirmed on subsequent or prior imaging. 2 GI radiologists interpreted either anonymized mixed kV (0.6 linear blend) or mixed kV with 50 keV images in a random order in 2 reading sessions separated by 2 weeks, evaluating each patients' images once/session. Radiologists identified potential HCC's, rating confidence in LI-RADS 5 diagnosis, arterial enhancement, washout, and patient level confidence in HCC (0-100 scales).

RESULTS

Nineteen of 46 patients had 25 HCCs, and 5 pts had 17 LI-RADs 3/ 4 lesions. HCC size was 1.4 cm ± 1.2 cm. Sensitivity for HCC was similar between mixed kV and mixed kV with 50 keV images (R1 - 80% v. 92.0%, p=0.3; R2 - 92.0% v. 96%, p=0.6). Sensitivity for detection of LI-RADS3/4 lesions significantly improved for one reader and tended to improve for the other with additional 50 keV images (R1 - 65% v. 76%, p = 0.02, R2 - 71% v 94%, p=0.08). Confidence in LI-RADS 5 diagnosis, arterial enhancement, pseudocapsule, and washout for HCC's significantly improved for one reader (p<0.003). For negative patients without HCC, there was a trend for both readers to have appropriately lower patient level confidence in HCC presence (p=0.17).

CONCLUSION

Dual energy 50 keV images significantly increased confidence in LI-RADs 5 diagnosis and imaging findings of arterial enhancement, pseudocapsule, and washout for 1 of 2 radiologists. They improved detection of LI-RADs 3/4 lesions for one reader and tended to improve detection for the other.

CLINICAL RELEVANCE/APPLICATION

Routine acquisition and examination of dual energy 50 keV images will improve the confidence in diagnosis of small HCC's as well as imaging findings of arterial enhancement and tumor washout for some radiologists.

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GI408-SD-WEA9

Multiparametric MRI Screening in Hereditary Pancreatic Cancer: Value of A Magnetization-Prepared Gradient Echo Sequence

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #9

Participants
Bas Boekestijn, MD, Leiden, Netherlands (*Presenter*) Nothing to Disclose
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Andrew Webb, DPHIL, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In CDKN2A/p16-mutation carriers with a 15-20% lifetime risk of developing pancreatic ductal adenocarcinoma (PDAC), annual MRI surveillance has been shown to successfully detect PDAC at an early stage, resulting in increased resectability and survival. In a retrospective study, we assessed the value of different MRI-techniques in early detection of PDAC.

METHOD AND MATERIALS

Since the start of our surveillance program in 2000, 217 subjects have been enrolled. During the observation period from January 2012 until March 2019, MRI protocols consisted of axial and coronal T2-weighted turbo spin echo (TSE), fat suppressed T1-weighted GRE dynamic contrast-enhanced (DCE), magnetic resonance cholangiopancreaticography (MRCP) and T1-weighted turbo field echo (TFE) sequences. Diffusion weighted imaging (DWI) was added in 2015. Two readers independently analysed the current and former MRI examinations for the presence of lesions and other imaging findings of subjects with a proven PDAC detected during the observation period.

RESULTS

Between January 2012 and March 2019, 16 PDAC were detected, of which 14 (87,5%) were resectable. The average size at pathology was 19 mm (range 6 mm - 70 mm). Fourteen of the 16 cancers were seen by both readers on T1-TFE and T1-DCE. DWI was available in 11 subjects, 7 lesions showed restricted diffusion as seen by both readers. In 11 of 13 subjects with an incident tumor, a lesion or indirect signs of malignancy could retrospectively be seen on previous examinations. In 2 subjects a lesion was retrospectively only visible on T1-TFE. The average growth rate of 9 retrospectively measurable lesions was 6.7 mm per year (s = 3.0) with an estimated volume doubling time of 157.5 days (s = 62.7).

CONCLUSION

Annual MRI surveillance in asymptomatic individuals at high risk of developing PDAC results in detection of tumours in a potentially resectable stage. A T1-weighted TFE sequence seems especially promising for detecting early pancreatic cancer.

CLINICAL RELEVANCE/APPLICATION

Annual MRI surveillance is able to detect early pancreatic cancer in high risk individuals, a T1-TFE sequence further enhances multiparametric protocols.

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GI410-SD-WEA11

Diagnostic Value of CT Lymphangiography (CTL) in Primary Intestinal Lymphangiectasia (PIL)

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #11

Participants
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PURPOSE

To investigate the clinical value of CT lymphangiography (CTL) in the diagnosis of primary intestinal lymphangiectasia (PIL).

METHOD AND MATERIALS

22 patients diagnosed as PIL with capsule endoscopy from 2010 to 2018 were retrospectively analyzed. All patients underwent CTL, and the imaging data were compared with endoscopic and pathological findings. CTL assessments included thickening of the intestinal wall, intestinal and mesenteric lymphangiectasia, serous effusion and its range, abnormal lymphatic vessels in the neck, thorax, abdomen, and pelvis. Based on the distribution of contrast media in intestines and mesentery,PIL was divided into four groups for comparison and statistical analysis. The statistically significant difference was set at P <0.05.

RESULTS

CTL displayed the intestinal and extra-intestinal lesions: intestinal wall thickening(n=19,unsatisfactory observation due to intestinal contraction in 1 case; 3-6 mm in 4 cases, 6-9 mm in 10 cases,>= 9 mm in 5 cases); intestinal and mesenteric lymphangiectasia (n=18, 3 cases in the mesentery, 9 cases in the intestinal wall and mesentery, 6 cases in the intestinal lumen); serous effusion (n=14), including ascites (n=8), pleural effusion (n=1), and ascites accompanied by pleural effusion (n=5); retroperitoneal and near iliac blood vessels changes(n=21): lumbar lymph trunk reflux (n = 12), right axilla(n=5), left axilla(n=4); abdominal and pelvic lymphangiectasis (n=17): 4 cases in pelvic fat gap, 10 cases, 15 cases, 6 cases, 13 cases in hilar, pancreas, spleen and omentum respectively, 5 cases in kidney, including 1 case in left, 2 cases in right, and 2 cases in both side; Mediastinal lymph reflux (n=10); abnormal distributions of contrast media around thoracic outlet (n =20),including 8 in bilateral neck, 12 in left venous angle. PIL was divided into four groups according to whether the contrast agent was distributed in the intestinal wall, intestinal lumen and mesentery. There was no significant difference in the abnormal distribution of CTL and the degree of intestinal wall thickening.

CONCLUSION

Compared to endoscope, CTL can not only show the intestinal tube and extraintestinal lesions, but also show the distribution and extent of abnormal lymphatic vessels, which is valueable for the diagnosis and treatment of PIL.

CLINICAL RELEVANCE/APPLICATION

CT lymphangiography (CTL) is useful in detecting PIL.

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GI417-SD-WEA10

Assessment of Liver Surface Nodularity, Sarcopenia, and Visceral Obesity as Predictors of Cardiometabolic Risk Factors in African Americans

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GI Community, Learning Center Station #10

Participants
Elliot Varney, MD, Jackson, MS (*Presenter*) Nothing to Disclose
Edward Florez, PhD, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose
Sarah Miller, BS, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose
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Seth Lirette, MS, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose
Candace M. Howard-Claudio, MD, PhD, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the association of Liver Surface Nodularity (LSN) with quality muscle mass (sarcopenia) and visceral fat depots in a high-risk population of African Americans (AAs).

METHOD AND MATERIALS

For this HIPPA-compliant, IRB approved retrospective observation study, non-enhanced abdominal CT images were obtained in 2475 African American participants. Anthropometric indices such as waist circumference (WC) and sagittal abdominal diameter (SAD) were measured in each subject using a DICOM software (OsiriX MD). In addition, regional abdominal muscles and fat volumes, including visceral adipose tissue (VAT) and superficial adipose tissue (SAT), were measured using a multi-layer segmentation software (slice-O-matic, TomoVision). Next, a validated quantitative software was used to measure LSN scores in 10 different slices on the left lobe of the liver. Finally, a statistical assessment was performed to correlate LSN scores with WC, SAD, VAT and SAT volumes, and intraclass correlation coefficients (ICC) with 95% confidence intervals were used to assess inter-observer variability in all parameters.

RESULTS

LSN scores showed direct correlation with WC ($R2=0.19$, 0.44, $p<0.001$), SAD ($R2=0.20$, 0.45, $p<0.001$), and all individual fat compartments. On the other hand, our results support what has been suggested by several recent studies that WC > 100 cm and SAD > 25 cm are more likely to be associated with metabolic disturbances. For SAD >= 25 cm, each 1 cm increase in SAD was associated with a 0.07 unit increase in LSN ($ß=0.07$, $p<0.001$). Analogously, for WC >= 100 cm there was a WC increase associated with the LSN score ($ß=0.02$, $p<0.001$). Likewise, inter-observer variability between two readers in a sub-cohort (n=300) shows excellent interclass correlation coefficient values (ICC>0.93, 95% CI) for all parameters.

CONCLUSION

This study shows a direct association between LSN score, anthropometric indices, abdominal fat depots and muscle volumes. Anthropomorphic measurements above a certain cut-off point (i.e. SAD >= 25cm and WC > 100cm for this study), were linked with increased LSN scores.

CLINICAL RELEVANCE/APPLICATION

Non-alcoholic fatty liver disease (NAFLD) is the most common liver disease in the Western world, is clinically silent, and is closely related to obesity and cardiometabolic disease. Anthropometrics as readily obtainable, low-cost biomarkers to predict NAFLD could increase its surveillance and diagnosis, earlier than conventional techniques.

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GU218-SD-WEA1

Evaluating New England Journal of Medicine Minor Diagnostic Criteria for Diagnosing Early Trimester Pregnancy Failure: A Single Institution Experience

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #1

Participants
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Liina Poder, MD, Mill Valley, CA (*Abstract Co-Author*) Nothing to Disclose
Priyanka Jha, MBBS, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The major criteria presented by Doubilet et al. help diagnose early pregnancy loss. The role of proposed minor criteria in predicting early pregnancy loss has not been studied. In this study, we aim to evaluate whether one minor criterion or a combination of several minor criteria may help definitively diagnose early pregnancy loss.

METHOD AND MATERIALS

In this IRB approved retrospective study, 1107 1st trimester ultrasounds were obtained. Definitively viable or non-viable pregnancies, ectopic pregnancies, pregnancy of unknown location, elective abortion, imaging lost to follow-up, and possible early intrauterine pregnancies (gestational sac (GS) < 10 mm) were excluded. Pregnancies of uncertain viability requiring follow-up as evidenced by GS without cardiac motion (with or without embryo) were included. Pregnancy outcomes were documented using follow-up imaging, ß-HCG levels and clinic notes. Each criterion was assessed independently by 2 readers with 5 and 10 years of US experience and blinded to the outcome. Odds ratio, positive predictive value and specificity were calculated for each criterion in predicting pregnancy outcomes. Combination of minor criteria leading to subsequent failure was assessed.

RESULTS

A total of 142 ultrasounds were included in the study. Among those, 49 pregnancies continued as normal pregnancies while 93 cases failed on follow-up. For reader 1, the odds ratio, specificity and PPV were 3.13, 63% and 77% for 'crown-rump length less than 7 mm' criterion while values were 1.02, 71% and 66% for 'absence of embryo after 6 weeks from last menstrual period' criterion. All other minor criteria had specificities and PPV of 100%. For reader 2, the odds ratio, specificity and PPV were 2.49, 65% and 76%, and 1.13, 69% and 67% for aforementioned criteria. All other minor criteria had specificities and PPV of 100%.

CONCLUSION

Minor criteria based on mean sac diameter, appropriately timed follow-up imaging studies, empty amnion and enlarged yolk sac have 100% specificity and 100% PPV to diagnose 1st trimester pregnancy loss. Minor criteria based on crown-rump length and last menstrual period alone do not have a high specificity to definitively diagnose early pregnancy loss.

CLINICAL RELEVANCE/APPLICATION

Minor diagnostic criteria can be used to definitively diagnose nonviable pregnancy in the 1st trimester and will result in more timely, appropriate and cost-effective care for the patients.

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GU219-SD-WEA2

Quantitation of Bladder Cancer for Prediction of Muscle-Invasion in Comparison with VI-RADS Categorization

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To investigate methods of quantitative bladder cancer assessment in prediction of muscle-invasion, and to compare their diagnostic performance to that of a qualitative method, represented by Vesical Imaging-Reporting and Data System (VI-RADS).

METHOD AND MATERIALS

Among the patients who underwent transurethral resection of bladder tumors or radical cystectomy from January 2018-March 2019, 72 preprocedural or preoperative 3-T MRIs were retrospectively analyzed. Two radiologists independently assigned VI-RADS categories, and quantified the followings for single index lesion of each patient, on axial T2-weighted, diffusion-weighted (b = 1000 s/mm2) and contrast-enhanced T1-weighted images: curvilinear length of tumor base, greatest tumor dimension, and their ratio. Inter-reader agreement was assessed with κ and intraclass correlation coefficients (ICCs). Multivariable logistic regression analysis was done to find meaningful indicators of muscle-invasion. Diagnostic performance of markers was compared to one another with receiver operating characteristic (ROC) curve analysis. Optimal cut-off point was suggested by Youden index J.

RESULTS

Inter-reader agreement was substantial (κ 0.76-0.80) for VI-RADS categorization and base-dimension ratio (ICC 0.67-0.74), and almost perfect for tumor base length and tumor dimension (ICC 0.86-0.98). Tumor base length (odds ratio [OR] 2.43-2.62) and VI-RADS categorization (OR 7.40-8.03) were independently associated with muscle-invasion ($p < 0.01$). Area under the ROC curves, optimal cut-off points, and sensitivity/specificity at the corresponding points were, 0.924, 2.7 cm, and 0.88/0.81 for tumor base length on diffusion weighted images, and 0.932, score 3, and 0.78/0.91 for VI-RADS categorization, respectively.

CONCLUSION

Curvilinear tumor base length may be a highly reproducible quantitative method, with comparable diagnostic performance in prediction of muscle-invasive bladder cancer to VI-RADS categorization.

CLINICAL RELEVANCE/APPLICATION

Comparing to qualitative assessment of bladder cancer characterized by high specificity, this simple and intuitive quantitative mean may provide additional sensitivity in prediction of muscle-invasion.

GU252-SD-WEA4

Necessity of Differentiating Small (<10 mm) and Large (>= 10mm) PI-RADS 4 Lesions

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #4

Participants
Amy I. Chang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Prostate Imaging Reporting and Data System version 2 (PI-RADSv2) provides reasonable performance in detecting significant cancers. However, it is unclear about whether all PI-RADS 4 lesions show the same cancer detection rate (CDR) regardless of tumor size. This study is designed to compare the CDRs of small (<10 mm) and large (>= 10 mm) PI-RADS 4 lesions.

METHOD AND MATERIALS

After magnetic resonance imaging (MRI) was performed in 684 men, a radiologist interpreted the MR images and detected 281 index lesions categorized as PI-RADS 4 in 281 men. Transrectal ultrasound-guided target and/or systematic biopsy was performed. PI-RADS4 lesions were divided in to small and large groups depending on size of 10 mm. Overall and significant CDRs were compared between the groups. A significant cancer was defined as one with Gleason score (GS) >= 7 or tumor volume >= 0.5 ml. Tumor volumes were roughly calculated as $\pi r^3 4/3$(π=3.14 and r=a half of tumor size) and were compared between the groups. Standard reference was a biopsy examination. Fisher's exact and Mann-Whitney tests were used for statistical analysis.

RESULTS

The overall CDRs of small and large groups were 39.0% (53/136) and 59.3% (86/145), respectively (p=0.0008). The median tumor volumes of cancer-proven small and large groups were 0.18 ml (0.01-0.38 ml) and 0.70 ml (0.52-1.44 ml), respectively (p<0.0001). Using GS or tumor volume, the significant CDRs of these groups were 26.5 % (36/136) and 59.3% (86/145), respectively (p<0.0001) and using GS alone, 26.5% (36/136) and 39.3% (57/145), respectively (p=0.0232).

CONCLUSION

PI-RADS 4 lesions should be sub-divided based on the size of 10 mm because of different significant CDRs.

CLINICAL RELEVANCE/APPLICATION

Men with a large (>=10 mm) PI-RADS4 cancer are not candidates of active surveillance, but of definitive treatment regardless of Gleason score because this tumor should be considered significant cancer due to the tumor volume greater than 0.5 ml.

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GU253-SD-WEA5

Evaluation of Renal Allograft Injury Using MRI Texture Analysis

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #5

Participants
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Wei Xing, MD, Changzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jie Chen, Changzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the value of MRI texture analysis in evaluating renal allograft injury.

METHOD AND MATERIALS

66 patients who underwent allograft renal transplantation between November 2013 and December 2016 were included in this study. All the patients were divided into three groups according to the estimated glomerular filtration rate (eGFR): normal renal allograft function (nRAF, eGFR >= 60 ml/min/1.73 m2, n = 15), mild to moderate renal allograft injury (mRAI, 30 <= eGFR < 60 ml/min/1.73 m2, n = 18), and severe renal allograft injury (sRAI, eGFR < 30 ml/min/1.73 m2, n = 33) group. Texture features of renal allograft based on T2WI, SWI, and BOLD MRI were extracted. Multiple dimensionality reduction for MRI texture features were performed, and the texture features based on T2WI, SWI, and BOLD MRI with absolute correlation coefficient of eGFR greater than or equal to 0.3 ($P < 0.05$) and also with the highest Z value for Boruta algorithm were selected. The differences in the texture features among the three groups and the diagnostic performance of the texture features in differentiating the three groups was assessed.

RESULTS

After Multiple dimensionality reduction, T2WI_Perc.50%, SWI_Perc.01%, BOLD_S(4,4)Contrast, and BOLD_S(5,5)Correlat were selected. There were significant differences in T2WI_Perc.50%, SWI_Perc.01%, BOLD_S(4,4)Contrast, and BOLD_S(5,5)Correlat between the nRAF group and the sRAI group (all $P < 0.05$). T2WI_Perc.50% in the mRAI group was significantly lower than that in the nRAF group ($P = 0.001$). BOLD_S(4,4)Contrast in the sRAI group was significantly lower than that in the mRAI group ($P = 0.032$). T2WI_Perc.50%, SWI_Perc.01%, and BOLD_S(5,5)Correlat showed equal capacities for differentiating the nRAF group with the mRAI group (AUC: 0.785, 0.720, and 0.700). T2WI_Perc.50%, SWI_Perc.01%, BOLD_S(4,4)Contrast, and BOLD_S(5,5)Correlat showed equal capacities for differentiating the nRAF group with the sRAI group (AUC: 0.687, 0.733, 0.784, and 0.737). BOLD_S(4,4)Contrast showed the ability to differentiate the mRAI group with the sRAI group (AUC: 0.667).

CONCLUSION

There is a correlation between MRI texture features and renal allograft function, and MRI texture analysis can provide valuable information for evaluating renal allograft injury.

CLINICAL RELEVANCE/APPLICATION

MRI texture analysis can demostrate renal allograft injury indirectly and is recommended as a non-invasive tool for monitoring renal allograft function in clinic.

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GU254-SD-WEA6

The Diagnostic Evaluation of PI-RADS V2 based on Simplified Biparametric MRI for Prostate Cancer

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #6

Participants
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PURPOSE

This study compare the performance of the PI-RADS scores obtained by using biparameter MRI and multi-parameter MRI for clinically significant PCa, respectively.

METHOD AND MATERIALS

MpMRI was performed for 333 patients with suspicious lesions on a 3T MR scanner including high-spatial-resolution structural imaging. For bpMRI, two radiologists scored only the cross-sectional T2W image and DWI for all cases in strict accordance with the PI-RADS V2 scoring standard. The patients with suspicious tumors PI-RADS V2 assessment category of>=3 were selected for MRI-TRUS targeted biopsy. The other patients with PI-RADS V2 assessment category of 1and 2 were selected for TRUS biopsy. The receiver operating characteristic curves were obtained by PI-RADS V2 scores based on bpMRI and mpMRI sequences.

RESULTS

A cohort of 333 patients was performed including 162 PCa and 171 non-PCa. bpMRI detected PCa in 131 patients and clinically significant PCa in 126 patients. The AUC of PI-RADS V2 score based on bpMRI and mpMRI for the diagnosis of PCa was 0.869 and 0.889, respectively (P=0.0638). The accuracy of bpMRI in the diagnosis of benign and malignant prostate diseases is 81.68% (272/333), the sensitivity is 80.86% (131/162), the specificity is 82.46% (141/171). The accuracy of mpMRI score in the diagnosis of benign and malignant prostate lesions was 84.98% (283/333), the sensitivity was 85.18% (138/162), the specificity was 84.80% (145/171). The AUC of PI-RADS V2 score based on bpMRI and mpMRI for the diagnosis of clinically significant prostate cancer was 0.879 and 0.890, respectively (P=0.1685). The diagnostic accuracy of bpMRI for clinically significant prostate cancer was 84.38% (281/333), the sensitivity was 92.42%(122/132), the specificity was 79.10%(159/201); The diagnostic accuracy of mpMRI was 85.59%(285/333), the sensitivity was 93.94% (124/132), the specificity was 80.10% (161/201).

CONCLUSION

BpMRI can effectively detect clinical significant prostate cancer; the diagnosis performance of bpMRI is similar to that of mpMRI for detecting prostate cancer. As a result, using bpMRI method can significantly shorten the acquisition and interpretation time and avoid the potential risk of DCE injection of contrast agent.

CLINICAL RELEVANCE/APPLICATION

This study compare the performance of the PI-RADS scores obtained by using biparameter MRI and multi-parameter MRI for clinically significant PCa, respectively.

HP126-ED-WEA6

Practical MR Elastography (MRE) - Tips from Experienced MRE Analysts on Achieving Best Practice

Wednesday, Dec. 4 12:15PM - 12:45PM Room: HP Community, Learning Center Station #6

Participants
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TEACHING POINTS

This exhibit is intended to provide detailed but simple instructions to facilitate optimal MRE acquisition and analysis in clinical practice. Target audience includes radiologists, radiology trainees, and technologists. The following objectives will be met using representative MRE examples: 1. Review MRE acquisition instructions to enable technologists to perform MRE examinations correctly and allow radiologists to oversee MRE examinations effectively in a busy practice 2. Review MRE postprocessing and analysis instructions to permit correct interpretation of MRE 3. Review common acquisition errors, as well as their solutions 4. Review common postprocessing and analysis errors, as well as their solutions 5. Understand the published literature on MRE reproducibility, accuracy, and performance using different pulse sequences (SE, GRE) and field strengths. 6. Provide templates for reporting MRE results

TABLE OF CONTENTS/OUTLINE

1. MRE acquisition a. Checklist b. Examples of correct and incorrect acquisition technique, with solutions as appropriate 2. Postprocessing and analysis a. Checklist b. Examples of correct and incorrect postprocessing and analysis, with solutions as appropriate 3. Literature review4. Sample cases and reporting templates

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HP218-SD-WEA1

Hands-On Radiology Education for Medical Students

Wednesday, Dec. 4 12:15PM - 12:45PM Room: HP Community, Learning Center Station #1

Participants
Susan J. Frank, MD, Park Ridge, NJ (*Presenter*) Nothing to Disclose
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PURPOSE

Our goal is to assess whether third year medical students rotating on a radiology clerkship can use an iPAD case-based learning program to increase their radiologic knowledge and image interpretative skills, and whether they view it as a positive learning experience.

METHOD AND MATERIALS

Radiologic cases with relevant plain film, CT, and ultrasound images were reviewed by the students on iPADS. Working in small groups, each student, with their own iPAD, manipulated imaging parameters, similar to the radiologist at the workstation. They identified imaging findings, formulated a differential diagnosis, and arrived at a diagnosis. A faculty facilitator reviewed the cases with the student group. The first portion of the study used a Likert survey to assess students' opinion of the activity. In the second part of the study, a different cohort of students were randomly divided into a study group and a control group of equal size, and a pre-test and a post-test were administered to each student to assess if learning occurred. Test scores range is from 0 to 10.

RESULTS

The Likert study included 125 students. Likert scores ranged from 4.60 to 4.85 (mean 4.72) out of 5 for IPAD survey items, indicating a favorable result. The knowledge assessment group included 219 students, 110 in the study group and 109 in the control group. No significant difference in initial scoring was seen between the study and control groups (p=0.315). The average improvement from the initial to the second test was 1.04 points among the control group and was 2.32 among the intervention group, which was statistically significant (p = 7.69x10-5).

CONCLUSION

We demonstrate that the IPAD exercise encourages active learning in a small group setting, increases the students' knowledge and interpretative skills, and is assessed as a positive learning experience by the students. Our computer-based simulation model enhances learning for these millennials who thrive on interactive teaching experiences.

CLINICAL RELEVANCE/APPLICATION

Technology can be harnessed as a tool to encourage active learning, resulting in a higher level of comprehension in a more positive learning environment

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HP219-SD-WEA2

A Comparison of Resident Improvement in Accuracy and Speed at A Single Institution with Independent Call

Wednesday, Dec. 4 12:15PM - 12:45PM Room: HP Community, Learning Center Station #2

Participants
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Eric Polley, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Katie N. Hunt, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Tara L. Henrichsen, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We evaluated diagnostic radiology resident improvement in accuracy and speed at a single institution with independent call. We focused on residents who were in the bottom 4 of their class (out of 13) for both speed and accuracy and compared their improvement over the busiest call periods of residency.

METHOD AND MATERIALS

Four residency classes were evaluated at 6 month increments (2013-2018) for total number of studies read and clinically relevant revisions by staff radiologists. Residents were evaluated during their 2nd and 3rd years of residency during the periods of most frequent call. The four residents in each class with the lowest number of studies read as well as most clinically relevant revisions were measured for their improvement relative to their peers. Additionally, each class in its entirety was evaluated for a trend in improvement of accuracy and speed over time using a mixed effect Poisson regression model as well as examined for any correlation between rank for speed and rank for accuracy.

RESULTS

The mean change in class rank in number of studies read for the bottom 4 residents from time-point 1 to time-point 4 was an improvement of 2.88 spots (min= -3 spots, max= +10 spots). 3/16 residents (18.8%) improved into the top half of their class. For rate of clinically relevant revisions, the mean change in class rank for the bottom 4 residents from time 1 to time 4 was an improvement of 5.44 spots (min= -1 spot, max= +9 spots). 9/16 residents (56.3%) improved into the top half of their class. Examining each class as a whole, there was a significant time trend for speed but not for accuracy, and no significant class effect for either outcome. Correlation between speed and accuracy was not statistically significant within each class (Spearman ρ=-0.04-0.23, p=0.09-0.93)

CONCLUSION

Residents at the bottom of their class for accuracy tend to improve relative to their peers to a greater extent than residents who are at the bottom of their class for speed.

CLINICAL RELEVANCE/APPLICATION

Increased knowledge of the resident on call learning experience will help to facilitate resident improvement.

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HP220-SD-WEA3

The Efficiency of Deep Learning-Based Bone Age Assessment System in Clinical Practice

Wednesday, Dec. 4 12:15PM - 12:45PM Room: HP Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate the efficacy of a deep learning (DL)-based bone age assessment (BAA) system in clinical practice.

METHOD AND MATERIALS

A total of 77 left hand and wrist radiographs of patients aged 5 to 12 years were collected in this study. A DL-based BAA system (InferRead DR Boneage Research, Infervision, Beijing) was utilized to estimate the bone ages with the TW3-C-RUS standard. The ground truth of bone ages (reference ages) was determined by a senior pediatric radiologist with the assistance of DL-based BAA system, using the same standard as the BAA system which was TW3-C-RUS standard from the Skeletal Development Standards of Hand and Wrist for Chinese Children-China 05. Pearson correlation analysis and bone age bias were used to evaluate the accuracy of the DL-based BAA. In addition, Bland-Altman analysis was used to evaluate the consistency between bone age and reference bone age.

RESULTS

Predicted bone ages from DL-based BAA system was significantly correlated with the reference bone age, the correlation coefficient $r = 0.969$ ($p < 0.01$). In addition, the root mean square error (RMSE) and mean absolute error (MAE) of the estimated bone age were 0.62 and 0.47 years, respectively, suggesting the high accuracy of the predicted values. In Bland-Altman consistency analysis, the mean difference between predicted and reference bone age was -0.24 years (95% limit of agreement, ± 1.12). Within the 95% limit of agreement, the absolute maximum difference between predicted bone age and the reference bone age was 1.2 years old, which was acceptable in clinical practice. Notably, it just took the DL-based BAA system about 0.258 seconds to estimate bone age for each sample, which was quite efficient.

CONCLUSION

DL-based BAA system displayed excellent accuracy and consistency in predicting bone age and could be applied to clinical bone age assessment.

CLINICAL RELEVANCE/APPLICATION

Our study indicates that DL-based BAA system is an efficient tool for pediatric radiologists to estimate bone age with TW3-RUS standard in clinical practice, which will greatly relieve them from tedious daily work.

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HP235-SD-WEA4

Content, Structure and Readability of Lung Cancer Screening Program Websites in the United States

Wednesday, Dec. 4 12:15PM - 12:45PM Room: HP Community, Learning Center Station #4

Participants
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PURPOSE

Patients and providers have cited insufficient knowledge of Lung Cancer Screening (LCS) as a significant barrier to participation and may seek more information on various LCS program websites. We assessed the content, multimedia structure and readability of LCS program websites of U.S. healthcare institutions.

METHOD AND MATERIALS

The top 269 search results for websites of LCS programs in the U.S. were identified in a Google search using the terms "lung cancer screening", "low dose CT screening", and "lung screening" on September 15, 2018 and analyzed by a team of 9 Thoracic Radiologists. Of these, 258 unique LCS program websites were included. Using a common checklist, text, images, videos, and PDF attachments of each website were assessed. Text was manually extracted and average grade level readability scores were calculated using a commercial web-based suite of tools (Readable.io), as an average of the Flesch-Kincaid, Gunning Fog, Coleman-Liau, SMOG, and Automated Readability scores.

RESULTS

64% of websites contained at least 1 image, but only 23% had at least 1 video. Only 15% of websites had a patient narrative endorsing LCS. 5% of websites had content in a language other than English. Only 25% had a least 1 link to a national LCS informational website. The most frequently linked sites included the NIH (cancer.gov) (9%), and shouldiscreen.com (6%). Academic (33%) and private practices (50%) were more likely to have a national link than community (16%) and hybrid (20%) practices ($p<0.007$).Readability analysis of website text revealed a median grade level of 10.1, median word count 516, and median reading time 137 seconds. Only 4 websites (1.6%) had a grade level of 6th grade or below. Differences between mean reading levels of academic (10.8) and community (9.8) [$p=0.005$] or hybrid (10.0) [$p=0.015$] practices were statistically significant.

CONCLUSION

A majority of LCS program websites may not be appropriately designed for patient education. The average reading level of LCS program websites is higher than the 6th grade level recommended by the American Medical Association. Most sites have a paucity of images, videos, and links to national LCS resources, and most lack multilingual resources.

CLINICAL RELEVANCE/APPLICATION

Adapting content, structure and readability to recommended standards for patient education may improve the educational effectiveness of institutional LCS program websites and may improve LCS uptake.

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HP236-SD-WEA5

Frequency, Predictors, and Clinical Utility of the Phrase "Correlate Clinically": Value of Correlative Recommendations in Radiology Reports

Wednesday, Dec. 4 12:15PM - 12:45PM Room: HP Community, Learning Center Station #5

Participants
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PURPOSE

To evaluate the frequency, predictors, and clinical utility of correlative recommendations in radiology reports.

METHOD AND MATERIALS

The "Impression" field from all radiology reports for calendar year 2018 was retrospectively searched for ["correlat*" or "clinic*"]. The following data for all "hits" were recorded: frequency, dates, modality, patient class, dictating radiologist, and verifying radiologist. To preliminarily gauge the clinical utility of correlative recommendations, one subset of a week's worth of Emergency Radiology (ER) reports was examined.

RESULTS

Overall, Impressions from 450,127 reports yielded 3% "hits" (n = 14,100) with a grossly equal distribution across three patient classes. "Hits" for each subspecialty ranged from <1% to 10%. There is a trend for greater use with more expertise (attendings > senior residents/fellows > junior residents). Modality-specific differences were evident (NM&MI > CT = Ultrasound > Radiography > MRI).For the ER subset, 120 verified "hits" represented 5% of 2323 reports. The most frequent modalities were: chest radiography, CT abdomen & pelvis and CT Spine, followed by CT head and limited ultrasound. Specifics included: 14% pediatric; 55% by attendings; 18% redundant recommendations; 60% specific actions (history, labs, physical exam); 12% additional imaging to characterize findings; 21% more imaging (60% followed); and 32% direct clinical benefit.Underlying themes included: 15% of findings incidental/unexpected findings; 15% artifacts, postsurgical changes or foreign materials; majority increased specificity of subtle findings. While not mutually exclusive, 43% of recommendations were for etiology, 18% for location of symptoms, and 8% for chronicity.

CONCLUSION

3-5% of radiology reports recommend clinical correlation, often specific and beneficial in at least one-third. Preliminarily, we found a trend for greater use of "correlate clinically" recommendations with more training and certain examinations/modalities. We plan to expand our clinical utility data to include a month's worth of Emergency Radiology reports (10,822 reports with 452 search-positive reports) and complete a comprehensive analysis of all annual data.

CLINICAL RELEVANCE/APPLICATION

The use of the phrase "correlate clinically" in radiology reporting may be interpreted as a diagnostic "hedge" or "uncertainty" by referring providers, yet our findings underscore its potential important impact on clinical care.

IN146-ED-WEA7

PACS Replacement Part I: Steps to Successful Selection from Discovery to Contract

Wednesday, Dec. 4 12:15PM - 12:45PM Room: IN Community, Learning Center Station #7

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TEACHING POINTS

Implemetation of a new PACS requires significant resources and finamcial commitment. Keys to success include 1.Dedicated PACS team with representation and active participation from all constituents accross the Health System 2.Clear articulation of needs and expectations from users 3.Strong internal IT team 4.PACS leadership experienced in negotiations and with decision-making power unfettered by undue bureaucracy

TABLE OF CONTENTS/OUTLINE

1.Motivation for PACS replacement : Is the replacement motivated by the need to create a system- wide infrastructure; has the legacy PACS become obsolete? 2.Constituting the PACS team: Success is closely related to the involvement and active participation of Radiologists, managers and technologists accross the system. 3.Surveying users to understand and prioritize expectations 4.Exploring PACS options. PACS committee members must dedicate time to educate themselves and visit technical exhibits at RSNA and other national meetings. 5.Deciding on a PACS architecture : the pros and cons of deconstructed versus traditional architectures must be considered. 6.On site vendors visits; Scoring and formal ranking will help document and justify choices 7.The RFP process: This complex exercise may necesitate outside resources and additional budget. 8.Contract negotiations and signing. Setting a Go Live date.

IN216-SD-WEA2

Early Experience Implementing a Web-Based Interface to Annotate Breast Imaging Reports with Patent-Oriented Definitions

Wednesday, Dec. 4 12:15PM - 12:45PM Room: IN Community, Learning Center Station #2

Participants
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CONCLUSION

A web-based interface to annotate screening mammogram reports with patient-oriented definitions can be successfully introduced to a large number of patients within a multi-hospital health system.

Background

The PORTER (Patient-Oriented Radiology Reporter) glossary was developed as a tool to annotate radiology reports so that patients can better understand their content. The glossary has previously been shown to provide excellent coverage of terms found in breast imaging reports. During a six-week period from February 25 to April 8, 2019, all patients who underwent screening mammograms in our health system were invited to access a web-based version of their report that was annotated with definitions from the PORTER glossary. Patients were presented with a binary rating system with "thumbs up" or "thumbs down" option to provide feedback.

Evaluation

Of the 9,266 screening mammograms performed in our health system over the six-week period, 268 patients (2.9%) viewed the annotated version of their report on the web portal. Twelve patients provided feedback. There were 10 "thumbs down" reviews, all related to technical issues retrieving reports from our electronic medical record system. Two annotated reports received positive reviews. One of these reports contained a total of 266 words, of which 71 words were contained within the PORTER glossary. The second report contained a total of 248 words, of which 61 were within the PORTER glossary. There were no technical terms present in either of these reports that were not contained within the glossary.

Discussion

Our early experience demonstrates the feasibility of introducing a web-based system to annotate radiology reports within a large health system. The PORTER glossary provides excellent coverage of technical terms included in screening mammogram reports and could thereby improve patient understanding of their reports. However, our results reveal that only a small fraction of patients accessed their annotated reports and many fewer provided feedback. Future efforts will focus on increasing utilization of this system and optimizing the ways in which we evaluate it.

IN218-SD-WEA6

Collaborative Robotics for Image-Guided Interventions in a Standardized Network for Clinical Environments

Wednesday, Dec. 4 12:15PM - 12:45PM Room: IN Community, Learning Center Station #6

Participants
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Andreas Melzer, MD, DDS, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

This work shows the possibility of KUKA arms to be utilized in medical environments and lays the basement for further investigations in clinical interventions. Realizing an SDC connection enables integration into various networked operation rooms.

Background

Robotic systems provide high precision, reliability and applicability in high risk environments. Utilizing robotics should improve the workflow during medical interventions. To prove this hypothesis, new approaches to integrate KUKA robots into the clinical domain for Ultrasound guided procedures and radiation therapy (RT) were investigated.

Evaluation

Concepts for clinical integration of robotic systems were examined with KUKA LBR iiwa 7 R800 robots (KUKA AG, Germany) in two setups. i) Treatment planning and robot interaction were evaluated on a mobile platform to position a wireless ultrasound (US) probe Clarius L7 (Clarius Inc., Canada) for the use case of US-guided biopsies. An augmented-reality based tablet application (Apple iPAD pro 2017) was used to plan US positioning based on segmented CT/MRI data under navigated control using an abdominal phantom (Abdominal Triple Modality Phantom, CIRS Inc. USA). Two lesions were targeted 5 times each, by calculating needle trajectories from US. The mean targeting error was 1.02 mm ± 0.58 mm. ii) To ensure save information exchange inside the operating room, interconnection was tested with two KUKA robots, modeled inside the IEEE 11073 SDC standard. The robots were implemented to mirror their respective movements and network times were recorded for 140 movement commands. The transmission speed was below 15.1 ms in all cases.

Discussion

This work provides promising results for future applications to position a variety of tools like US probes or hyperthermia therapeutic transducers for image guided procedures. The mean targeting error of 1.02 mm shows possible usage of the system for precise steering of interventional tools. The standardized interconnection of two robots with transmission times below 15.1 ms assures real-time-controllability in collaborative environments. Future studies have to consider trajectory errors in US imaging and robotic movement for reactions in safety-critical situations.

IN235-SD-WEA3

Improving Communication between Radiologists, Pathologists, and Urologists by Using a PI-RADS Structured Reporting System

Wednesday, Dec. 4 12:15PM - 12:45PM Room: IN Community, Learning Center Station #3

Participants
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David J. Vining, MD, Houston, TX (*Abstract Co-Author*) Royalties, Bracco Group; CEO, VisionSR; Stockholder, VisionSR
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CONCLUSION

We developed a PI-RADS structured reporting system to make it easier for radiologists to apply PI-RADS and to enhance communication for multidisciplinary care of patients with prostate cancer.

Background

The advent of targeted prostate biopsies is encouraging more accurate communication between radiologists, pathologists, and urologists. Clinicians rely on radiologists' reports to guide the location and severity, but radiology reports are plagued by variable language and lack of connectivity to images stored in a PACS. PI-RADS is a standard set of guidelines for acquiring, interpreting, and reporting mpMRI examinations in order to perform risk stratification and improve communication; however, the application of PI-RADS by radiologists remains tedious, time-consuming, and not widely adopted. We have developed a PI-RADS structured reporting system to automate the assessments and improve communication.

Evaluation

Our PI-RADS structured reporting system is designed as a clinical decision support tool to aid radiologists when applying PI-RADS and as a means to improve communication with clinicians by illustrating imaging findings in graphical displays. The system works by capturing key images of MRI findings and a radiologist's dictations, and then tagging the data with PI-RADS-specific language using natural language processing. The system employs a set of diagnostic templates that match dictated elements to the appropriate PI-RADS score. The MRI images can be linked to histological images in timelines in order to perform radiology-pathology correlation and calculate outcomes. Finally, the data is presented in graphical displays to aid in the efficient communication of information.

Discussion

Correlation of radiological findings to prostate biopsy specimens and histological analysis is an arduous task. To improve the efficiency of this task and enhance communication, we are employing a PI-RADS structured reporting system to automate the calculation of PI-RADS scores and communicate the MRI findings using graphical displays depicting the locations and severity of disease. The ability to link histological data from prostate biopsies to radiological images enables the calculation of outcomes.

IN244-SD-WEA1

3D Ultrasound-Based Measurement of Hydronephrosis Index to Assess the Severity of Pediatric Hydronephrosis

Wednesday, Dec. 4 12:15PM - 12:45PM Room: IN Community, Learning Center Station #1

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PURPOSE

To design and evaluate a new 3D ultrasound (US)-based quantitative imaging tool for accurate hydronephrosis (HN) severity score measurement.

METHOD AND MATERIALS

The retrospective dataset (IRB approved) consists of 64 patients (mean age 25±9 months; age range 0 to 186 months) diagnosed with HN of variable severity (grade 1 to 4 according to the Society for Fetal Urology (SFU) HN scale. 3D US images were acquired with a Philips iU22 system, using an X6-1 xMATRIX array transducer. To measure HN index (HI), we first extracted kidney regions semi-automatically using a real time kidney shape template deformation method. Next, we segmented collecting system (CS) regions automatically using the U-net deep neural network. To refine the segmented CS regions, we used the anatomical location of the renal fat spots around the CS. Finally, we calculated HI using the ratio of CS volume to the total kidney volume. Ground truth and inter-user variability were obtained by manual segmentation of two experts using the ITK-SNAP interactive software.

RESULTS

The results showed that the proposed method could segment CS automatically with an average volume overlap of 0.76 ± 0.12 and an average symmetric surface distance value of 1.29 ± 0.95 mm. These results were similar to the expert inter-variability of 0.74 ± 0.18. Our method measured HI with an error of 2.1 ± 2.8%, similar to the manual segmentation-based HI measurement (p-value=0.58 using the Wilcoxon signed-rank test).

CONCLUSION

Image analysis with 3D US images can measure HI with high accuracy and as reliably as the human expert.

CLINICAL RELEVANCE/APPLICATION

Automatic measurement of HI based on 3D US images could provide a quantitative, reproducible, and objective assessment of HN compared to the subjective visual assessment of HN in the SFU system.

IN247-SD-WEA4

Paradigm Shift in Diagnostic Radiology Training using Simulation Workshops: Intracranial Malignancies

Wednesday, Dec. 4 12:15PM - 12:45PM Room: IN Community, Learning Center Station #4

Participants
Aparna Devi Yepuri, MBBS, Herndon, VA (*Abstract Co-Author*) Nothing to Disclose
Ramin Javan, MD, Washington, DC (*Presenter*) Nothing to Disclose
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CONCLUSION

By implementing Weasis and add-on reporting system, a real-time, easy-access, sophisticated Image Database can be established for trainees to take part in workshops on any given topic of interest. Teaching cases can easily be accumulated for learning and evaluation purposes seamlessly during day to day read-outs. This implementation provides a new opportunity for both training and evaluation purposes for training programs.

Background

Many small and intermediate-sized radiology training programs may not have an abundance of cases highlighting certain topics. This may prevent trainees from gaining adequate exposure to those types of cases depending on the institutional focus, size and location. In order to create a tailored and active learning experience for trainees simulating a realistic exposure to cases on a day to day basis, we utilized an open-source web-based PACS named 'Weasis'.

Evaluation

We utilized the open-source PACS system 'dcm4chee' and integrating Weasis as image viewing browser, MySQL as database and JBOSS as application server. The development environment is MyEclipse and development language is JAVA. We use WADO (Web Access to DICOM Object) to achieve web-client DICOM access. Java applets are used via a browser to serve as a DICOM viewer with full PACS functionality. Each anonymized full study is transferred through the secure hospital network to reside on a dedicated computer server after a few clicks.

Discussion

Fifty cases of brain tumors, some containing multiple studies, were chosen, including a various gamut of diagnoses ranging from tumor mimickers to ones with complex findings such as pseudoprogression. The anonymized cases are accessible on any computer throughout the hospital that is connected to the hospital's secure network. Multiple trainees can simultaneously simulate being a radiologist, independently formulating an opinion and typing up a brief report, without the need for occupying an expensive PACS workstation. Results can be viewed on a separately stored hard-copy under the supervision of an attending radiologist. The typed impressions can be manually scored electronically using the custom designed user interface.

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IN256-SD-WEA5

Automatic Structuring of Sentences in Chest X-Ray Reports to Enable Structured Reporting

Wednesday, Dec. 4 12:15PM - 12:45PM Room: IN Community, Learning Center Station #5

Participants
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PURPOSE

The goal of this work is to automatically structure sentences occurring in chest X-ray reports from the unsupervised detection of radiological findings and their known associations with anatomical and other structures.

METHOD AND MATERIALS

We use a prepared vocabulary with predefined mappings of findings to structuring elements and combines with lexical and natural language analysis to detect radiological findings. It was generated from findings/diseases concepts within a UMLS knowledge base of 5.9 million concepts spanning 70 reference vocabularies and augmented with a custom vocabulary radiological findings most commonly seen in chest X-rays and mapped to 12 major structural labels including lungs, pleura, trachea/major airways, heart, mediastinum, recesses/angles, diaphragm, soft tissues and bones, technical assessment and tubes/lines-related findings. To detect findings, we first extract initial clinical concepts using the longest common subfix algorithm (https://aaai.org/ocs/index.php/AAAI/AAAI17/paper/view/14794) which allows non-contiguous word matches and greater variation due to spoken utterances. A dependency graph is formed from natural language analysis per sentence, and lemmas generated are clustered as shown in Figure 1. The resulting complex concepts with the semantic finding label are used to recover the structuring labels. By clustering labels from consecutive sentences, we classify a block of text into the respective structured section.

RESULTS

A set of 1116 chest X-rays selected from the recently released NIH dataset [3] were re-interpreted by a team of radiologists and the report text was entered into the respective structured sections. The report text was then blinded before automated analysis, and the predicted structuring labels were recorded. The accuracy was measured by the fraction of sentences that had at least one finding that matched the respective structured label. The method was applied to 1116 textual reports resulting in 7800 sentences. The overall accuracy was 81.74%.

CONCLUSION

In this paper we have presented a novel algorithm for automatically structuring sentences in chest X-ray reports from radiological findings.

CLINICAL RELEVANCE/APPLICATION

Adopting structured reporting has been difficult due to the tedium and inconsistency issues with manual structuring. Automatic structuring could lead to both improvements in consistency of reports and increase in productivity of radiologists

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MI211-SD-WEA1

A Multi-Site Phantom Study to Quantify Variation of Hypoxic Fraction Measurement with PET

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MI Community, Learning Center Station #1

Participants
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PURPOSE

'Hypoxic fraction' (HF) calculation in PET hypoxia imaging relies on counting the number of voxels above a predetermined uptake threshold in the tumor. However, there is no consensus on how to choose the threshold. This work is to test the effect on HF values with 2 thresholding methods, namely, a fixed and a statistical threshold.

METHOD AND MATERIALS

We ran a study with a 'hypoxia standardization phantom' to quantify the variation of HF measurements over 9 PET-CT and 1 PET-MR scanners at 7 sites in the QIN CT-PET Working Group. The phantom was made of an insert placed in a NEMA IEC PET body phantom shell. The insert was constructed with 4 cylindrical columns, aligned with 2 mm solid polycarbonate rods in the cylindrical direction in predetermined patterns. A 40% uniformly filled pattern is used as 'reference'. As the phantom was filled with 80-100 MBq of pure 18F or FDG, the rod patterns would give different averaged activity concentrations in the 3 remaining 'tumor' regions on the PET image simulating tumor uptake in a FMISO or FAZA study. Each participating site did the scan and reconstruction according to 2 imaging and 3 reconstruction protocols. The central site performed a preliminary analysis on HF using (i) a statistical threshold of mean + 3 s.d. of reference distribution, and (ii) a fixed threshold of 1.2 times the mean of reference distribution.

RESULTS

For a 'typical' clinical imaging and reconstruction protocol, phantom images across the 10 scanners exhibit differences in background signal-to-noise ratio (S/N) ranging from 9.2 to 24.3. Among the scanners, variations of HV for the same 'tumors' are greater for the statistical threshold than for the fixed threshold. HFs range from 20 to 98%, 14 to 90% and 10 to 73% respectively over 'tumor' 1, 2 and 3 respectively for the statistical threshold; the corresponding ranges are 66 to 91%, 47 to 90% and 20 to 60% for the fixed threshold.

CONCLUSION

The preliminary results show a large range of S/N on images of similar protocols among the scanners. HFs calculated with the fixed threshold have less variation among these scanners than those of the statistical threshold. Further analysis might lead to a more robust method for HF calculation.

CLINICAL RELEVANCE/APPLICATION

There is a marked scanner dependent variation in HF measurement with 18F-labelled nitroimidazole-based isotopes; harmonization of scanners and using a fixed threshold might reduce such variation.

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MI223-SD-WEA2

Whole-Body DWI in Lymphoma - First Order Global ADC Histogram Parameters Discriminate Lymphomatous Nodes from Normal Lymph Nodes

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MI Community, Learning Center Station #2

Participants
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PURPOSE

To discriminate lymphomatous from normal lymph nodes using first order general ADC (gADC) histogram parameters derived from whole-body DWI (WB-DWI).

METHOD AND MATERIALS

WB-DWI of 23 lymphoma patients and 20 healthy individuals, performed on a 1.5T MRI system were reviewed retrospectively. All malignant nodal groups of the lymphoma cohort and all nodes visible on b900 images from the neck to groin area of the healthy individuals were included to generate a total nodal volume (tNV). From the tNV of each patient gADC mean, median, skewness, kurtosis, minimum, maximum, interquartile range (IQR), standard deviation (SD), 10th and 90th centile were derived. gADC parameters were compared between lymphomatous and normal nodes using t-tests, a p-value < 0.05 was deemed significant. The discriminatory ability of each significant parameter was assessed by ROC curve analyses.

RESULTS

Mean, median, 10th and 90th centiles gADC values were significantly lower in lymphomatous than in normal lymph nodes (each $p < 0.001$). tDV, gADC skewness and kurtosis were significantly higher in lymphomatous nodes (each $p < 0.05$). The SD, min and max gADC showed no significant difference (each $p > 0.128$). The order of maximum diagnostic accuracy of gADC parameters as indicated by the AUC from highest to lowest was: 10th centile, mean, median, 90th centile, skewness, kurtosis and IQR. A 10th centile gADC threshold of 0.68 x 10^{-3} mm^2/s identified lymphomatous nodes with 91% sensitivity and 95% specificity.

CONCLUSION

gADC histogram parameters derived from WB-DWI allow discrimination between lymphomatous and normal lymph nodes.

CLINICAL RELEVANCE/APPLICATION

WB-DWI can distinguish lymphomatous from normal lymph nodes.

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MI224-SD-WEA3

Can Whole-Body MRI Help to Improve the Assessment of the Bone Scan 'Flare Effect' in Patients with Prostate Bone Metastases?

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MI Community, Learning Center Station #3

Participants
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PURPOSE

The assessment of treatment response of prostate bone metastases using bone scintigraphy is confounded by the 'flare effect', which can be misinterpreted as disease progression. We aim to evaluate the response categorization by whole body MRI (WB-MRI) in patients with suspected 'flare effect' on bone scintigraphy at 12 weeks after therapy.

METHOD AND MATERIALS

Ten patients (mean age at baseline evaluation: 73.5+/-10) with metastatic prostate cancer demonstrating at least two news bone lesions at bone scintigraphy at 8 to 12 weeks after initiating treatment compared with baseline imaging; who also had WB-MRI including DWI at baseline and at 8 to 12 weeks after therapy were identified by search of electronic health record. The WB-MRI images were reviewed by an expert radiologist with > 10 year experience and response categorized according to MET-RADS-P criteria (score 1-5; 1 = definite response, 5 = definite progression). The bone scintigraphy were evaluated using the Prostate Cancer Working Group criteria that require a subsequent confirmatory bone scintigraphy performed at 6-12 weeks. The soft tissue disease was evaluated using RECIST 1.1.

RESULTS

Disease sites in the 10 patients were bone only (n=6), bone and soft tissue (nodal n=3 and liver n=1). At follow-up, 3 patients had progressive disease by RECIST 1.1, treatment was stopped and no confirmatory bone scintigraphy was performed. In the 7 patients with subsequent confirmatory bone scintigraphy (week 24 of therapy), the outcome based on PCWG criteria was: A) FLARE (n=2) B) Progression (n=3) and C) Non evaluable due to malignant superscan (n=2). The corresponding 8-12 week WBMRI evaluation was: A) Response (n =1 of 2) and Discordant response (n=1 of 2) ; B) Progression (n=3 of 3) and C) Progression (n=1 of2) and Response (n=1 of 2).

CONCLUSION

WB-MRI at 8-12 weeks of therapy can help to better categorize responders and non-responders earlier in patients with prostate bone metastases differentiating the flare effect from disease progression on bone scintigraphy, as well as identifying discordant response between disease sites.

CLINICAL RELEVANCE/APPLICATION

The use of WB-MRI can help to overcome the diagnostic pitfall of the 'flare response' on bone scintigraphy when patients with prostate bone metastases undergo treatment.

MK327-ED-WEA10

Put Your Shoulder Into It (and Elbow And Wrist For That Matter): Ultrasound-Guided Procedures of the Upper Extremity

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #10

Awards
Certificate of Merit

Participants
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TEACHING POINTS

1. There are a range of common conditions that cause upper extremity joint pain. 3. US can accurately diagnose non-traumatic causes of shoulder, elbow and wrist pain. 4. US-guided fenestration, tenotomy, barbotage, cyst aspirations, and joint injections are safe and effective therapeutic procedures for shoulder pain. 5. An organized and practiced approach to US-guided musculoskeletal interventions of the upper extremity is key for effective treatment.

TABLE OF CONTENTS/OUTLINE

1. Introduction a. Background about upper extremity joint pain. b. Background about US-guided shoulder procedures. 2. Learning objectives 3. Basic Principles a. Informed consent b. Equipment c. Anatomy d. Target sites 4. Shoulder a. Joint injection b. Subdeltoid/Subacromial bursa injection c. Biceps tendon d. Brachial plexus block e. Calcific tendinitis barbotage f. Paralabral cyst aspiration 5. Elbow a. Common extensor tenotomy b. Common flexor tenotomy c. Joint injection 6. Wrist a. Needle fenestratioinn of flexor pulley and retinaculum b. Tendon sheath steroid injection for trigger finger c. Small CMC joint injections for OA. 10. New directions/procedures 11. Summary 12. References

MK328-ED-WEA11

Most Common MRI Findings of Muscle Sport Injuries in Professional Football Players: A Pictorial Review

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #11

Participants
Jaime Isern, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
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Gil Rodas Font, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. To describe the Anatomy and Histology of the most common muscle injuries in football players. 2. To review the pathophysiological mechanism. 3. To present the specific MRI Protocol for diagnosis of muscular injuries of the lower extremity. 4. To describe our Grading System for MRI Evaluation of Muscle Injury. 5. To show the expected range of pathological findings. 6. To describe the MRI findings of residual changes of a muscle tear.

TABLE OF CONTENTS/OUTLINE

Anatomy and histology of Muscles of the lower extremity. Pathophysiological Mechanism of Injuries. MRI protocol for diagnosis of Traumatic Muscle Injuries. Grading System for MRI Evaluation of Muscle Injury. Review of imaging findings. Range of normal and pathological findings following conservative and surgical treatment.

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MK329-ED-WEA12

Common and Uncommon Complications of Reverse Total Shoulder Arthroplasty: Pictorial Review and Review of the Literature

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #12

Awards
Certificate of Merit

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TEACHING POINTS

The purpose of this exhibit is: 1. To review the biomechanics of and indications for reverse total shoulder arthroplasty (RTSA) 2. To review the range of normal postoperative appearance of RTSA 3. To demonstrate common and uncommon complications of RTSA and explain their biomechanical rationale

TABLE OF CONTENTS/OUTLINE

Biomechanics of RTSA Indications for RTSA Normal Postoperative appearance of RTSA Complications -Anterior Dislocation -Acromial Stress Fracture -Scapular Notching -Loosening of Components -Perihardware Fracture -Infection Summary

Printed on: 10/29/20

MK330-ED-WEA7

Demystifying Sacral Masses: Imaging Findings, Rad-Path Correlation, and Biopsy Techniques

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #7

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Participants
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Paul Buttars, Columbia, MO (*Abstract Co-Author*) Nothing to Disclose
James D. Stensby, MD, Columbia, MO (*Abstract Co-Author*) Nothing to Disclose
Ryan Davis, MD, Columbia, MO (*Abstract Co-Author*) Nothing to Disclose
Ambarish Bhat, MD, Columbia, MO (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Teaching points: - Sacral Anatomy : Osseous/Ligamentous, relationship with nerves/vascular structures - Sacral Masses: Classification, prevalence, age on incidence, distribution. - Key imaging features of common and uncommon sacral masses with pathologic correlation. - Biopsy Techniques to improve sampling yield in sacral masses.

TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline: Essential Sacral Anatomy with illustrations are depicted. Sacral masses discussed with pertinent imaging and pathological findings. - Masses include, metastasis, Chordoma, Myeloma, Chondrosarcoma, Osteosarcoma, Ewing's Sarcoma, neurofibroma. Biopsy techniques and tricks to improve sampling yield. Prognostic features of sacral masses.

MK331-ED-WEA8

High Resolution Ultrasonography (US) of the Elbow Demonstrating Standard Technique and Its Variations with Emphasis on Detailed Evaluation of Ligaments, Tendons, and Nerves

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #8

Participants
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TEACHING POINTS

To demonstrate elbow joint ultrasonography (US) standard procedures and its variations in illustration of normal elbow joint anatomy with emphasis on detailed evaluation of ligaments, tendons and nerves.

TABLE OF CONTENTS/OUTLINE

1) Standard techniques for compartmental evaluation of elbow joint. 2) Anterior compartment: • Anterior joint recess • Distal biceps brachii muscle (Oblique anteromedial approach, lateral approach, cobra position) • Biceps brachii tendon (BAM sign) • Lacertus fibrosus • Distal brachialis muscle • Median nerve (BAM sign) 3) Lateral compartment: • Capitellum and radiocapitellar joint • Common extensor tendon (CET) • Lateral collateral ligamentous complex • Annular recess • Radial nerve (Superficial radial nerve and Posterior Interosseous nerve) • Arcade of frohse 4) Medial compartment: • Medial epicondyle • Common flexor tendon (Elevator method) • Anterior band of the ulnar collateral ligament (UCL) 5) Posterior compartment: • Posterior joint recess • Olecranon bursa • Distal triceps muscle and tendon • Ulnar nerve and cubital tunnel 6) Dynamic evaluation: • For evaluation of ulnar nerve subluxation • For evaluation of tear of anterior band of ulnar collateral ligament.

MK332-ED-WEA9

Articular Cartilage Injury of the Knee Reporting and Data System (ACIK-RADS): A New Proposal for the Report of Cartilage Injury in the Knee by MRI

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #9

Participants
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TEACHING POINTS

1. To exemplify the current classification systems that are validated for the assessment of chondral lesions 2. To propose a new mapping system for reporting lesions of the articular cartilage of the knee, in order to improve communication with the rest of the multidisciplinary team and surgical planning. 3. To standardize radiological reports and reduce variability amongst radiologist

TABLE OF CONTENTS/OUTLINE

NORMAL ANATOMY. Bone landmarks. ASSESSMENT AND REPORTING Reporting Articular cartilage injury mapping system ICRS classification Step by step assessment. CORRELATION CASES WITH EACH GRADE INJURY. POSSIBLE MISTAKEN WITH BORDERLINE CASES.

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MK367-SD-WEA1

Evaluation of Articular Cartilage of the Glenohumeral Joint in Patients with Labral Injury Using T2 Mapping Technique: Relationship between Labral Tear Location and T2 Mapping Value: Evaluation of Articular Cartilage of the Glenohumeral Joint (GHJ)

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #1

Participants
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PURPOSE

To evaluate T2 values of glenoid and humeral cartilage in patients with labral tear, including SLAP and Bankart lesions. To investigate the correlation between the T2 values of cartilage of GHJ according to different locations and frequency of dislocation, location, and extent of labral tears.

METHOD AND MATERIALS

IRB approval was obtained and informed consent was obtained for this prospective study. From November 2016 to July 2018, we prospectively obtained and analyzed 30 unilateral shoulder MRIs with T2 mapping in patients with suspected labral tears. T2 values of cartilage were measured dividing the glenoid and humeral side into 9 areas as antero-superior, antero-central, antero-inferior, central-superior, central-central, central-inferior, postero-superior, postero-central, postero-inferior and measured twice by two radiologists. Intra- and interobserver agreements were calculated by using the intraclass correlation coefficient (ICC). Labral tears were classified according to location and extent as follows: SLAP II (variants included), SLAP V, VIII, inferior labral tear, circumferential labral tear. The correlation was analyzed using independent student T test and ANOVA test.

RESULTS

Inter-observer agreement of MRI using T2 mapping value of cartilage was moderate (glenoid; 0.612, humerus; 0.530), intra-observer agreement was good (glenoid; 0.763, humerus; 0.866). Location and extent of labral tears showed a tendency to correlate with T2 values at glenoid cartilage although no statistically significant correlation was found. No significant association existed between the frequency of shoulder dislocation and T2 values of cartilage.

CONCLUSION

Cartilage T2 values of glenohumeral joint cartilage showed good agreement regarding reproducibility; however, there was neither significant correlation with location and extent of labral tears and nor frequency of dislocation.

CLINICAL RELEVANCE/APPLICATION

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MK368-SD-WEA2

Radiomics and Machine Learning May Accurately Preoperatively Be Predicting the Histopathological Grades of Soft Tissue Sarcomas Based on Multiparametric MRI

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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Pei Nie, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Preoperative prediction of the Soft tissue sarcomas(STSs) grade is important due to it affect the treatment plan. The purpose of our study was to assess the value of radiomics features in the distinguishing of histological grades of STSs.

METHOD AND MATERIALS

Eighty patients (18 low-grade [grade I]; 62 high-grade [grade II and III]) with STSs, who underwent T1WI and fat-suppressed T2WI were enrolled in the discovery set. The T1WI and fat-suppressed T2WI were analyzed to derive volume-based data of the entire tumor.Radiomics features were related to histological grades of STSs. Multiple machine learning methods were trained to establish classification models to predict STSs grades. We validated the model in a validation set (33patients; 7 low-grade; 26 high-grade) .

RESULTS

The machine learning method showed different performances based on the machine learning algorithms. The best classification model for the prediction of STSs grades had an area under the curve of 0.9615 (95% confidence interval [CI], 0.8944-1) in the validation set. The accuracy, sensitivity, and specificity of the best mehod were 93.94, 96.15, and 85.71% in the validation set, respectively.

CONCLUSION

Multiparametric Radiomics feature-based machine learning method are useful for distinguishing STSs grades, which provided great effort to improve the precision of preoperative diagnosis and may affect the treatment strategies.

CLINICAL RELEVANCE/APPLICATION

Radiomics feature-based machine learning classifiers of T1WI and fat-suppressed T2WI are useful for differentiating soft tissue sarcoma grade

MK369-SD-WEA3

Correlation Between Thoracic Vertebral Bone Strength and Quantitative Lung CT Assessment in Chronic Obstructive Pulmonary Disease Patient

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #3

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PURPOSE

Chronic obstructive pulmonary disease (COPD) is associated with extrapulmonary chronic inflammatory response, and osteoporosis is one of the critical abnormalities leading to the vertebral fractures and the deteriorate pulmonary function. The purpose of this study is to determine the value of quantitative lung CT analysis in vertebral bone strength prediction of COPD patients.

METHOD AND MATERIALS

Thirty-seven consecutive COPD patients were included in this study. They underwent CT covering the whole lung and pulmonary functional test within a month. The low-attenuation volume percentage (LAV%) (threshold between normal lung and the LAV was defined as -950HU) were calculated on CT. Pulmonary functional tests were performed after the patients had used bronchodilators. Failure load of the thoracic vertebra (Th4, Th7, and Th10), determined by the CT-based finite-element method (FEM), was used as the gold standard for bone strength. A forward stepwise multiple regression analysis for evaluating the availability of the quantitative lung CT analysis was performed. A logistic model was used with age, body mass index (BMI), smoking index, the pulmonary functional test parameters (FEV, FEV%, VC, and %VC), and the LAV%.

RESULTS

On univariate analysis, age (r=-.287), BMI (r=.283), FEV (r=.328), FEV% (r=.433), and LAV% (r=-.462) were significant independent factors for bone strength in COPD patients ($p<0.01$). On stepwise logistic regression analysis of all variables, LAV% was the only significant predictive factor for the failure load by CT-FEM ($p<0.001$).

CONCLUSION

LAV% had a significant negative correlation with bone strength in COPD patients. Lung CT quantification of emphysema can potentially be used in predicting bone strength in COPD patients in clinical practice.

CLINICAL RELEVANCE/APPLICATION

CT is widely used as a tool for assessment of the presence, pattern, and severity of COPD. Our results suggested that quantitative lung CT assessment without additional radiation exposure can provide additional information in bone strength prediction in COPD patients.

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MK404-SD-WEA4

Longitudinal Change of Long Head of the Biceps Brachii Tendon on Magnetic Resonance Imaging After Rotator Cuff Repair

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #4

Participants
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PURPOSE

To determine the relationship between the alteration of long head of biceps tendon (LBT) after rotator cuff repair surgery and the immediate postoperative condition of shoulder elements on magnetic resonance (MR) images.

METHOD AND MATERIALS

Two-hundred nineteen patients (F:M=148:71; mean age, 57.4 years) who had undergone the rotator cuff repair surgery and examined postoperative MR more than twice by one year after surgery were included. The LBT was graded with 6-severity scale: normal, mild, moderate, severe intratendinous signal change, partial tear and complete tear. The deterioration of LBT was defined by increased grade or extent of the LBT abnormality between the first and second postoperative MR. To find the possible association between postoperative MR findings and LBT deterioration, the fatty degeneration of superior cuff (supraspinatus and infraspinatus muscles) and subscapularis muscle, the initial condition of LBT, subluxation of LBT, superior labral tear and adhesive capsulitis were evaluated on the initial postoperative MRI. Additionally, 63 patients (F:M=39:24; mean age, 57.3 years) with long-term follow-up MRI over 3 times, the association between preservation or improvement of LBT and the aforementioned factors were analyzed. The logistic regression was used to evaluate the association between the alteration of LBT and the postoperative factors.

RESULTS

Among total 219 patients, 48.9% (n=107) showed LBT deterioration. In univariate analysis, the fatty degeneration of superior cuff (p=.002) and subscapularis muscle (p=.026) were associated with LBT deterioration while the subluxation of LBT showed a tendency (p=.059). In multivariate analysis, only the fatty degeneration of superior cuff was significantly associated with LBT deterioration. In patients with long-term follow-up (1166.3±610.3 days), 8, 23 and 32 were improved, stable, and further deteriorated, respectively. The fatty degeneration of superior cuff and the initial condition of LBT showed significant association with long-term preservation of LBT in multivariate analysis (p=.007, p=.028), respectively.

CONCLUSION

The degree of fatty degeneration in rotator cuff is associated with the LBT deterioration on 1 year MRI follow-up, and the LBT preservation in long-term MRI follow-up.

CLINICAL RELEVANCE/APPLICATION

The degree of fatty degeneration in rotator cuff may have a predictive value for LBT status after rotator cuff repair surgery.

MK405-SD-WEA5

Piriformis Syndrome: Pain Response Outcomes Following CT-Guided Injection Incremental Value of Botulinum Toxin Injection

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #5

Participants
Kevin Yan, MD, Dallas, TX (*Presenter*) Nothing to Disclose
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Rocco Hlis, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, Flowermound, TX (*Abstract Co-Author*) Consultant, ICON plc; Consultant, Treace Medical Inc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

PURPOSE

Piriformis syndrome is a common pain condition affecting the buttock and posterior hip with or without radiation to the leg, and management of the condition involves many treatments. In this study, we hypothesize that a CT-guided injection with Botox is more effective in providing pain relief than a CT-guided injection without Botox.

METHOD AND MATERIALS

97 consecutive patients with piriformis syndrome presented for a CT-guided injection of the piriformis muscle and perineural injection of the sciatic nerve. After the injection, the patients received a visual analog scale pain log to record their pain level until the follow-up appointment. Wilcoxon-Mann-Whitney tests and Chi-square tests were used to identify potential confounders. The effect of Botox on 48-hour response and duration of response was tested using Cochran-Mantel-Haenszel (CMH) test and stratified Kaplan-Meier analysis.

RESULTS

There was no significant difference found between the patient characteristics and imaging findings in the Botox group and in the non-Botox group. At 48 hours, the patients in the Botox group were more likely to have had a positive response than patients in the non-Botox group ($p=0.0046$). In addition, patients who received Botox were likely to have a longer duration of response than patients who did not receive Botox ($p=0.04$).

CONCLUSION

In conclusion, CT-guided injections with Botox for patients with piriformis syndrome is more likely to lead to a positive response and a longer duration of response than patients who receive a CT-guided injection without Botox.

CLINICAL RELEVANCE/APPLICATION

We hope to see prospective randomized blind trials for patients with suspected piriformis syndrome, because it greatly affects patients' quality of life and ability to perform everyday activities.

MK406-SD-WEA6

US Features in the Median Nerve for the Assessment of Carpel Tunnel Syndrome Using High Frequency US Imaging

Wednesday, Dec. 4 12:15PM - 12:45PM Room: MK Community, Learning Center Station #6

Participants
Kibo Nam, PhD, Philadelphia, PA (*Presenter*) Equipment support, Cannon Medical Systems Corporation; Research funded, , Cannon Medical Systems Corporation
Shawn Peterson, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To compare the diagnostic performance of US features from the median nerve (MN) in normal volunteers and patients with Carpal Tunnel Syndrome (CTS) using high frequency US.

METHOD AND MATERIALS

All consented subjects of this ongoing IRB approved study were examined in the sitting position with a palm facing up using an Aplio i800 system (Cannon Medical Systems, Otawara, Japan). The cross-sectional area (CSA; in mm2) and blood flow of MN were evaluated at the wrist using an i24LX8 probe (9-24 MHz). Blood flow was assessed using Color Doppler Imaging (CDI), Power Doppler Imaging (PDI), Monochrome/Color Superb Microvascular Imaging (mSMI/cSMI) with the same imaging settings for all subjects. The maximum vascular area was quantified offline by counting colored pixels (arbitrary unit) using Matlab (MathWorks, Natick, MA). Shear wave elastography (SWE) images were acquired using i18LX5 probe (4-18MHz) at the wrist. The stiffness (in kPa) in the MN was quantified using a built-in software tool. T-tests and receiver operating characteristic (ROC) analysis were performed for the ultrasonic features.

RESULTS

To date, analysis included 20 hands in 10 normal volunteers and 9 hands in 6 patients with clinically diagnosed CTS. The MN in patients with CTS showed significant higher values in CSA ($p<0.001$), vascular area (CDI, $p=0.001$; PDI, $p=0.006$; mSMI, $p=0.02$; cSMI, $p<0.001$), and stiffness of MN ($p=0.006$) compared to those in normal volunteers. CSA (AUC, 0.91; specificity, 100%; sensitivity, 78%), vascularity from CDI (0.93; 85%; 100%), and stiffness (0.81; 80%; 89%) showed high diagnostic performance independently, albeit based on a small sample size. Additionally, the combination of these three predictors using generalized linear regression showed a specificity of 100% and a sensitivity of 89% with an AUC of 0.95.

CONCLUSION

US features of CSA, CDI, and stiffness of MN at the wrist showed potential to be useful for the initial assessment of CTS independently. The combination of these three predictors showed improved diagnostic performance.

CLINICAL RELEVANCE/APPLICATION

It may be helpful to utilize US features for the initial assessment of CTS.

NM135-ED-WEA6

"Virtual Planar Image" Reconstructed from SPECT Data: How to Process and Its Clinical Feasibility

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NM Community, Learning Center Station #6

Awards
Certificate of Merit

Participants
Akira Imoto, Suita, Japan (*Presenter*) Nothing to Disclose
Keisuke Kiso, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Emi Tateishi, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
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Tetsuya Fukuda, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Planar image (PI) of scintigraphy is one of the useful modalities for diagnosis of cardiovascular diseases in addition to SPECT image. In most cases, PI is evaluated by count ratio of contralateral regions or target/control regions. For example, 'Right/Left ratio' in lung perfusion scintigraphy in pediatric patients, 'Lung/Heart ratio' in stress myocardial perfusion scintigraphy, 'Heart/Mediastinum ratio' in myocardial MIBG scintigraphy, 'Heart/Contralateral ratio' in 99mTc-PYP scintigraphy, etc. are often evaluated in clinical practice. However, since these scintigraphic examinations require mainly SPECT image, rather than PI, additional acquisition of PI is sometimes omitted to save the examination time in many institutions. Therefore, we developed the novel algorithm to generate PI from SPECT data (hereafter 'virtual planar image: VPI'). The purpose of this exhibit is to present how to process VPI and its clinical feasibility. Learning this technique will bring you more efficient performance of scintigraphy in terms of the saving time of PI acquisition without losing its information.

TABLE OF CONTENTS/OUTLINE

1.Explanation of how to process VPI. 2.Presentation of the clinical examples of cardiovascular diseases which show the feasibility of VPI compared with conventional planar image. 3.Verification of accuracy of measurement by VPI: phantom study.

NM136-ED-WEA7

Imaging in Chronic ThromboEmbolic Pulmonary Hypertension

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NM Community, Learning Center Station #7

Participants
Hina Shah, MD, Boston, MA (*Presenter*) Nothing to Disclose
Hyewon Hyun, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

After reviewing the exhibit, the learner is expected to: Understand what Chronic Thromboembolic Pulmonary Hypertension (CTEPH) is, including WHO groupings Know the pathophysiology of CTEPH Discuss the advantage and disadvantages of various imaging modalities in the evaluation of CTEPH

TABLE OF CONTENTS/OUTLINE

Outline of proposed presentation: CTEPH Definition and WHO groupings Pathophysiology of CTEPH Advantages and Disadvantages of various imaging modalities Each example illustrated with nuclear medicine, CT and angiographic image where appropriate with management and outcome

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NM218-SD-WEA1

Malignancy Probabilistic Model in Mediastinal and Hilar Lymph Nodes in Lung Cancer Based on PET/CT and EBUS

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NM Community, Learning Center Station #1

Participants
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PURPOSE

Mediastinal lymph node (LN) staging of non-small cell lung cancer (NSCLC) is routinely performed by PET/CT, and EBUS-TBNA if histological confirmation is required. Among the variability of the SUVmax cut-off points for PET/CT staging, other variables such as metabolic parameters and different ratios have been proposed. Ultrasonographically, different variables associated with the probability of malignancy of a lymph node such as diameter of its short axis (DSA) and the morphology have been described. However, there are no studies exploring the diagnostic capacity of both techniques together. Our aim was to find an algorithm based on combined PET/CT and EBUS variables together with clinical criteria that provide the most accurate probability of malignancy for each LN explored.

METHOD AND MATERIALS

We performed a retrospective study of mediastinal staging of NSCLC (51.4% adenocarcinoma; 34.9% squamous cell carcinoma; 13.7% other), based on PET/CT and EBUS-TBNA. LNs were identified according to the clinically approved staging level (IASCLC) (N1, N2 and N3) and by anatomical region (AR) (subcarinal, not subcarinal, and hilar). Metabolic parameters (MTV, TLG, SUVmax, SUVmean and SUVpeak) were determined for each sampled LN as well as for pulmonary mass. Also liver and blood pool SUV were registered as reference. The ultrasound features collected were: DSA, morphology, border, echogenicity and presence of the vascular hilium. For the construction of the predictive algorithm a mixed model of logistic regression of Firth was used.

RESULTS

116 consecutive patients were included and a total of 358 LN were evaluated. The set of variables that presented the best discrimination were: age, DSA, SUVmax and AR. The model determines the probability for malignancy for each LN, using the following formula = (-9.26) constant + (-0.21) Age + (4.29) SUVmax + (0.52) DSA + AR. The discrimination power of the model measured by the Area Under the Roc curve was =0.95.

CONCLUSION

The model including age, DSA, SUVmax and AR provide the probability of malignancy for each LN with the highest accuracy. All other variables can be discarded when combining PET/CT and EBUS image features. A further analysis is warranted.

CLINICAL RELEVANCE/APPLICATION

Mediastinal lymph node staging is routinely performed by PET-CT and EBUS-TBNA. However, there are no studies the diagnostic capacity of both techniques together.

NM219-SD-WEA2

Convolution Neural Network in Grading of Parkinson Syndrome on Dopamine Transporter Single Photon Emission CT (DaT-SPECT) with (123I) Ioflupane

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NM Community, Learning Center Station #2

Participants
Jun Haneda, Koshigaya, Japan (*Presenter*) Nothing to Disclose
Akihiko Wada, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Mari Aida, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) GE, Toshiba/Canon, Fuji Film, Fuji RI/Toyama Kagaku, Eisai, Daiichi-Sankyo/GE pharma, Mediphysics, Siemens, Bayer, Guerbet, Bracco-Eisai, Shimazu

PURPOSE

DaT-SPECT with 123I ioflupane (DaTscan) assists practitioners more accurately in their clinical evaluation diagnosis of suspected Parkinson's syndromes, based upon the appearance of the striata which reflects loss of DaT receptors. The normal DaTscan image appears as two symmetric comma or crescent shape accumulation. The abnormal appears as dot shape or none with asymmetric or symmetric deplete in putamen and caudate nucleus. The grading is made visually by the shape. We demonstrated the accuracy of grading DaTscan image by using Convolution Neural Network (CNN) on patients with Parkinson's symptoms and examined the possibility of contribution in the clinical diagnosis.

METHOD AND MATERIALS

Image of 171 (Male 86, Female 85, mean age 73.4) patients with Parkinson's symptoms who underwent for DaTscan were retrospectively reviewed. All patients had a SPECT/CT scan with the collimator of low energy high resolution and the matrix size of 128×128. Four-point grading system was obtained prescribed in the FDA information for DaTscan. Images were evaluated by two experienced radiologists (one with 13 and the other with 9 years) as ground truth (grade 0/1/2/3 : 74/28/38/37). The evaluation was made independently and the differences in grading between the evaluators were resolved by consensus. The degree of the association between the ground truth and the two evaluators, CNN were analyzed by using Kappa coefficient (K). The architecture of 6 layers CNN (2 convolution, and 4 affine layers) was automatically designed and obtained as machine learning. Hyper parameters were learning rate : Adam, epoch : 500, batch size : 25, activation function : ReLU(rectified linear unit)/PReLU(parametric ReLU)/SELU(scaled exponential linear unit). The accuracy was evaluated by using 5-fold cross validation method. The process time was also measured.

RESULTS

The processs time for a case was 0.84sec. CNN achieved a high performance with an accuracy of overall/average : 0.83/0.79, a F-measure of macro/micro : 0.83/0.79. K showed in high order as 13 years/CNN/9 years : 0.86/0.73/0.59.

CONCLUSION

CNN may support young radiologist in grading of DaTscan image and may reduce time in grading for more experienced radiologist.

CLINICAL RELEVANCE/APPLICATION

Using Convolution Neural Network as machine learning for SPECT image to support young radiologist with diagnosis and to save time for experienced.

NM220-SD-WEA3

Whole-Body [18F]FDG-PET/MRI versus [18F]FDG-PET/CT in Melanoma Patients

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NM Community, Learning Center Station #3

Participants
Dominik Berzaczy, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
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Marius E. Mayerhoefer, MD,PhD, Vienna, Austria (*Abstract Co-Author*) Speaker, Siemens AG; Research support, Siemens AG

PURPOSE

To assess the diagnostic performance of simultaneous whole-body [18F]FDG-PET/MRI compared to [18F]FDG-PET/CT for detection of distant metastatic disease in patients with malignant melanoma.

METHOD AND MATERIALS

Patients with histologically proven, malignant melanoma were included in this prospective, IRB-approved study. Patients underwent [18F]FDG-PET/MRI and subsequent [18F]FDG-PET/CT after a single tracer injection on the same day for staging or restaging purposes. Images were evaluated for the presence of metastatic lesions by two rater teams, each consisting of a nuclear medicine physician and a radiologist, in an observer-blinded fashion. Overall agreement, accuracy, sensitivity, and specificity, relative to a composite reference standard (consensus review including follow-up data), were calculated.

RESULTS

Between July 2014 and December 2018, 22 patients were enrolled. Overall agreement and accuracy between the two rater teams were 87.8% (71-84.9) and 93.2% (95%CI 90.2-95.3) for PET/MRI and 78% (70.2-84.3) and 94.9% (95%CI 93.2-97.4) for PET/CT, respectively (P=1.00). Overall, PET/MRI reached 83% Se (95%CI 76.4-88.1) and 100% Sp (95%CI, 98.1-100), PET/CT showed 87.4% Se (95%CI 81.3-91.8) and 100% Sp (95%CI, 98.1-100) for the detection of metastatic disease in malignant melanoma.

CONCLUSION

Whole-body [18F]FDG-PET/MRI appears to be comparable to [18F]FDG-PET/CT for lesion detection in patients with malignant melanoma.

CLINICAL RELEVANCE/APPLICATION

The diagnostic performance of Whole-body [18F]FDG-PET/MRI seems to be equally well compared to [18F]FDG-PET/CT in patients with metastatic malignant melanoma.

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NM244-SD-WEA4

MUO-Metastasis of Unknown Origin in Head and Neck-Role of FDG PET CT in Finding the Culprit

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NM Community, Learning Center Station #4

Participants
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Avinash R. Kesari, Bangalore , India (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To assess the role of FDG PET CT in searching for primary in cases with histology/cytology proven malignancy in neck lymphnodes where primary has not been found on clinical , and endoscopic evaluation.

METHOD AND MATERIALS

We performed a retrospective review of PET CT scans of cases with MUO head and neck over a period of two years from 1-01-2017 to 01-01-2019. 40 cases were included in the study. All these cases had cytology/biopsy proven metastasis in neck lymphnodes and no primary was identified on clinical, endoscopic examination. Some of these patients had prior CT/MRI study done prior to PET CT.

RESULTS

Out of 40 cases, 7 cases (17.5%) had no identifiable primary on FDG PET CT. Amongst the 33 positive cases (82.5%) most commonly identified primary was in order - Tonsils(6/33 -18.1%), Valleculae (5/33-15.1%), Pyriform fossa(5/33-15.1%),Tongue base(4/33-12%), nasopharynx(3/33-9%), carcinoma lung (2/33-6%),carcinoma thyroid (2/33-6%). Other rare sites of primary seen were supraglottis, parotid gland, posterior pharyngeal wall, esophagus, gingivobuccal sulcus and breast.

CONCLUSION

Most common sites for primary in MUO in our study were tonsils, valleculae, pyriform sinus and posterior tongue base which are blind spots and can be missed on routine endoscopy. PET CT helped in identifying distal primaries which were associated with metastatic cervical lymphnodes.

CLINICAL RELEVANCE/APPLICATION

FDG PET CT plays a valuable role in identifying rare sites of primary which can be missed on clinical evaluation and conventional radiological examinations.

NM245-SD-WEA5

Comparison of 68Ga-DOTATOC PET-MRI and MR-DWI for Whole-Body Staging of Patients with Neuroendocrine Tumors

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NM Community, Learning Center Station #5

Participants
Ahmed Salem, MD, Essen, Germany (*Presenter*) Nothing to Disclose
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Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Michal Chodyla, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

To compare the diagnostic potential of integrated 68Ga-DOTATOC Positron emission tomography-magnetic resonance imaging (PET-MRI) and diffusion weighted imaging-MRI (DWI-MRI) for whole-body staging of patients with neuroendocrine tumours (NET).

METHOD AND MATERIALS

A total of 43 patients with a histopathologically proven NET (50% G1, 30% G2 and 5% G3) underwent a whole-body 68Ga-DOTATOC PET-MRI examination 60 minutes after the injection of a mean activity of 60,2 MBq. The MR study protocol comprised the acquisition of a T1w 3D VIBE sequence (pre- and post-contrast), a T2w HASTE and a diffusion-weighted EPI sequence. Two readers evaluated the following datasets 1. whole-body MRI including DWI, 2. 68Ga-DOTATOC PET-MRI without DWI regarding (1) lesion detection, (2) lesion conspicuity (4-point ordinal scale) and (3) diagnostic confidence (5-point ordinal scale). Wilcoxon's signed-rank test was used to determine the significance of differences between the ratings.

RESULTS

68Ga-DOTATOC PET-MRI correctly detected 70 malignant lesions. Among them, MRI-DWI enabled correct identification of 59 malignat lesions. Additionally, 68Ga-DOTATOC PET-MRI exhibited a significant higher conspicuity (PET-MRI: 2.93 ± 0.75; MRI+DWI: 2.27 ± 0.99) and diagnostic confidence (PET-MRI: 4.59 ± 0.60; MRI+DWI: 4.09 ± 0.88) in the detection of malignant lesions ($p<0.01$). Furthermore, 68Ga-DOTATOC PET-MRI and MRI-DWI showed an equivalent performance in the detection of benign lesions.

CONCLUSION

Our results demonstrate the superiority of 68Ga-DOTATOC PET-MRI in detecting malignant lesions when compared to MR-DWI alone, underlining its superior potential for whole-body staging of patients with NETs when compared to MR-DWI.

CLINICAL RELEVANCE/APPLICATION

68Ga-DOTATOC PET-MRI superior in detecting malignant lesions of neuroendocrine tumours when compared to MR-DWI alone.

NR011-EB-WEA

Non-Traumatic Head and Neck Emergencies, Pearls and Pitfalls: A Pictorial Essay

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Hardcopy Backboard

Participants
Shervin Kamalian, MD, Boston, MA (*Presenter*) Nothing to Disclose
Laura L. Avery, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pamela W. Schaefer, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company; Research support, Siemens AG; Consultant, Takeda Pharmaceutical Company Limited;
Shahmir Kamalian, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Review of the important head and neck anatomical landmarks, including cervical fascias and spaces. 2. Familiarity with imaging findings of a variety of head and neck infectious, inflammatory, and neoplastic diseases that bring patients to the emergency department.

TABLE OF CONTENTS/OUTLINE

1- Neck fascial anatomy and spaces; 2- Important antomic landmarks of the oral cavity and orbit; 3 - Pictorial assay of a veriety of infectious, inflammatory, and neoplastic disease, which are arranged based on their anatomical involvement: 3a- Infectious: Dental infection with deep neck and intracranial complication, Ludwig's angina, tonsillitis and peritonislar abscess, epiglottitis/supraglottitis, pyolaryngocele, Lemierre's syndrome, retropharyngeal abscess, descending mediastinitis, , discitis-osteomyelitis, septic facet arthritis, scialadentitis, infected branchial cleft cyst, invasive fungal sinusitis, preseptal and orbital cellulitis, and dacrocystitis, 3b- Inflammatory: Angioedema, sarcoidosis, carotidynia, and longus colli calcific tendinitis, 3c- Neoplastic: Extraglandular parathyroid hemorrhage, carotid blowout syndrome, and juvenile nasopharyngeal angiofibroma; 4- Complictaions, pearls and pitfalls.

NR351-ED-WEA9

Keep an Eye on the Eye: Imaging of Orbital Trauma

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #9

Participants
Hanna Tomsan, MD, Darby, PA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is: 1. To review normal ocular anatomy at CT, MRI and ultrasound imaging 2. To discuss the advantages and disadvantages of different imaging modalities in the setting of orbital trauma 3. To describe various types of traumatic injuries of bony orbit and it's contents, their potential mimics and complications 3. To provide a comprehensive approach to CT interpretation of traumatic orbital injury

TABLE OF CONTENTS/OUTLINE

Normal anatomy of the orbit at CT, MRI and ultrasound imaging - Bony orbit - Intraorbital contents (globe, muscle cone, intraconal and extraconal spaces) Imaging protocols, advantages and disadvantages of imaging modalities Traumatic injuries of the globe - Open-globe injuries - Anterior chamber injuries - Lens injuries - Posterior segment injuries - Mimics of globe injury Intraorbital foreign bodies - Types of foreign bodies - Evaluation for nonmetalic foreign bodies - Foreign bodies mimics Orbital wall fractures - Blow-out and blow-in fractures - Orbital apex fractures - Pediatric orbital fractures - Nasoorbitoethmoid trauma Complications of orbital injuries - Infectious complications - Vascular emergencies - Intracranial complications Imaging of orbital trauma repair

NR352-ED-WEA11

Open Your Mouth and Your Eyes! Don't Lose Teeth Affections

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #11

Awards
Certificate of Merit

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TEACHING POINTS

1.Review anatomy and dental embryology. 2.Correctly identify the dental elements, how to name them and number them. 3.Differentiate the main anomalies of dental development. 4.Identify and classify the main lesions that affect the teeth, according to their location, periapical or pericoronal, and their tomographic characteristics as cystic, sclerotic or mixed 5.Remember other findings in the dental image such as surgical changes, trauma and treatments performed

TABLE OF CONTENTS/OUTLINE

1.Dental embryology. 2.Dental anatomy 3. Developmental anomalies 4.Tooth image. What not to forget to look for? 5.Classification of the main dental lesions 6.Review of imaging findings of the main lesions: Sample cases 7.Other conditions? What else to look for?

NR353-ED-WEA10

Getting the Most from Brain Cortex: Gray Matter Segmentation and Potential Clinical Applications of Cortical Thickness Techniques

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #10

Participants
Teodoro M. Noguerol, MD, Jaen, Spain (*Presenter*) Nothing to Disclose
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TEACHING POINTS

1. Review the main grey matter / white matter segmentation methods. 2. Explain the technical adjustments and minimal requisites for a proper reconstruction of cortical thickness 3. Show potential applications of cortical thickness techniques in different clinical scenarios.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Grey matter / white matter segmentation methods. a. MRI preprocessing b. Segmentation methods i. Intensity-based ii. Atlas-based iii. Contour-based iv. Hybrid approaches 3. Technical adjustments. a. Pipeline workflow b. Image source requirements c. Visual information and Data derived. d. Drawbacks and potential pitfalls. 4. Potential clinical applications a. Malformation of cortical development (polymicrogyria, tuberous sclerosis, cortical dysplasia and other conditions) b. Brain aging and atrophy patterns assessment. c. Multiple sclerosis and other neurodegenerative diseases. d. Trauma and extraaxial lesions evaluation. e. Does cortical thickness techniques should be included in routine post-processing protocols? 5. Conclusions and take home messages

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NR382-SD-WEA1

Morphology and Density are the Most Relevant Predictors of Poor Outcome in lobar ICHs on Brain Non-Contrast CT (NCCT) and Deep ICHs, Respectively

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #1

Participants
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PURPOSE

The objective is to analyze the radiological signs of brain non-contrast computed tomography (NCCT) scan in patients with intracerebral hemorrhage (ICH) and identify which ones can serve as predictors of poor prognosis and examine its efficacy in predicting the risk of ICH growth.

METHOD AND MATERIALS

We retrospectively studied 118 (n) patients aged >18 years with spontaneous ICH confirmed on NCCT scan who were seen at a single academic hospital between January 2016 and April 2018. Two blinded radiologists independently reviewed CT images and evaluated the presence of Island sign (IS), Blend sign (BS), Swirl sign (SwS), Black hole sign (BH), irregular shape (>=3) and heterogeneous density (>=3), according to Barras score. The main outcome was ICH growth and/or not-emergency surgical decompression and/or clinical deterioration and/or death. The predictive value of each sign was assessed in logistic regression models.

RESULTS

Of 118 patients with spontaneous ICH, 55 presented with IS (46,2%), 27 with BS (22,7%), 2 with SwS (1,7%), 23 with BH (19,3%), 64 with irregular shape (53,8%) and 29 had heterogeneous density (24,4%). In univariable logistic regression analysis, the presence of IS (odds ratio, OR 3,99), BH (OR 4,05), irregular shape (OR 3,6) and heterogeneous density (OR 3,86) on admission NCCT correlate with poor outcome (all p<0,0001). Stratified by location, in lobar ICHs, the presence of IS (OR 3,75, p<0,0001), BH (OR 2,67; p=0,008) and irregular shape (OR 3,25; p=0,001) was associated with poor outcome, while in deep ICHs the presence of BH (OR 3,49; p=0,001) and heterogeneous density (OR 4,24; p<0,0001) did.

CONCLUSION

This study demonstrates the utility of IS, BH, irregular shape and heterogeneous density as predictors of poor outcome in patients with ICH in general. Of all these signs, BH showed to be the most important outcome predictor. In addition, this study introduces the idea that, in lobar ICHs, morphology (represented by IS and shape) is the most relevant predictor of poor outcome; while, in deep ICHs, density (represented by BH and heterogeneity) has an important role.

CLINICAL RELEVANCE/APPLICATION

We analyzed in the same study all six head NCCT signs regarding ICHs prognosis, which do not require contrast or more radiation, and weighted their role predicting poor outcome after ICHs.

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NR383-SD-WEA2

Clinical Usefulness of Deep Learning-Based Automated Detection Algorithm in the Intracranial hemorrhages

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #2

Participants
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PURPOSE

There are various physicians who should order a brain computed tomography (CT) to rule out intracranial hemorrhages. The purpose of this study was to investigate the clinical usefulness of deep learning based automated detection algorithm in terms of physicians.

METHOD AND MATERIALS

A total of 5702 patients' brain CTs including 3055 cases with no intracranial hemorrhage and 2647 cases with intracranial hemorrhages, including traumatic and non-traumatic intracerebral hematoma, subarachnoid hemorrhage, intraventricular hematoma, epidural hematoma, and subdural hematoma, were used to develop the cascaded deep learning (CDL). A total of 38 physicians were recruited and categorized into 12 groups as follows: (1) 4 interns, (2) 4 internal medicine residents, (3) 4 pediatrics residents, (4) 4 emergency medicine junior residents, (5) 4 emergency medicine senior residents, (6) 4 neurosurgery junior residents, (7) 4 neurosurgery senior residents, (8) 2 radiology junior residents, (9) 2 radiology senior residents, (10) 2 emergency medicine specialists, (11) 2 neurosurgery specialists, (12) 2 neuroradiology specialists. These physicians were examined by test data set, and the diagnostic accuracy of hemorrhage and diagnostic time were evaluated in terms of physician alone and physician assisted by CDL.

RESULTS

In terms of the binary classification, the performance of the CDL in test data set showed an AUC of 0.989 (95% CI, 0.961-1.000). In terms of differential diagnosis among intracranial hemorrhages, the performance of the CDL in test data set revealed an AUC of 0.966 (95% CI, 0.941-0.989). There were specific physician groups whose diagnostic accuracy were significantly improved by CDL, such as interns, internal medicine residents, pediatrics residents, and emergency junior residents (p=0.029). Additionally, emergency medicine senior residents and neurosurgery junior residents got help from CDL (p=0.057). However, the difference of diagnostic time between physician alone and physician assisted CDL revealed no statistical significance, and the mean value of diagnostic time in physician assisted by CDL showed higher than those in physician alone.

CONCLUSION

Even though CDL may not reduce the diagnostic time unlike expectation, it may play a role in improving the diagnostic accuracy in specific physicians groups.

CLINICAL RELEVANCE/APPLICATION

Cascaded deep learning in brain CT may play a role in improving physicians' diagnostic accuracy.

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NR384-SD-WEA3

Using 3D Printing to Model Occlusive Balloon Performance in Aneurysmal Defects

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #3

Participants
Joseph Knox, San Francisco, CA (*Presenter*) Nothing to Disclose
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PURPOSE

Occlusion balloon catheters are essential to assisting in the endovascular coiling of brain aneurysms but the performance and pressure requirements of different balloon types when used in aneurysmal defects are currently unknown. We sought to create a model system to test the relative performance of different occlusive balloon catheters.

METHOD AND MATERIALS

We used Tinkercad (Autodesk, Montreal, Quebec) to create model vessels with aneurysmal defects and subsequently 3D printed these designs with PLA using the Ultimaker2 (Ultimaker, Geldermalsen, Netherlands). Using commercially available materials, we constructed a pressurized box capable of reaching physiologic pressures that housed our model vessels and then tested occlusive balloons under fluoroscopy from 3 separate companies: Hyperglide (Medtronic), Transform (Stryker) and Scepter (Microvention). Each balloon was inflated to a deformation point (herniation of the balloon through the defect) at each defect and at each inflation, the deformation height above the defect and internal balloon pressure was recorded. The Phillips Intellivue X2 (Phillips, Amsterdam, Netherlands) patient monitor was adapted for internal balloon pressure monitoring. A linear regression analysis was performed to model balloon deformation height (deformation) with independent predictors including vessel diameter, defect diameter, balloon diameter, balloon length, pressure and balloon type.

RESULTS

Of balloons that achieved deformation, height above the deficit ranged from 0.08 mm to 0.80 mm. From our regression analysis, the Scepter corresponded to a 0.13 mm increase in deformation compared to the transform ($p=<0.001$) and a 0.08 mm increase compared to the hyperglide ($p=0.004$) when controlling for all other independent predictors, including pressure. In addition, we found the 5 mm length balloons correspond to a 0.14 mm increase in deformation compared to 15 mm length balloons ($p=0.004$).

CONCLUSION

Smaller length occlusive balloons and the Scepter occlusive balloon appear to require less pressure compared to their counterparts to adequately deform through model anuerysmal defects.

CLINICAL RELEVANCE/APPLICATION

Modeling occlusive balloon performance in anuerysmsal defects can inform operators of optimal balloon type and size when trying to minimize balloon pressure in fragile brain aneurysms.

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NR431-SD-WEA5

Comparing an Artificial Intelligence Algorithm to Staff Neuroradiologists Performances in Diagnosing Ischaemic Lesions in Emergency CT Exam in a Stroke Center Routine

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #5

Participants
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PURPOSE

Evaluate the performance of an Artificial Intelligence Software for ASPECTS classification and its use compared to Neuroradiologist's daily practice at a Stroke Center.

METHOD AND MATERIALS

Retrospective and randomized analysis of 200 suspected stroke cases between 2008 and 2016 at a Stroke Center. All cases were read by certified neuroradiologists in less than 10 min from exam completion using a standardized report containing ASPECTS scale and individual arterial territory assessment. Neuroradiologists had access to clinical and artery-status data, when possible. A commercially available software (automated ASPECTS classification based on machine learning algorithms) was used to analyse ASPECTS score and stratify ischemic areas by territory: results were available almost instantaneously. Reference standard for stroke diagnosis were follow-up CT or MRI scans in up to 72 hours from the first exam. Exclusion criteria were unsatisfactory reference CT or MRI scans. Statistical analysis included concordance between groups, # error , clinical relevance error (ASPECTS threshold=6), and # errors in more than 3 territories compared to reference standard. All tests were based on Wilcoxon matched-pairs signed test and pairing evaluation (Spearman's).

RESULTS

From the initial 200 cases evaluated, 149 were included. The A.I. algorithm showed higher number of errors (65/149 x 50/149) and lower accuracy (62% x 71%) compared to Neuroradiologists. There were no significant differences between the groups in the analysis of clinical relevance error (different final ASPECTS score group,<6 and >= 6) and errors in >= 3 territories compared to reference standard. However, the groups showed high disagreement over the affected territories in: M1, M3, M5, and M6 (p<0,002), related to the presence or absence of ischaemia, considering left and/or right hemispheres.

CONCLUSION

The routine use of an A.I. algorithm resulted in increased number of false-positive errors compared to neuroradiologist in this study. However, there was no statistically significant difference in clinical relevance errors. The A.I. software can be an important tool for stroke management in non-specialized centers and pre-hospital care considering time/performance balance.

CLINICAL RELEVANCE/APPLICATION

A.I. algorithm performance was similar to Neuroradiologist's performance considering treatment decisions between ASPECTS groups <6 and >=6. The A.I. algorithm showed more errors and less specificity.

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NR432-SD-WEA6

Evaluating the Benefit of High-Resolution DSE-MRI with Golden-Angle Radial Sparse Parallel Reconstruction of the Pituitary Gland in a Clinical Setting

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #6

Participants
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PURPOSE

Pituitary macroadenomas and skull base meningiomas can have overlapping imaging features with conventional MRI. Golden-Angle Radial Sparse Parallel (GRASP) MRI sequence combines temporal and spatial information in high resolution. 4D GRASP MRI has found a role in abdominal imaging and also more recently in evaluation of the pituitary gland. We sought to determine if GRASP could improve diagnostic confidence in differentiating skull base meningiomas from pituitary macroadenomas.

METHOD AND MATERIALS

A database of 100 patients with meningioma and pituitary macroadenoma who underwent brain MRI with GRASP were reivewed. Those patientes with pre-operative GRASP imaging followed by surgical resection and pathologically proven, non-atypical tumors were included, resulting in 5 macroadenomas and 5 meningiomas for evaluation, including 2 patients with both tumors and 2 patients who had been misclassified before surgery. Regions of interest (ROI) were drawn centrally within the tumor, the supraclinoid internal carotid artery and superior sagittal sinus and time-intensity curves (TIC) were plotted using clinically available postprocessing software. The slope of the inflow intensity curve, area under the curve and peak concentration were measured and compared.

RESULTS

Meningiomas were consistently characterized by a rapid inflow pattern, with a mean slope intensity curve of 1.57 compared to 7.75 in the adenoma group, as well as a gradual washout compared to a concentration plateau for adenomas. Mean area under the curve and peak concentration were consistently smaller in the adenoma group.

CONCLUSION

Visual and semi-quantatative analysis of GRASP-MRI time intensity curves in a smalll but pathologically proven series suggest that it is possible to use GRASP 4D imaging to differentiate skull base meningioma from pituitary macroadenoma.

CLINICAL RELEVANCE/APPLICATION

4D dynamic GRASP MRI is a promising radiological method to distinguish between tumors of the sella region before surgical resection.

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NR433-SD-WEA7

Multi-Modal Convolutional Neural Networks with 2D and 3D Information Can Improve its Sensitivity and Specificity for Detecting Cerebral Aneurysms in MR Angiography

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #7

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PURPOSE

Convolutional neural networks (CNN) with two-dimensional inputs for detecting cerebral aneurysm in magnetic resonance angiography (MRA) images have been proposed. The CNN can archive high sensitivity, although its outputs contain a large number of false positives. Various efforts for reducing false positives were implemented so far, but techniques applying three-dimensional information have not been reported. The purpose of this study was to develop multi-modal CNN taking advantage of both 2D and 3D information, and to investigate the performance improvement of aneurysms detection. As the 2D and 3D streams extract different features from inputs, we hypothesized multi-modal CNN could obtain new feature representations different from CNN with 2D input only.

METHOD AND MATERIALS

This study included 142 aneurysms (mean size, 4.1 mm ± 1.7 [standard deviation]; range, 1.3 - 9.7 mm) in 125 patients (76 men and 49 women; mean age, 67.6 years; range, 13 - 86 years). MRA were acquired with 81 1.5-T and 44 3.0-T MRI units, respectively. Two radiologists delineated volumes of interests (VOI) of each aneurysm on MRA with consensus. Multi-modal CNN with two streams, 2D and 3D CNNs was developed. Maximum intensity projection (MIP) images around VOI were input into 2D CNN, and a box containing VOI was directly used as the input voxel of 3D CNN. 4-fold cross validation was performed to calibrate generalization ability of the model. The new model was compared with conventional CNN with only 2D input using free-response receiver operating characteristic (FROC) analysis.

RESULTS

The average sensitivities of the 2D CNN and multi-modal CNN to detect aneurysms were 92.4% and 95.2% in eight positive candidates. Although the best sensitivity of 2D CNN was 92.4% at 6.7 false positives per image (FPI), multi-modal CNN achieved the same sensitivity as above at 5.7 FPI. In particular, the number of true positives increased at the middle cerebral artery using the proposed model.

CONCLUSION

Multi-modal CNN using 3D appearance information in addition to conventional 2D shape information improved sensitivity and specificity for detecting cerebral aneurysms compared with conventional CNN with 2D input only.

CLINICAL RELEVANCE/APPLICATION

Adding an auxiliary three-dimensional information can improve sensitivity and specificity of convolutional neural networks-based system for detecting cerebral aneurysms in MR angiography.

NR434-SD-WEA8

Utility of Quantifying Iron Deposition in the Brainstem during the Early Stages of Parkinson's Disease Development

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NR Community, Learning Center Station #8

Participants
Hiroto Takahashi, MD, Suita, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

Parkinson's disease (PD)-related iron deposition occurs in the substantia nigra pars compacta (SNpc), especially in the dorsolateral SNpc containing the nigrosome 1 which is the largest nigrosome subgroup and is most affected in PD. Meanwhile, age-related iron deposition occurs in both the SNpc and the red nucleus (RN). During the development of early PD, rapid eye movement sleep behavior disorder (RBD) has been reported as a precursor that develops to PD. Our aim was to assess the utility of consecutive iron deposition in the brainstem with iron-sensitive MRI in evaluating the early stages of PD development.

METHOD AND MATERIALS

Eighteen patients (ePD group) with early PD (Hoehn and Yahr scale: 1-2), 16 patients with RBD (RBD group) and 25 age-matched healthy controls (HC group) underwent quantitative susceptibility mapping (QSM) on a 3T magnetic resonance imager. The QSM value of each whole and dorsolateral SNpc and RN was calculated using an automatic volumetric region of interest selection method. In order to compensate the effect of age-related iron deposition on the SNpc, each whole and dorsolateral SNpc/RN value was calculated. The significance of the intergroup differences using analysis of variance with Tukey's post hoc test was tested for each value. The performance of each value to discriminate among the groups was assessed using receiver operating characteristic (ROC) analysis.

RESULTS

The QSM value of the dorsolateral SNpc was significantly higher in ePD group than in HC group. The dorsolateral SNpc/RN value was significantly higher in ePD group than in both HC and RBD groups. Meanwhile, there were no significant differences in the QSM value of each whole SNpc and RN and in the whole SNpc/RN value among the groups. The area under the ROC curve (AUC) for dorsolateral SNpc was 0.72 for diagnosing early PD. The respective AUCs for dorsolateral SNpc/RN value were 0.76 for diagnosing early PD and 0.75 for discriminating early PD from RBD.

CONCLUSION

Quantifying iron deposition with the focus on the dorsolateral SNpc may be useful in the diagnosis of early PD. The compensation of age-related iron deposition with the RN value can improve the performance for both diagnosing early PD and evaluating PD development from RBD.

CLINICAL RELEVANCE/APPLICATION

Quantifying consecutive iron deposition within the brainstem can provide a good performance for monitoring the development of early PD from healthy subject and precursor state.

OB183-ED-WEA1

Imaging for Fetal Interventions: Criteria, Considerations, and Complications

Wednesday, Dec. 4 12:15PM - 12:45PM Room: OB Community, Learning Center Station #1

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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TEACHING POINTS

1. Recognize imaging findings of fetal abnormalities amenable to in utero procedures and indications for intervention in these conditions. 2. Identify sonographic inclusion and exclusion criteria for fetal interventions. 3. Understand the role of ultrasound for pre-procedure assessment, real-time guidance, monitoring during interventions, and evaluation for possible post-procedure complications.

TABLE OF CONTENTS/OUTLINE

Imaging features, indications for fetal interventions, criteria for appropriate case selection and potential complications will be demonstrated. 1. Intra-uterine fetal transfusion 2. Myelomeningocele repair 3. Resection of sacrococcygeal teratoma 4. Thoracentesis & thoraco-amniotic shunt placement 5. Aortic valvuloplasty 6. Tracheal balloon occlusion for congenital diaphragmatic hernia (CDH) 7. Resection of large congenital pulmonary airway malformation (CPAM) 8. Vesicocentesis & vesico-amniotic shunt placement 9. Fetoscopic laser procedure (ablation of intertwin vascular connections) to treat twin-twin transfusion syndrome (TTTS) 10. Radiofrequency ablation for twin reversed arterial perfusion (TRAP) sequence 11. Radiofrequency ablation for selective reduction of anomalous twin in monochorionic diamniotic pair 12. Ex-utero intrapartum treatment (EXIT) procedure - for delivering fetuses with neck masses and/or high airway obstruction

OB184-ED-WEA2

When the 'Floor' Falls: A Basic Guide to Assess to Dynamic Female Pelvic Floor MRI

Wednesday, Dec. 4 12:15PM - 12:45PM Room: OB Community, Learning Center Station #2

Participants
Oscar A. Sandoval Fernandez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Rocio Ramirez Cardona, MD, Mexico , Mexico (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

• Pelvic floor dysfunction is a prevalent disorder in older people, especially in women, causing a decrease in the quality of life. • The diagnosis based only on the clinical and physical examination is limited and often erroneous and that can lead to erroneous and sometimes unnecessary surgical interventions. • MRI allows a more complete and accurate evaluation of the pelvic compartments, in addition to assessing other structures such as muscles and ligaments involved in the function of the pelvic floor. • Basic knowledge of the anatomy of the pelvic floor is crucial to correctly interpret pelvic MR images and to fully understand dysfunction associated with pelvic floor weakness. • There are several reference lines used to assess the presence and degree of pelvic floor dysfunction. Appropriate placement of these lines is the first and one of the most crucial steps in interpreting dynamic pelvic floor MRI.

TABLE OF CONTENTS/OUTLINE

o Introduction o Overview of basic anatomy of the female pelvic floor o Dynamic magnetic resonance imaging evaluation of the compartments of the pelvic floor. o Reference lines and measures in the valuation of pelvic floor dysfunctions. o Illustrative cases o Conclusions

PD181-ED-WEA6

Practical Application of Microvascular Ultrasound Imaging in Children

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PD Community, Learning Center Station #6

FDA Discussions may include off-label uses.

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TEACHING POINTS

Microvascular ultrasound imaging is a unique Doppler method to minimize clutter artifacts and effectively preserves flow signals from low flow components in small vessels. We consider microvascular ultrasound imaging technique is valuable in the field of pediatric ultrasound and review the practical application of microvascular ultrasound imaging in children, focused on the comparison between microvascular imaging and conventional color Doppler imaging.

TABLE OF CONTENTS/OUTLINE

Topics are listed according to the body part. 1. Brain: small vessels of normal brain parenchyma. 2. Parotid gland: normal gland, acute parotitis. 3. Thyroid: normal gland, goiter (toxic, non-toxic), thyroiditis (Hashimoto, autoimmune). 4. Liver: subcapsular vessels, fat deposition, hepatic hemangioma. 5. Gallbladder and biliary trees: gallbladder edema, choledochal cyst. 6. Bowel: acute gastroenteritis, acute appendicitis, intussusception, inguinal hernia. 7. Kidneys: acute pyelonephritis, abscess, scar, stones, hypoplasia, nephropathy, polycystic disease. 8. Urinary bladder: normal ureteral jet, vesicoureteral reflux, hemorrhagic cystitis. 9. Ovary and Testis: normal features, ovarian hernia. 10. Lymph nodes: reactive lymph nodes (cervical, mesenteric), metastatic lymph nodes. 11. Spinal cord. 12. Soft tissue masses.

PD188-ED-WEA7

Contrast-Enhanced Ultrasound (CEUS) in Pediatric Patients: Overview of Bowel Applications

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PD Community, Learning Center Station #7

FDA Discussions may include off-label uses.

Awards
Identified for RadioGraphics

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TEACHING POINTS

1) List the advantages and disadvantages of grayscale and color Doppler ultrasound evaluation of pediatric bowel disease compared with other modalities. 2) Describe mechanism/technique of ultrasound contrast agents, and advantages of CEUS over standard grayscale and color Doppler ultrasonography. 3) Understand common bowel pathologies best evaluated with CEUS in children.

TABLE OF CONTENTS/OUTLINE

1) Review role of grayscale bowel ultrasound in pediatric patients and discuss advantages and disadvantages. 2) Describe background of US contrast and FDA approvals, contrast types, contrast composition, and mechanism. 3) Review advantages of CEUS over standard grayscale and color Doppler ultrasonography. 4) Discuss role of elastography as potential use for distinguishing inflammatory and fibrotic disease, with case examples. 5) Discuss indications for CEUS use in pediatric patients for bowel pathology. 6) Highlight and discuss different bowel pathologies best evaluated with contrast enhanced ultrasound in pediatric patients with case examples (appendicitis, IBD, abscess vs phlegmon, necrotizing enterocolitis, bowel infarct and their complications). 7) Illustrate examples: exemplary case examples, pitfalls in CEUS of the bowel, comparative cases of CEUS vs. MR enterography. 8) Future directions for improving imaging evaluation of pediatric bowel pathology.

Printed on: 10/29/20

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PD219-SD-WEA2

Diagnostic Reference Levels for Japan During Diagnostic and Therapeutic Cardiac Catheterization in Age-Based Pediatric Examinations

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PD Community, Learning Center Station #2

Participants
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PURPOSE

Diagnostic reference levels (DRLs) for the diagnostic and therapeutic cardiac catheterization in the pediatric patient have yet to be established in Japan as well as in the rest of the world- from our understooding.The purpose of this study was to propose DRLs for air-kerma at the reference point (Ka, r), air-kerma area product (PKA), fluoroscopy time (FT), and number of cine images (CI) during diagnostic and therapeutic cardiac catheterization in pediatricians of four pediatric age groups - from less than 1year, 1-5years, 6-10 years, and 11-15 years in Japan.

METHOD AND MATERIALS

We sent a nationwide questionnaire by post to 132 facilities. Questions focused on the procedure identification, age, eight, height, Ka,r, PKA, FT, and CI during pediatric diagnostic and therapeutic cardiac catheterization.

RESULTS

In diagnostic cardiac angiography, the 75th percentile values were as follows; Ka,r: 103, 127, 194, and 351 mGy, PKA: 7.0, 12.3, 14.3, and 47.2 Gycm2, FT: 36.8, 30.7, 33.4, and 35.7 min, and CI: 2018, 2313, 2408, and 2016 images for less than 1year, 1-5years, 6-10 years, and 11-15 years respectively. In therapeutic cardiac angiography, The 75th percentile values were as follows; Ka,r: 146, 209, 130, and 501 mGy, PKA: 7.54, 16.0, 8.35, and 46.0 Gycm2, FT: 56.5, 52.0, 49.4, and 52.0 min, and CI: 4075, 4514, 3576, and 5984 images for less than 1year, 1-5years, 6-10 years, and 11-15 years respectively.

CONCLUSION

To promote the optimization of diagnostic and therapeutic cardiac catheterization at pediatric protocols from our study, it is therefore necessary to establish DRLs for pediatric cardiac catheterization examinations in Japan.

CLINICAL RELEVANCE/APPLICATION

It is hoped that DRL for the cardiac catheterization and therapeutic procedures will also lead to the reduction of the whole country's dose by presenting this paper and making it a reference.

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PD220-SD-WEA3

Role of Fetal MRI in the Assessment of the Central Nervous System (CNS) Involvement in Fetuses with Congenital Heart Diseases (CHD)

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PD Community, Learning Center Station #3

Participants
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PURPOSE

To demonstrate the diagnostic value of fetal MRI in predicting Central Nervous System (CNS) involvement in fetuses with prenatal echocardiographic diagnosis of congenital cardiopathies (CHD).

METHOD AND MATERIALS

64 fetuses (gestational age: 19-33) underwent MRI examination between February 2012 and March 2018 using a clinical 1.5 T scanner (Siemens Healthcare, Erlangen, Germany) without maternal-fetal sedation, due to a echocardiographic diagnosis of fetal CHD. The diagnostic confirmation of the encephalic findings was obtained by pathological findings and by post-natal encephalic MRI, if performed.

RESULTS

On 64 cases, 19/64 had interatrial septal defects (IASD), septal interventricular defect (IVSD) and atrioventricular canal defect (CAVC), 16/64 had cardiac rhabdomyomas, 9/64 left heart syndrome and hypoplastic aorta, 5/64 had transposition of the great vessels, 5/64 had Fallot tetralogy, 5/64 had aorta coartation and 5/64 had intracardiac masses of uncertain significance. MRI was able to detect the associated CNS anomalies in 24/64 fetuses: we found 11/24 corpus callosum (CC) dysgenesis (4/11 CC hypoplasia, 4/11 complete CC agenesis and 3/11 partial CC agenesis), 7/24 ventriculomegalies or hydrocephalus, 3/24 had subtentorial features (Dandy-Walker, vermian hypoplasia and vermian malrotation) and 3/24 cortical malformations. Furthermore, in 9 fetuses with complex heart disease, was recognised an enlargement of pericerebral fluid spaces.

CONCLUSION

Due to the high risk of encephalic anomalies associated with CHD, it is essential to suggest an MRI study of the fetal brain in prenatal age, especially in complex forms that suggest a syndromic background.

CLINICAL RELEVANCE/APPLICATION

Our data suggest that MRI, as a complement to US, represents a valid imaging tool in the non invasive evaluation of CNS malformations associated with CHD, in terms of diagnostic accuracy and changes in prognosis and in clinical management, providing useful informations on which formal counselling can be based.

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PD248-SD-WEA4

Altered Brain Networks in Postoperative Non-Syndrome Cleft of Lip with or without Palate (NSCL/P) Children after Speech Correction: A Resting-State fMRI Study

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PD Community, Learning Center Station #4

Participants
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PURPOSE

Various neuroimaging researches had testified alternations of cerebral activity and structures in NSCL/P. Yet, little was known about the topological properties of the postoperative NSCL/P after speech correction by a graph theoretical analysis. This study was to investigate the topological properties of the postoperative NSCL/P with speech correction and its relationships with speech behavior.

METHOD AND MATERIALS

A total of 28 children (aged 5-16 years; mean 10.0years; male/female 21/7) with NSCL/P and 28 gender- and age-matched healthy controls underwent rs-fMRI examinations on a 3.0 T MR scanner. Preprocessing steps were conducted by using the GRETNA software. The local nodal metrics, global network metrics and small-worldness were calculated. Between-group differences of computed topological properties were assessed with a series of two-sample t-tests. The threshold was set as bonferroni corrected $p < 0.05$. Besides, Chinese language clear degree scale (CLCDS) scores were performed in NSCL/P group and the correlations between all the topological properties and CLCDS scores were calculated.

RESULTS

Compared with the health controls, the nodes of significantly changed local nodal properties were shown in prefrontal cortex, language network and primary visual center. There was no significant between-group difference in Cp, Lp, Eglob, Eloc and λ. In NSCL/P group, the γ ($p= 0.0006$, $t= 3.64$) and σ ($p= 0.0015$, $t=3.33$) showed significant between-group differences. For further correlation analysis, the local node metrics of left insular cortex (negative), right sperior parietal lobule (positive), right frontal pole (negative) and right temporal fusiform cortex (positive) were significant correlation (Bonferroni corrected) with CLCDS scores.

CONCLUSION

The prefrontal cortex, language network and primary visual center played an important role in speech therapy for postoperative patients. Those with speech correction had no statistical difference in global network metrics and higher σ than healthy controls, and the topological organization of brain network has reached a new balance between functional differentiation and integration. Topological properties of the nodes correlated with CLCDS scores can predict the effect of speech therapy.

CLINICAL RELEVANCE/APPLICATION

These topological metrics can be used as biomarker of clinical speech correction and guide clinical development of personalized speech therapy programs.

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PD249-SD-WEA5

Utilization of Knee Radiography as a Method for Bone Age Evaluation

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PD Community, Learning Center Station #5

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PURPOSE

To compare the O'Connor (OC) and Hoerr-Pyle (HP) methods of bone age(BA), assessed at the knee, and these with the hand-wrist method of Greulich-Pyle(GP).

METHOD AND MATERIALS

In 64 patients (34 boys and 30 girls), between 8 and 17 years old, it was assessed hand-wrist BA by the GP and knee bone age by the OC and HP methods, both radiographs made at the same moment, by 3 independent observers (2 endocrinologists and 1 radiologist). Statistics analysis (SigmaStat software 3.2): for comparison between continuous variables, t test; association between BA, Spearman Correlation and to evaluate if there is concordance between methods, Bland Altman test.

RESULTS

The mean of chronological age (SD) was 13,2 (2,4). The mean of bone age (GP) and those assessed at the knee by the methods of OC and HP, was, respectively, 13,3 (1,5), 13,6 (1,5) and 13,1 (1,8), with no difference between the methods. The concordance among the 3 observers by OC method was 78% and by HP method was 93%. There was a correlation between GP and OC ($r = 0,79$ e $p < 0,001$) and with HP ($r = 0,83$ e $p < 0,001$), in both boys and girls. However, girls showed higher bone age advancement by GP and OC, which was not seen in HP. There was concordance between the 3 methods.

CONCLUSION

There was a good correlation between the 3 methods and a good concordance between the observers, suggesting that the knee bone age is a reliable method. Bone age is more advanced in girls by GP and OC.

CLINICAL RELEVANCE/APPLICATION

Adult height prediction is essential for treatment decision. The current methods avalible uses the hand-wrist methods. The bone age assessed at the knee surges as another tool to improve this evaluation.

PH135-ED-WEA7

Sonar to the Rescue: Curb Ionizing Radiation with Application of Contrast-Enhanced Ultrasound and Elastography/Controlled Attenuation Parameter Techniques

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PH Community, Learning Center Station #7

Participants
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TEACHING POINTS

1. To provide a comprehensive approach to understanding the physical and clinical aspects of new ultrasound techniques: Contrast-enhanced Ultrasound (CEUS) and Elastography/Controlled Attenuation Parameter (CAP). 2. To understand how to adequately perform CEUS and Elastography/CAP. 3. To elucidate potential pitfalls and artifacts inherent to both CEUS and Elastography/CAP.

TABLE OF CONTENTS/OUTLINE

1) Highlight clinical indications for using CEUS and Elastography/CAP techniques: 1a) CEUS: Obviates need for iodinated and gadolinium-based contrast agents, for example, in MRI unsafe patients. 1b) Elastography/CAP: Inexpensive method to assess liver fibrosis and hepatic steatosis without liver biopsy. 2) Review relevant underlying physics: 2a) CEUS: Microbubble structure and physical characteristics that create the ultrasound image. 2b) Elastography/CAP: Physics of 2D shear wave elastography and CAP. 3) Performing the studies and recognition of common artifacts and pitfalls: 3a) Provide a pictorial step-by-step instructional guide for each technique. 4) Sample cases highlighting the clinical utility with interpretation of results: 4a) CEUS: Benign and malignant processes along with non-conventional uses. 4b) Elastography/CAP: Elastogram and CAP value analyses and report interpretation.

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PH214-SD-WEA1

Scanned Projection Radiograph and Ultra-Low-Dose CT for Monitoring PICC Line Malposition

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PH Community, Learning Center Station #1

Participants
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PURPOSE

Peripherally inserted central catheters (PICCs) are increasingly used for intravenous contrast injection in CT. However, safety concerns exist due to the possibility of PICC movement during injection. Scanning projection radiographs (SPRs) have been recommended by the Infusion Nursing Society to identify PICC tip position before and after power injection, which is sometimes challenging due to limited SPR image quality. The purpose of this study is to optimize the SPR technique and to compare results with those of an ultra-low-dose CT (ULD-CT) for monitoring PICC line malposition.

METHOD AND MATERIALS

An anthropomorphic chest phantom (Lungman, Kyoto Kagaku) with added plate was used to mimic an average-sized adult patient. A thin PICC line (3 French, PowerPICC SV, Bard) was attached within the plate with the tip close to the area of right atrium. SPR and ULD-CT images of the phantom were acquired with a 192-slice CT scanner (Force, Siemens). The SPRs were acquired at 70, 80, and 120 kV, and 100 kV with added tin filtration (100Sn), each at multiple dose levels (0.04, 0.09, 0.18 mGy CTDIvol equivalent) and 4 different kernels (Tr20, Tr60, Tx20, and Tx60). ULD-CT was acquired at 70 and 100Sn kV (0.09 mGy CTDIvol). For reference, a routine-dose CT was also performed at 120 kV and 5.0 mGy. Maximum intensity projection (MIP) images were created from CT images to view PICC position. Detectability of the PICC tip was visually compared among all SPRs and ULD-CT images.

RESULTS

The optimal kernel for the SPR images was Tr60, which provided the sharpest appearance of the PICC line. Lower tube potentials (70 and 80 kV) had enhanced contrast, which improved visibility of the PICC tip compared to higher tube potentials (120 and 100Sn). With a dose level as low as 0.09 mGy, ULD-CT images displayed in the MIP format provided sufficient image quality to visualize the PICC line, with additional 3D information to identify the PICC tip location compared to a SPR image.

CONCLUSION

SPRs with low tube potentials and sharp kernels can improve the visibility of a PICC line, while ULD-CT at an equivalent low dose level can provide 3D PICC localization information.

CLINICAL RELEVANCE/APPLICATION

PICC line malposition can be identified with an SPR scan using optimized tube potential and kernel. ULD-CT is an alternative method that may provide more accurate localization than SPRs.

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PH215-SD-WEA2

Improvement of Nodule Classification Using Domain-Transformed Chest X-Ray Images

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PH Community, Learning Center Station #2

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Hiroshi Fujita, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Training of convolutional neural networks generally requires a large dataset. However, collection of labeled clinical samples can be difficult. Although use of the pretrained networks with a large natural image dataset is considered effective, high level features may be better extracted using medical images. The purpose of this study is to improve classification of lung nodules in CT images using simulated samples generated by domain transformation from chest x-ray images with a generative adversarial network (GAN).

METHOD AND MATERIALS

Lung CT dataset used in this study consisted of 995 cases. For each nodule, a region of interest at the central slice was extracted. They were randomly split into training, validation, and test sets. The training set consisted of 278 primary cancers, 131 metastases, and 190 benign nodules, and validation and test sets each consisted of 91 primary cancers, 43 metastases, and 64 benign nodules. Simulated nodule images were generated using a cycle GAN, which was trained with unpaired nodules in CT and chest x-ray images. The network consisted of 2 sets of a generator based on the residual network and a discriminator with 5 convolutional layers. For CT images, 599 nodules in the training set were used, whereas for the plain images, 123 nodule images from the Japanese Society of Radiological Technology (JSRT) database were employed. After training, remaining 31 nodule images from the JSRT database were used as input data, and the output CT-like images by domain transformation were used as additional training data for classification network. Our baseline network for classification between benign and malignant nodules was a residual network. The network was trained with original images only, augmented samples by rotation and flipping, and mixed samples with the generated images.

RESULTS

The classification accuracies using the original data, augmented data, and simulated mix data were 62.6, 66.7, and 68.2%, respectively. The test AUC was slightly improved from 0.60 with the original data only to 0.67 with the augmented samples and 0.69 with the generated mix samples.

CONCLUSION

The proposed method can be useful for improving CNN training when the training samples are limited.

CLINICAL RELEVANCE/APPLICATION

Computerized classification system can assist radiologists in the diagnosis of lung cancer.

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PH216-SD-WEA3

Novel Ultrahigh-Resolution CT Using a CMOS Detector Built on a Conventional Multislice CT Scanner's Detector

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PH Community, Learning Center Station #3

Participants
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PURPOSE

We developed an ultrahigh-resolution (UHR) CT system constructed by adding a high-resolution CMOS detector with a 0.1-mm pixel pitch to a 16-row multislice (MSCT) scanner. The purpose of this study was to evaluate the performance of the UHR-CT compared with a 64-row MSCT.

METHOD AND MATERIALS

A dedicated handmade base was mounted on the detector of a 16-row MSCT, and the CMOS detector (1536 channels, 68 rows) was installed on it. To prevent the geometric unsharpness with the 0.8-mm focal spot of the MSCT, a contact geometry with a focal spot-to-detector distance of 635 mm was used. The rotation speed was 1.5 s/rot., and the dose level was set to CTDIw of 4 mGy. CT images were reconstructed by filtered back projection. Comparative images were obtained at the same radiation dose using a 64-row MSCT. Thin metal wire and 100-mm cylindrical water phantoms were scanned for measurements of the modulation transfer function (MTF) and noise power spectrum (NPS), respectively. The system performance functions (SPFs), based on the prewhitening theorem, were calculated from the results of MTF and NPS. In addition, foot and head phantoms were scanned, and the trabecular bone and inner ear structure were visually checked.

RESULTS

The 10% MTF value was 2.7 mm-1, which was notably higher than the 0.99 mm-1 of the 64-row MSCT. SPF was inferior to MSCT by 20%-30% at low frequencies. The relationship was reversed at more than 0.5 mm-1 and the superiority was continued to 3.0 mm-1, while MSCT's was limited to 1.0 mm-1. The UHR-CT clearly visualized fine trabecular bone structures and auditory ossicles, unlike MSCT.

CONCLUSION

The UHR-CT system, which enabled ultrahigh-resolution scan by simply attaching a CMOS detector to a conventional MSCT system, provided notably higher-resolution images compared with conventional MSCT. The feasibility of this type of UHR-CT was indicated through the investigation.

CLINICAL RELEVANCE/APPLICATION

Fine anatomical structures of bones and the inner ear, which have not been sufficiently visualized by conventional MSCT scanners, can be clearly visualized by this UHR-CT.

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PH260-SD-WEA5

Performance of a First Dark-Field Chest X-Ray System on Patients

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PH Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Awards
Trainee Research Prize - Resident

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PURPOSE

To demonstrate - for the first time - the successful implementation of dark-field chest radiography on patients and thus, to provide a novel imaging tool that generates structure-sensitive information for an improved diagnostic assessment of the lung's physical condition.

METHOD AND MATERIALS

The study was approved by the institutional ethics review board and the federal office for radiation protection. A prototype scanner, capable of acquiring dark-field and attenuation chest X-rays has been developed and installed on site for a first, great extent study on COPD patients. The system is assembled from medical X-ray components such as source, collimator, flat-panel detector and an interposed three-grating interferometer. Prior to the measurement, the field of view is adjusted to the patient in order to properly cover the region under investigation. Similar to conventional chest radiography, the patient stands upright and is advised to hold breath for the duration of the scan. Within the scope of the currently ongoing study, a total number of 500 participants will be involved whereof 65 have already been investigated. The proband collective includes patients without lung disorders for reference and such with mild to severe stages of COPD. By help of a questionnaire, computed tomography and spirometry, the individual severity of the disease is assessed.

RESULTS

The dark-field and attenuation images are obtained simultaneously in one 7 s scan at an average effective dose of 0.04 mSv. Thus, the acquisition is compatible with clinical requirements. We found that healthy patients exhibit a distinct and homogeneous signal over the entire pulmonary region. Here, intact alveolar structure with lots of air-tissue interfaces induces strong small-angle scattering, resulting in a pronounced image representation of the lungs. In contrast, a weak signal is obtained for COPD patients, where parenchyma degradation prevails.

CONCLUSION

These preliminary results indicate that dark-field radiography is capable of probing the lung's underlying microstructure, which remains inaccessible with currently deployed medical imaging methods while it is highly affected by disorders such as emphysema, fibrosis or lung cancer.

CLINICAL RELEVANCE/APPLICATION

Particularly with regard to early detection of COPD, we consider the technique's transfer to a human application as breakthrough and expect it to become an invaluable tool in clinical routine.

Printed on: 10/29/20

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PH261-SD-WEA6

Multichannel Image Restoration for Quantitative MRI

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PH Community, Learning Center Station #6

Participants
Nan Zhao, Cincinnati , OH (*Presenter*) Nothing to Disclose
Gregory R. Lee, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

In quantitative MRI, one often applies curve fitting to a series of images acquired under different conditions. The quality of the fit is sensitive to the noise level. We propose a method to take advantage of the similarity of the underlying structure to do a better job of jointly denoising a set of images.

METHOD AND MATERIALS

The Bayesian least squares estimate with Gaussian scale mixture (BLS-GSM) method is based on a statistical model of the coefficients of a basis which allows improved denoising by considering neighboring coefficients jointly rather than thresholding each coefficient independently. In this work a 3D dual-tree wavelet transform was used as the basis for the BLS-GSM approach. In the context of MR parameter mapping experiments, 'neighboring' pixels can also include neighbors at the same spatial location, but acquired with different contrast. An MR parameter mapping dataset is commonly 4D (3D spatial + 'channels' corresponding to separate measurements). BLS-GSM was applied both with and without joint multichannel denoising (images with 3 different flip angles). For comparison, three other established denoising methods were applied to each channel independently: non-local means (NLM), wavelet shrinkage (BayesShrink) and total variation (TV) denoising. 1.4 mm isotropic spoiled GRE brain magnitude data with high SNR was used as a ground truth reference. Data was collected under informed consent on a 1.5 T scanner. Gaussian noise was added (for MRI, real and imaginary components each have Gaussian noise). Fairly high noise was used in the presented example for better visualization of differences. Peak signal to noise ratio (PSNR) values were used as a comparison metric. For NLM and TV denoising, manual optimization over hyperparameters was performed. Wavelet and BLS-GSM approaches required no tuning (only an estimate of the noise variance).

RESULTS

The BLS-GSM approach performed best with PSNR=33.66 and 34.51 when applied without and with joint multichannel denoising. NLM, Wavelet and TV gave PSNR values of 32.79, 30.80 and 31.64 respectively.

CONCLUSION

BLS-GSM denoising gave the best result and requires no manual tuning.

CLINICAL RELEVANCE/APPLICATION

A method of jointly denoising a series of images as acquired in quantitative MRI parameter mapping is presented. The goal is to enable improved fits for a range of quantitative MRI experiments.

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PH262-SD-WEA4

Identification and Assessment of Scan Frequency and Cumulative Radiation Exposure in Repeated CT Scans: A Retrospective Cohort Study

Wednesday, Dec. 4 12:15PM - 12:45PM Room: PH Community, Learning Center Station #4

Participants
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PURPOSE

To identify and assess the scan frequency and cumulative radiation exposore in repeated CT scans on a large cohort of patient populations undergoing various protocols in an academic enterprise.

METHOD AND MATERIALS

This IRB-exempt study evaluated CT examinations performed in 2016, 2017, and 2018 by 30 scanners from two vendors with 14 models over three site hospitals in an academic enterprise. An in-house developed informatics system, called 'METIS', automatically collected and extracted scan information (protocol and dose) and patient demographics data from the PACS and electronic health record (EHR) systems. The scan frequency and cumulative effective dose (E) for each unique patient were then calculated. K-factors from the AAPM TG-96 were adopted. For young patients (age<18) with higher scan frequencies, scan interval and protocols adopted were further investigated.

RESULTS

300,000 CT studies on 120,000 patient (ages 0 - 70 and sizes 6 - 50 cm) with 270 different CT protocols were analyzed. Over 45% patient received repeated scans with scan frequencies ranging from 2 to 68 times. The types of protocols adopted by each patient ranged from 1 to 14 and E were found up to 1,283 mSv (38.9 ± 45.8 mSv). 358 young patients were identified receiving over 4 time repeated scans within past three years and E ranged from 4.4 to 442 mSv (48.5 ± 44.9 mSv) from 94 protocols. 52 young patients received over 5 scans (E: 10.5 - 442.4 mSv) in a single month and 30 young patients received over 10 times scan within a calendar year (E: 25 - 442.4 mSv).

CONCLUSION

This study offers a practical data-driven solution for automatically identifying and assessing CT repeated scans and cumulative radiation exposure using a large cohort of patient data. A large proportion of patients were identified to undergo repeated scans thus received substantial radiation exposure, which outweighs the potential risk, especially for those who are young. The findings in this study enable prospective optimization of clinical practice to maximize the imaging benefit while minimize patient safety across the healthcare enterprise.

CLINICAL RELEVANCE/APPLICATION

The radiation dose delivered to patients becomes a particular concern, especially in young patients. The level of radiation is even compounded by repeated follow-up CT examinations throughout their life.

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QI012-EB-WEA

Radiology Information System (RIS) Integrated Faculty Scoring and Feedback System for After Office Hours (AOH) On-Call Resident Provisional Radiology Reports

Wednesday, Dec. 4 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

While the radiology residents in our general acute care hospital are rostered on subspecialty-based rotations during office hours as per ACGME model, they are required to provisionally report any acute diagnostic imaging scans across different subspecialty in first line after office hours (AOH) on-call duties. These provisional reports are subsequently re-read and approved by various attending faculty radiologists independently the next working day, allocated according to subspecialty. As our resident appraisal model is subspecialty based, there is currently no objective method to assess their reporting accuracy during AOH on-call duties. Furthermore, it is logistically challenging for the various attending faculty radiologist to provide feedback on the provisional reports given the different physical locations of subspecialty teams within campus and residency working hour limits.

METHODS

We designed a faculty report scoring and feedback module integrated into our electronic Radiology Information System (RIS) software, Carestream Vue RIS version 11 (Carestream Health, Rochester, New York, USA). All attending faculty radiologist are encouraged to voluntarily grade all provisional AOH CT and MRI scan reports transcribed by the on-call resident before verifying the reports. There are 4 options on the scoring scale: A, B, C and D. Grade A, matched to numerical value of 4 for analytic purposes, represents an excellent report without need for report amendments. Grade B, matched to value of 3, represents a typical report with only minor non-significant report amendments such as missing a simple renal cyst. Grade C, matched to value of 2, represents reports with minor discrepancies defined as clinically significant but not life threatening misdiagnosis such as missing a pulmonary nodule. Grade D, matched to value of 1, represents reports with major discrepancies defined as life threatening misdiagnosis such as missing an intracranial hemorrhage. The module also includes a free text box for the scorer to provide written feedback. At the end of each month, a residency program administrator processes the application generated log of all the reports graded. Individualized report card are sent via email to each resident comprising of: mean score for the month, number of discrepancies graded (grade C and D), list of scored reports from the resident including free text comments. Analysed cohort results and commonly misdiagnosed conditions are also discussed in monthly residency faculty meetings and reviewed during performance appraisal.

RESULTS

Our pilot project ran for 9 months from July 2018 to March 2019. A total of 2972 CT and MRI scans were scored - mean of 330.2 scans per month, range from 232 to 393. Most of the scans scored were from neuroradiology subspecialty (2491, 83.8%), followed by body (thorax and abdominal) subspecialty (331, 11.1%) and musculoskeletal subspecialty (150, 5%). There were total of 146 reports scored as minor discrepancy (mean 16.2 per month) and 1 report scored as major discrepancy (mean 0.1 per month). Total of 361 reports were given free text comments (mean 40.1 per month). Mean of 19.7 residents were graded per month (range 14 to 23) and the individual mean scores per month range from 2.9 to 4.

CONCLUSION

Our scoring and feedback system for AOH on-call resident provisional radiology reports has gained acceptance in the department as an integral part of summative workplace assessment and identified significant number of AOH provisional report discrepancies. It enables residents to objectively review their on-call reporting accuracy, temporal development and obtain individualized feedback from faculty. Concurrently our teaching faculty utilized the data obtained to identify common reporting discrepancies, thereby modify training curriculum to address knowledge gaps and indirectly improving patient care. Moving forward, we plan to survey the residents and faculty to assess subjective results of this project at the end of 1 year. The program will subsequently be improved upon based on collated feedback. We expect to introduce mandatory grading of all AOH on-call reports eventually, which will allow us to track longitudinal and objective improvement in resident performance.

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QI013-EB-WEA

Impact of a Lecture Evaluation System on Lecture Type and Quality: A 24-Month Analysis and Insights on Resident Learning Styles

Wednesday, Dec. 4 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

With the recent change in ABR exam structure and the gradual change in resident learning style, classroom-based resident education has required adaptation. We implemented a live lecture evaluation system to provide instant feedback from the residents to individual lecturers/division directors and to observe long-term trends in the ratings of different education methods.

METHODS

A lecture evaluation system was created in February 2016, which allowed anonymous feedback after completion of the lecture. The evaluations included lecture content ratings and type of interactive component, including traditional hot seat case conference, lectures with live audience response through a web-based app (RSNA Diagnosis Live), or a non-interactive didactic lecture. Additionally, residents reported if the lecture would be improved with interactivity to account for lectures best presented in didactic-only format. Responses over 24 months were analyzed. Unpaired t-test analysis was performed on the different groups (interactive versus non-interactive conferences, and live audience response versus traditional case conference). Impact of the lecture evaluation system on the number of lectures with interactivity was analyzed from year 1 to year 2.

RESULTS

Over the 24-month timeframe, 524 lectures were performed and 1580 evaluations were received. There were 275 lectures in year 1 and 249 lectures in year 2 that received evaluations. In year 1, 134 lectures (49%) were non-interactive and 141 lectures (51%) were interactive. Within the interactive year 1 subset, there were 26 lectures (18%) that utilized a web-based lecture format and 115 lectures (82%) that were traditional case-based conference. In year 2, there was a significant increase in the proportion of interactive lectures (61% vs 51%, p=.03) and a significant increase in the overall lecture rating for the interactive lectures (4.48 to 4.59, p=.04). There was a significant decrease in the number of didactic lectures that would benefit from interactivity (52% to 38%, p=.04). There was no significant difference in the percentage of web-based lectures in each year. Combining both years, the mean lecture rating for the interactive subset was 4.57, which is significantly higher than the mean lecture rating of 4.18 for the non-interactive subset (p<0.0001). Within the interactive group, the web-based lectures were rated significantly higher than the oral case-based lectures (4.7 and 4.53, respectively; p=0.02).

CONCLUSION

The implementation of the lecture evaluation system had a significant impact on lecture type and lecture quality after just one year, presumably due to direct feedback to the individual lecturers and program directors. By the second year, more lectures included interactivity and a majority of the non-interactive lectures were perceived to be best delivered in a didactic format. Based on resident feedback over 24 months, interactive lectures are better received than non-interactive lectures, with the web-based format as the preferred method. Adapting the curriculum based on lecture evaluations and resident learning style is crucial for promoting better resident education.

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QI022-EB-WEA

Lung Biopsy On-Time Starts and Day of Procedure Patient Wait Times

Wednesday, Dec. 4 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

Improve on time starts and decrease day of procedure patient wait time for lung biopsies. In the first half of 2017, 13% of the lung biopsies started within 60 minutes of their scheduled start time (on-time start) and 27% of patients waited in the department more than 120 minutes before their procedure started. We sought to increase on-time procedure starts from 13% to 50%, and increase patients waiting fewer than 120 minutes from 27% to 60% by December 31, 2018.

METHODS

A3 problem solving methodology was employed to improve the day of procedure workflow for outpatient lung biopsies at our institution. A problem-solving team consisting of radiologists, nursing, schedulers, and IT was formed. Two metrics to track performance were selected: on time start rate, as defined as first image time within sixty minutes of procedure scheduled time, and day of procedure patient wait time, as measured by time between patient arrive in department and first image time. Baseline performance was measured, and SMART goals were set. Team members traveled to the Gemba and observed the current workflow. A process map was compiled. The factors contributing to delays were mapped on a fishbone diagram, and a value stream map was created. The baseline data was stratified by patient arrival time to further study the impact of patient timeliness on workflow. These analyses demonstrated that our main problems were with patient flow through pre-op, procedure room availability, and communication amongst team members. We devised five interventions, which were sequentially performed in small PDSA cycles: institution of an electronic list of patients ordered for lung biopsy, moving informed consent of patients to a time prior to the day of biopsy, pre-signing orders, instructing patients to arrive an extra thirty minutes early, and weekly e-mails amongst team members to prepare for the coming week's biopsies.

RESULTS

Our process map demonstrated there is a lot of redundant communication amongst team members, and that there are multiple roadblocks in the process. Therefore, we designed interventions to facilitate communication: we developed an online biopsy list accessible to all team members, and started weekly planning e-mails amongst team members. To reduce roadblocks, we started meeting patients in clinic on a day prior to the biopsy to perform informed consent and sign day of procedure orders. The value stream map showed that the greatest variability within the process (as measured by the standard deviation divided by the mean) is for patients waiting for the procedure room to open up. Stratification of our data by patient arrival time demonstrated that procedures for patients who arrive extra early started more often on time and patient wait time was not affected. Therefore, all patients were subsequently instructed to arrive 60 minutes before their procedure start time, instead of 30 minutes, as was the standard before. Following these interventions, on time starts doubled from 13% to 27% and patients waiting fewer than 120 minutes doubled from 24% to 54% by December 31, 2018. This is less than our goal of 50% on time starts and 60% of patients waiting fewer than 120 minutes.

CONCLUSION

Structured quality improvement methodology assisted in improving on time lung biopsy starts and decreasing patient wait times. Our performance remains below our target, and additional countermeasures to improve procedure room availability will be tested.

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QI027-EB-WEA

Increasing Time Between Interruptions In A Busy Reading Room

Wednesday, Dec. 4 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Awards
Quality Improvement Reports Award
Identified for RadioGraphics

Participants
Ethan A. Smith, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Rachel Smith, MS, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Radiologists are required to perform complex cognitive tasks during the course of their daily work, often interpreting studies with thousands of images. Prior research has shown that repeated interruptions can have a negative effect on humans performing complex tasks, resulting in errors, decreased efficiency and increased stress levels. Frequent interruptions are common in radiology department reading rooms and occur by phone, in person, or by pager. The purpose of this quality improvement project was to use quality improvement methodology to increase the median time between interruptions that occur daily in our busiest reading room by 50% between July 2018 and January 2019.

METHODS

An improvement team was established, consisting of 2 radiologists, 2 technologists, a reading room assistant and a quality improvement specialist. Data was collected manually by a trained observer counting the number of interruptions that occurred, the type of interruption (telephone, pager, in-person), and the time (in minutes and seconds) between each interruption for 1 hour per day, 5 days per week between the hours of 10 am - 3 pm. The median time between interruptions was calculated. Data was displayed in a time between run chart. To drive improvement, a process map was developed outlining how typical interruptions occur, and a simplified failure modes effect analysis was performed. After several rounds of data collection, a Paretto chart was made demonstrating the most common types of interruptions, and a key driver diagram was developed. Multiple interventions were tested attempting to reduce the most common unnecessary interruptions. Successful interventions were adopted on a larger scale.

RESULTS

At baseline, the median time between interruptions was 187 seconds. The most common causes of interruptions were technologists calling to check images per departmental protocol, telephones ringing in multiple locations at the same time, and in-person visits to the reading room, mostly by clinical colleagues. The improvement team worked to evaluate departmental protocols requiring technologists to check images, create clear expectations for clinicians and others visiting the reading room, and design an upgraded phone system to reduce redundant phone calls. The interventions tested included allowing technologists to perform the initial quality control checks on their own images for most examinations (involving the radiologist only if needed), adding signage to the reading room directing visitors to the reading room assistants for appropriate triage, and designing a phone system that would eliminate the problem of multiple phones ringing at once. At the end of the project period, the median time between interruptions was increased to 336 seconds, a 77% increase.

CONCLUSION

Using quality improvement methodology and a team approach, we were able to increase the time between interruptions in our busiest reading room by 77%. Although we exceeded our initial project goal, we plan to continue our work to further increase the time between interruptions. We believe that this work will help to decrease radiologist stress levels and increase work efficiency.

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QI123-ED-WEA1

Improving MRI Outpatient Wait Times

Wednesday, Dec. 4 12:15PM - 12:45PM Room: QR Community, Learning Center Station #1

Participants
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Julia Drose, BA, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Nancy Cheung, MPH, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

When comparing our outpaitent MRI mean wait times from time of check-in to time when exam begins, to the American College of Radiology (ACR) GRID data, we found ours (53.2 minutes) to be 10% longer than other academic radiology centers in the United States (48 minutes), 31% longer than institutions in the west (36.7 minutes) and 51% longer than the aggregate of all sties who submitted data (26 minutes). MRI Outpatients are routinely asked to arrive 30 minutes prior to their scheduled appoinment time, in order to ensure they are screened for potential contraindications and given an IV when contrast is necessary. Therefore, our ultimate goal was to decrease the 53.2 minute wait time to 30 minutes.

METHODS

Several different quality improvement tools were utilized throughout this process. We began by performing a time study observing outpatients scheduled to receive either contrasted or non-contrasted MRI studies. A variety of parameters were recorded, including patient arrival in the Department, patient check-in, lenght of time to fill out an MRI screening form, IV insertion time and time the exam began. We also recorded the amount of time the patient spent in the central waiting room and the time they spent after changing and having an IV inserted, in the MRI waiting room. Interviews with MRI Technologists and Radiology RNs were conducted during the time study to glean their thoughts on factors contributing to increased outpatient wait times. A guiding coalition was then convened, with representation from every area in Radiology that interacted with MRI outpatients. This included schedulers, receptionists, RNs, Technologists, tech assistants and Radiologists. A value stream analysis of the baseline time study data was presented showing value-added versus non-value-added wait times. A process map outlining current state was then constructed and reviewed. Several exercises were conducted with the group to identify issues perceived as contributing to unnecessary patient waits, and then selecting those that occurred most frequently. From this, a measurement and improvement plan was constructed which included implementation of several different interventions. PDSA cycles were utilized to review collected data and determine if a specific change was statistically significant in reducting wait times. Bimonthly meetings were held with the guiding coalition to review findings and identify subsequest interventions to be studied. A run chart of average turn-around-time from patient arrival to exam begin was constructed to show which interventions contributed to a decrease in patients waiting. From this data several process improvements were implemented in the MRI outpatient area.

RESULTS

A time-and-motion study was conducted to evaluate current state. The value stream maps constructed from this data indicated an average of 27 minutes spent on tasks for contrasted exams and 15 minutes spent on tasks for non-contrasted exams. Patients spent an average of 28 minutes waiting in between steps for both contrast and non-contrast exams. Five PDSA cycles were implimented based on process changes suggested by the guiding coalition. PDSA 1 involved giving MRI outpatients bags to remove and place jewelry in at check-in, negating the need to do this prior to entering the MRI. This intervention did not impact mean wait times, but was adopted due to patient satisfaction. PDSA 2 involved limiting the times MRI Technologists would attempt to scan paitents unable to hold still, to two attempts. This change resulted in a mean wait time of 48 minutes, and was adopted. PDSA 3 asked RNs to alert MRI Technologists when patients had an IV placed and were ready to be scanned , either by calling or waking into the MRI control room. Mean wait time following this change was 41 minutes. PDSA 4 assigned a dedicated MRI Technologist to the reception desk to bring patients back to the changing area immediately following check-in. The Technologist would then place the IV if an RN was not immediately available and complete the MRI screening form with the patient. The mean wait time following this change was 40 minutes. A 5th PSDA involved changing time slots in the EPIC Radiant scheduling module to 15 minute increments to eliminate gaps and adjusting exam time lengths to more accurately represent specific protocols. An average wait time of 42 minutes was realized following these changes, but data collection for this PDSA is on-going. An Xbar-R chart of average turn-around-time from checkin to exam begin by PDSA showed a sustained improvement of 10.6 minutes after testing and implimentation of PDSAs 3-5. This was a 20% improvement from the baseline period.

CONCLUSION

MRI outpaitent wait times will continue to be monitored for sustainability and improvement. Ongiong interventions include revising scheduled exam times as necessary, opening an additional IV start area and implimentation of physicial and technological modifications to improve efficiency.

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QI124-ED-WEA2

AI Driven Quantitative System for Assessing the Quality of Diagnostic Ultrasound

Wednesday, Dec. 4 12:15PM - 12:45PM Room: QR Community, Learning Center Station #2

Participants
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PURPOSE

To present a quantitative system, driven by AI, for assessing the quality of ultrasound examinations, and to determine its reproducibility, taking into consideration if the images obtained in the abdominal ultrasound exam fulfill the established requisites from the protocol.

METHODS

One of the basic criteria of quality is the presence of key images defined in the abdominal ultrasound protocol by AIUM. Our AI-driven system is an important tool to help us check if the set of images of an abdominal ultrasound exam matches the AIUM requisites or not. A dataset composed of the main classes of images required in the abdominal protocol is used to train the AI algorithm. Each class of images is composed of at least 400 images obtained from different patients, about 3 images per patient for each class, properly anonymized. A mobile NASNet was trained from scratch to classify the images in 15 classes. After that step, the algorithm is able to recognize the pattern present in each class: (1) longitudinal image of the left hepatic lobe, (2) longitudinal image os the right hepatic lobe, (3) hepatic veins and IVC, (4) portal vein, (5) longitudinal gallbladder, (6) transversal gallbladder, (7) pancreas, (8) aorta, (9) longitudinal right kidney, (10) transversal right kidney, (11) spleen, (12) longitudinal left kidney, (13) transversal left kidney, (14) urinary bladder. There is also a (15) NO category, composed of non-identifiable abdominal images.

RESULTS

Once the inference is performed in an abdominal ultrasound with it's given set of images, it is possible to analyze how many images matches with the established standard. The accuracy in the training/validation/test sets was, respectively, 99.8/98.2/97.5%. With the ongoing growth in the number of images in our dataset, we are aiming better results. It's interesting to state that the most common wrong predictions were confusing right and left kidney.

CONCLUSION

It will also be possible to ensure quality improvement in ultrasound departament, with this low cost and wide range quality assessment tool. We can open new possibilities in the near future, for instance classifying not only the presence of the key images, but also other quality criteria as focus, depth and gain adjust on each image. Protocol driven quality improvment aided by AI, will benefit patients, doctors and sonographers as well, once we ensure to follow all cybersecurity recommendations and conventions, technology will perform as a tool for intelligence augmentation and business scale, and not as a threat.

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RO210-SD-WEA1

Investigation of the Volume of Prostate, Bladder and Rectal Wall Variation During External Beam Radiotherapy

Wednesday, Dec. 4 12:15PM - 12:45PM Room: RO Community, Learning Center Station #1

Participants
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Osamu Tanaka, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The change in prostate size for intensity-modulated radiotherapy (IMRT) planning in patients with small prostate glands has not yet been elucidated. If the size of prostate was changed, the cover of radiation dose is influenced. Therefore, we evaluated the changes in prostate, rectum and bladder wall size during IMRT of 2Gy per daily fraction using MR image.

METHOD AND MATERIALS

A total of 24 consecutive patients with prostate cancer were enrolled in the study. Two gold fiducial markers were placed on the prostate 3 weeks before planning CT/MRI examination. MR imaging was performed at three time points. The initial MRI was performed prior to the start of radiotherapy. Second MRI was performed at 38 Gy (range: 36-40 Gy), which represented the halfway point of the radiotherapy course. The last MRI was performed on the day of completion of the radiotherapy course (76 Gy range: 74-78 Gy). We estimated those organs at three time points.

RESULTS

There was no significant difference between the estimated sizes of prostate during RT in all three phases. Volume of rectal wall was not changed in all phases. Volume of bladder wall was decreased from the initial to the last time points significantly. Standard deviation (SD) of subtract from the initial to the last was large (mean 30.1 SD; 10.1).

CONCLUSION

In this study, no significant change in the volume of prostate and rectum wall was observed during IMRT. However, bladder wall was decreased during IMRT. The range of subtraction of volume of the bladder wall was wide. Estimating the bladder wall may be useful to reduce inter fraction variation. It is not necessary to reevaluate the size of the prostate during a radiotherapy period in small volume prostate.

CLINICAL RELEVANCE/APPLICATION

(dealing with MRI for radiotherapy) Prostate size was not changed during radiotherapy

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RO211-SD-WEA2

Imaging-Guided Target Volume Reduction in Radiotherapy of Lung Cancer: The Prospective Randomized Multinational PET-Plan Trial

Wednesday, Dec. 4 12:15PM - 12:45PM Room: RO Community, Learning Center Station #2

Participants
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PURPOSE

Advanced medical imaging offers a chance for target volume reduction in modern radiotherapy, which may lead to more effective local treatments with reduced toxicity and offer the protection of draining lymph nodes and large vessels, possibly of importance for the upcoming combination of radiotherapy and immunotherapy. Locally advanced non-small cell lung cancer (NSCLC) with improvable local control and high toxicity is an excellent model to investigate this topic.

METHOD AND MATERIALS

In the prospective randomised controlled PET-Plan trial (NCT00697333), patients with inoperable stage II/III NSCLC and an indication for radiochemotherapy were randomized at a 1:1 ratio. In conventional arm A target volumes were informed by FDG-PET and CT plus elective nodal irradiation and in experimental arm B they were solely informed by FDG-PET. In both arms, quality assured isotoxically dose-escalated IMRT or 3D-CRT (60 - 74Gy, 2Gy per fraction) was planned and applied to the respective target volumes along with simultaneous platinum-based chemotherapy. The primary objective was time to locoregional progression (LRP) in terms of non-inferiority of experimental arm B.

RESULTS

311 patients were recruited, 205 patients included in the intent to treat (ITT) (A: n=99, B: n=106) and 172 patients in the per protocol (PP) analysis (A: n=84, B: n=88). Median FU time in the PP set was 16 months. Non-inferiority of experimental arm B was confirmed for the pre-specified non-inferiority margin. The risk of LRP was lower in the experimental arm B (2y-LRP 0.20 vs. 0.39; HR=0·57; 95% CI: 0·30-1·06; p=0·039) with no difference between study arms concerning survival (2y-OS 0.57 vs. 0.54), out-field recurrence and toxicity.

CONCLUSION

In radiochemotherapy for locally advanced NSCLC, PET-Imaging based reduction of radiotherapy target volumes is feasible and may improve local control without increasing toxicity.

CLINICAL RELEVANCE/APPLICATION

The procedures established in this clinical trial provide a radiotherapy standard for future NSCLC trials including immunotherapy and may furthermore inspire trials on imaging based target volume reduction for other tumor types.

RO218-SD-WEA3

Prospective Assessment of Diffusion-Weighted Magnetic Resonance Imaging as a Biomarker of Radiation-Induced Dysgeusia in Head and Neck Cancer

Wednesday, Dec. 4 12:15PM - 12:45PM Room: RO Community, Learning Center Station #3

Participants
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PURPOSE

Dysgeusia is a nearly ubiquitous toxicity in head and neck cancer patients undergoing radiotherapy (RT) and can result in long-term taste changes leading to impaired appetite and weight loss. The aim of this study is to determine whether diffusion weighted-magnetic resonance imaging (DW-MRI) can predict radiation-induced dysgeusia.

METHOD AND MATERIALS

24 patients with oropharyngeal cancer (23 males, median age: 60 years, median RT dose: 70 Gy) underwent serial MRI before and mid-RT in a prospective trial. Simultaneously, dysgeusia was assessed with the MD Anderson Symptom Inventory Head and Neck questionnaire (MDASI-HN) rating taste changes on a 10-point Likert scale from 0-'not present' to 10-'as bad as you can imagine'. The whole tongue as well as the taste bud-bearing tongue mucosa regions-of interest (ROIs) were segmented on T2 images of each time point. ROIs were then propagated to the co-registered apparent diffusion coefficient (ADC) maps generated from DW-MRIs. Mean ADC values were subsequently extracted using an in-house Matlab-based software. We evaluated the differences of ADC values and MSADI score in different time points using the Wilcoxon signed-rank test. To test for the correlation of percentage change in ADC values (delta ADC) with dysgeusia and radiation dose, Spearman's rho test was applied.

RESULTS

Patients were treated for Stage I-IV cancer of the tonsil (54%), base of tongue (33%) und unknown primacy (13%). Mean MDASI taste score at baseline was 1.5±3.0 (42% G1+ dysgeusia, 17% with moderate-to-severe dysgeusia (MDASI>=5)) and 3.4±3.0 mid-treatment (88% G1+ dysgeusia, 29% with moderate-to-severe dysgeusia) (p=0.007). The average ADC values increased at mid-RT by 10.2% (p=0.034) for the whole tongue, and 9.8% (p=0.116) for the taste bud-bearing mucosa. Delta ADC of the tongue was significantly correlated with the change in dysgeusia from pre- to mid-treatment (p=0.046), but was not correlated for the tongue mucosa (p=0.346). No correlation was found between delta ADC and mean dose for both structures.

CONCLUSION

Our preliminary findings indicate that DW-MRI parameters showed a significant rise during RT in the tongue. These changes were significantly correlated with the radiation-induced increase in dysgeusia mid-treatment.

CLINICAL RELEVANCE/APPLICATION

Our results showed that detectable imaging changes during the radiation course could be used as a potential biomarker of radiation-induced toxicity.

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UR188-ED-WEA7

Metastasis or Recurrence of RCC: How, When, and Where

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #7

Participants
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TEACHING POINTS

The purpose of this exhibit is: To review the pathway of metastasis or recurrence of RCC To discuss the time of RCC metastasis and post-treatment follow-up criteria Use cases to explain the common and uncommon place of RCC metastasis and its imaging features.

TABLE OF CONTENTS/OUTLINE

Outline How- The pathway of Metastasis or Recurrence of RCC When- Time of Metastasis or Recurrence Post-Treatment Follow-Up Criteria Where- Common and uncommon place and Imaging features

Printed on: 10/29/20

UR189-ED-WEA8

Leading the Way with PI-RADS and MRI-Directed Biopsy Pathway for the Diagnosis of Prostate Cancer

Wednesday, Dec. 4 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
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TEACHING POINTS

Appreciate the benefits of performing PI-RADS compliant MRI prostate before biopsy in patients suspected of prostate cancer who would be candidates for treatment pre-agree strategies for follow-up of patients that do not undergo immediate biopsy after a negative MRI, with clear criteria for re-investigation weigh and tailor the options for management of the PIRADS 3 category, considering the care priorities and clinical risk profiles understand the biopsy options for PIRADS 4-5 depending on the clinical management priorities become familiar with key international recommendations on MRI use before biopsy in biopsy-naive men and in repeat biopsy men.

TABLE OF CONTENTS/OUTLINE

Introduction Overview of PI-RADS v2.1 and MRI-directed biopsy pathway Review evidence for management options for negative scans (PI-RADS 1-2 categories) Present and explore the management options for PI-RADS 3 lesions Review the evidence and discuss targeted vs focal saturation vs systematic biopsies for patients with PIRADS 4-5 lesions Present international recommendations on MRI use before biopsy, comparing European and US guidelines

VI139-ED-WEA9

Five Stages of Artifacts: Denial, Anger, Bargaining, Depression, and Acceptance

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #9

Awards
Certificate of Merit

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TEACHING POINTS

Image-guided interventions (such as biopsy, ablation, transarterial embolization, etc) are frequently utilized for diagnostic and therapeutic purposes. Image guidance improves target accuracy and increases the safety of procedures. However, intraprocedural imaging can also be challenging to interpret if the image quality is degraded by artifacts. This exhibit aims to (1) demonstrate different types of artifacts commonly encountered during image-guided interventions, including those guided by ultrasound or x-ray based technologies, (2) highlight common limitations of imaging modalities that can delay or impede interventional procedures, and (3) provide alternative approaches to improve image quality or alternative modalities that can be utilized.

TABLE OF CONTENTS/OUTLINE

a. Ultrasound-guidance Types of procedures that US can be used with Types of artifacts How to optimize view and alternatives b. Fluoroscopy-guidance Types of procedures that fluoroscopy can be used with Types of artifacts How to optimize view and alternatives c. Conventional and cone-beam CT-guidance Types of procedures that CT can be used with Types of artifacts How to optimize view and alternatives d. Quiz Cases

VI142-ED-WEA10

Apneic Ventilation Strategies to Limit Respiratory Motion During Percutaneous Ablation

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #10

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS

1. Techniques for limiting respiratory motion during critical periods of interventional procedures include breath holds, pre-ventilation, and apneic ventilation techniques. 2. Common apneic ventilation strategies include high- and low-frequency jet ventilation and transnasal humidified rapid-insufflation ventilator exchange (THRIVE). 3. Apneic ventilation techniques can limit respiratory motion, thereby simplifying percutaneous access, during difficult ablation cases.

TABLE OF CONTENTS/OUTLINE

1. Overview of Respiratory Motion Restriction 2. Limitations of Breath Holds 3. Jet Ventilation 4. Case 1: Pleural-Based Nodule Cryoablation with Jet Ventilation 5. Transnasal Humidified Rapid-Insufflation Ventilator Exchange 6. Case 2: Liver Dome Neuroendocrine Tumor Microwave Ablation with THRIVE

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VI212-SD-WEA1

Capembol: Safety, Feasibility and Early Oncological Outcomes of Prostatic Artery Embolization in the Management of Low-Grade Localized Prostate Cancer in Patients Candidate to Active Surveillance: A Monocentric Pilot Study - Preliminary Results

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Participants
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PURPOSE

We aim to assess the feasibility, short-term oncologic and functional outcomes of unilateral prostate artery embolization (PAE) as a focal therapy in patients with localized low-risk prostate cancer candidate to active surveillance (AS).

METHOD AND MATERIALS

This first-results prospective monocentric pilot study enrolled patients with unilateral prostate cancer Gleason 6 (3+3), prostate specific antigen < 10ng/ml, clinical stage < T2b and concordant PIRADS >= 3 target lesion on multiparametric MRI (mpMRI). Primary endpoint was the feasibility defined by the technical success of PAE and absence of severe adverse effects according to the Clavien-Dindo classification. Secondary endpoints were overall survival, need for radical treatment, necrosis of the treated lobe on mpMRI, histological evaluation at 6-month follow-up and urinary and erectile functions evaluation after PAE at 1, 3 and 6-month.

RESULTS

Six patients were included in the study from June 2018 to January 2019. Median age was 74,5 years (71-77), median initial PSA rate was 6,9 ng/ml (3,2-10,14), all cancers were Gleason 6 (3+3) and T2a clinical. All lesions ranked PIRADS 4. Technical success was 100%. Median procedure time was 40,5 minutes (35 - 48). No major complication occurred. No decrease in urinary and erectile functions was observed in the first four patients at 3-month follow-up. An improvement in urinary continence was even noted in the first four patients at 3 months. In one of the two patients followed 6 months, the target lesion was no longer visible on mpMRI and was negative on the targeted biopsy.

CONCLUSION

Unilateral prostate artery embolization as a focal therapy to manage localized low-risk prostate cancer is a feasible and well tolerated procedure. First early oncological results are promising. Further research are required to demonstrate its long-term oncologic efficiency and functional outcomes.

CLINICAL RELEVANCE/APPLICATION

This first "proof of concept" prospective study demonstrated the feasibility, safety, well tolerance and early oncological efficacy of PAE in the management of unilateral low-risk localized prostate cancer and may represent an alternative treatment approach to active surveillance in order to delay standard therapy in carefully selected patients.

VI213-SD-WEA2

Measurement of Scatter Radiation Dose to the Eye of Interventional Radiologists Performing Fluoroscopically Guided Procedures: Are You Sure You Are Protected?

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #2

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PURPOSE

To quantify radiation eye dose during the typical variety of fluoroscopic procedures faced by interventional radiologists in real world situations--as opposed to optimized phantom studies--ranging from fistulograms to stent grafts; assessing the impact of different shielding devices, lead glasses and the position of the radiologist.

METHOD AND MATERIALS

Prior to the procedure, Optically Stimulated Luminescent (OSL) dosimeters were affixed using eyelash glue to each cheek and under each lower eyelid of the principal operator. Procedure, access site, imaging parameters, and patient, monitor and shield positions were recorded. The OSL chips were read immediately after each study using a Landauer Microstar radiation dose chip reader.

RESULTS

In an ongoing study, eye doses during 125 cases have been recorded. Total procedural dose range 2-6335mGy (mean 873.5mGy), DAP range 17-148333uGym2 (mean 17173 uGym2), and fluoroscopy time range 4-5146s (mean 1042s). Recorded doses: right eye range 0-0.472mGy (mean 0.027mGy), right cheek range 0-0.522mGy (mean 0.032mGy), left eye range 0-0.738mGy (mean 0.050mGy), and left cheek range 0-0.905mGy (mean 0.061mGy). The left side of the face closer to the fluoroscope record 1.89x higher radiation dose than the opposite. Wearing lead glasses frequently did not result in significant decrease in eye dose.

CONCLUSION

The side of the face closer to the fluoroscope consistently received higher radiation doses than the opposite. As opposed to optimized phantom studies, lead glasses did not consistently demonstrate a significant decrease in radiation dose to eyes. Orientation of the head to the radiation source appears to be critical and may significantly reduce the impact of leaded glasses. Barrier protection alone may be providing a false sense of security to the interventionist.

CLINICAL RELEVANCE/APPLICATION

Under real world situations, lead glasses provided less protection compared to previous phantom studies and monitor position during IR procedure is important in terms of radiation exposure.

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VI214-SD-WEA3

Effects of Oxytocin on High-Intensity Focused Ultrasound Ablation of Leiomyoma: A Clinical Trial Study

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #3

FDA Discussions may include off-label uses.

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PURPOSE

To investigate the impact of oxytocin on high-intensity focused ultrasound (HIFU) ablation for the treatment of leiomyoma.

METHOD AND MATERIALS

This clinical trial study was approved by institutional review board. 40 patients with symptomatic leiomyoma underwent HIFU treatment. They were divided into two groups based on perfusion classification: group A (n = 20, if time-signal intensity curve of leiomyoma lower than that of myometrium regarded as weak perfusion group) and group B (n = 20, if time-signal intensity curve of leiomyoma equal to or higher than that of myometrium). Groups A and B was subdivided into two subgroups A1 (n = 10), B1 (n = 10) (with only intravenous infusion normal saline) considered as control group and two subgroups A2 (n = 10), B2 (n = 10) with intravenous infusion oxytocin 0.2 U/min (with 500 ml of 0.9% normal saline added 60 units of oxytocin running at the rate of 2 ml/min) considered as oxytocin group. Treatment results, adverse events were compared.

RESULTS

The mean non-perfused volume ratio (NPVr) of groups A and B was 92% ± 18 and 67% ± 24 ($p<0.05$). The mean power of groups A and B was 160W ± 28 and 200W ± 34 ($p<0.05$). The mean time treatment of groups A and B was 134minute ± 12 and 155minute ± 30 ($p<0.05$). The mean NPVr of subgroup A1 and A2 was 93% and 90% ($p>0.05$). The mean power of subgroups A1 and A2 was 158W and 164W ($p>0.05$). The mean treatment time of subgroup A1 and A2 was 126minute and 138minute ($p>0.05$). The mean NPVr of subgroup B1 and B2 was 72% and 60% ($p<0.05$). The mean power of subgroup B1 and B2 was 192W and 222W ($p<0.05$). The mean treatment time of subgroup B1 and B2 was 140minute and 168minute ($p<0.05$). There were no differences in adverse events between group A and group B, subgroups A1 and A2, B1 and B2. There were no oxytocin-related adverse events reported.

CONCLUSION

Oxytocin could solely improve the treatment efficacy by reducing the power, enhancing the treatment speed, thus achievement of higher NPVr for patients with strong perfusion leiomyoma.

CLINICAL RELEVANCE/APPLICATION

The clinicians should take oxytocin into consideration during ablation procedure in cases of strong perfusion leiomyoma to obtain better HIFU outcomes for patients.

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VI263-SD-WEA6

Evaluation of Technical Success and Complication Rates Following Endovascular Thrombolysis Interventions

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #6

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PURPOSE

This study aims to evaluate the technical success and complication rates following endovascular thrombolysis in arterial, venous, and pulmonary arterial systems, as well as in hemodialysis circuits, in a large tertiary care center.

METHOD AND MATERIALS

Following approval by an institutional ethics review board, a retrospective chart review was performed for all thrombolysis cases performed in the 5-year period between November 1, 2013 and November 1, 2018. Cases were identified by conducting a search of our local RIS for any studies containing the words 'thrombectomy' or 'thrombolysis'. Any patients older than 18 years who had received endovascular thrombolysis were included. Stroke thrombolysis cases were excluded. Patient demographic data, procedural details, thrombolytic agents used, as well as technical success and complications (as defined by the SIR) were recorded. Analysis of statistical significance was performed using Chi-squared contingency tests.

RESULTS

There were a total of 208 thrombolysis cases, of which 120 were in males (mean age 55) and 88 in females (mean age 53). Overall technical success rate was 83%. There was a significant difference in the success rate between procedure types, with venous thrombolysis cases demonstrating the greatest success (90%), followed by pulmonary arterial (88%), arterial (75%), and dialysis fistulae (61%), $p < 0.05$. Relative to published guidelines, these were within the accepted thresholds. Overall complication rates were 17%, with 4.8% of cases having major complications. There was a significant difference in complication rate depending on procedure type, with complications highest in the arterial cases (33 %), followed by pulmonary arteries (12%), hemodialysis circuits (11%), and veins (11%), $p < 0.05$. The overall 30-day mortality rate was 4.8%, with pulmonary arterial cases demonstrating the highest mortality (14%).

CONCLUSION

Endovascular thrombolysis in the arterial system carries a lower success rate and greater complication rate than the venous or pulmonary arterial systems. Despite adherence to published guidelines, the complication rate for endovascular thrombolysis can exceed the published thresholds, indicating that further studies are needed in this area.

CLINICAL RELEVANCE/APPLICATION

With the advent of new and exciting technologies for endovascular thrombolysis, rigorous review of their safety and efficacy is crucial. Here, we present comparative results over a 5-year period.

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VI264-SD-WEA7

Split Renal Function after Treatment of Small Renal Masses: Comparison between Radiofrequency Ablation and Laparoscopic Partial Nephrectomy

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #7

Participants
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PURPOSE

Radiofrequency ablation (RFA) and laparoscopic partial nephrectomy (LPN) are used to treat small renal masses (SRM, <=4cm). Studies report conflicting results in creatinine and eGFR changes following treatment, without evaluating how the affected renal parenchyma responds to treatment. On contrast enhanced CT (CE-CT) images quantity and quality of renal function can be evaluated by calculating the split renal function (SRF). We aimed to compare renal function after RFA or LPN treatment of SRMs by evaluation of the SRF in the affected kidney.

METHOD AND MATERIALS

Single T1a renal tumors successfully treated (without tumor progression, mean follow up 3.2 years) with RFA (n=60) or LPN (n=31) were retrospectively compared. The SRF was calculated on pre-treatment CE-CT images and on the first follow up exam 3 months after completed treatment. Serum creatinine and eGFR values were collected simultaneously. To compare renal function outcomes Students t-test and multivariable linear regression models (adjusted to RFA/LPN treatment, pre-treatment SRF/eGFR, BMI, age, tumor characteristics and Charlson comorbidity index) were used.

RESULTS

Both groups showed a reduction in SRF following treatment. The LPN group had a greater reduction (RFA -5.7% vs LPN -3.5%; difference 2.2, p = 0.001). After adjusted analysis the LPN group still showed a significantly greater SRF reduction (SRF -3.2%, CI 1.3 to 5.1; p=0.001). There was no difference between groups in pre-treatment values or in change of creatinine/eGFR following treatment.

CONCLUSION

Both RFA and LPN are nephron sparing when treating SRMs. However in this series LPN showed a significantly greater SRF reduction in the affected kidney in comparison to RFA.

CLINICAL RELEVANCE/APPLICATION

Patients with renal tumors treated with RFA showed a smaller reduction in renal function compared to those treated with LPN in these series. RFA should be favoured for patient with low renal function.

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VI266-SD-WEA4

Effect of Hepatic Flow Parameters on Coagulation Range of Radiofrequency Ablation in Liver Malignancies Patients: A Prospective Clinical Study

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #4

Participants
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PURPOSE

To assess the difference in hepatic flow parameters of contrast enhanced ultrasound (CEUS) between liver cirrhosis and normal liver and investigate the effect of hepatic blood flow on coagulation range of radiofrequency (RF) ablation in patients with liver malignancies.

METHOD AND MATERIALS

Between 2015 and 2018, 194 patients who had liver malignancies and underwent ultrasound guided percutaneous RF ablation in our center prospectively enrolled into this study. They were 63 females and 131 males with average age of 57.6±10.5 years old (range 48-71 years old). According to imaging findings, there were 86 patients had liver cirrhosis and 108 patients had normal liver background. The arrive time (AT) of contrast agent at hepatic artery, portal vein and hepatic vein were measured on CEUS before RFA. RFA was conducted with 3cm or 4cm celon electrode. 4D CEUS was used to evaluate the coagulation ranges in 24hr after RFA, including length, width, thickness and volume. Then the coagulation ranges were compared between liver cirrhosis and normal liver.

RESULTS

Based on CEUS before RFA, the average AT of hepatic artery, portal vein and hepatic vein in cirrhosis liver was significantly longer than normal liver (16.1±5.3 vs. 14.3±3.4 cm/s, p=0.002; 22.1±6.4 vs. 18.9±4.2cm/s, p<0.001; 29.2±7.4 vs. 24.3±4.7cm/s, p<0.001). With two 3cm tip RF electrodes, the average coagulation in cirrhosis liver was significantly larger than those in normal liver (width 2.6±0.5 vs. 2.4±0.5 cm, p=0.005; thickness 2.2±0.4 vs. 1.9±0.4 cm, p<0.001; volume 94.4±48.7 vs. 69.0±35.3 cm3, p=0.001). With three 4cm tip RF electrodes, the average coagulation in cirrhosis liver was significantly larger than those in normal liver (length 4.8±0.8 vs. 4.5±0.7 cm, p=0.012; width 3.8±0.6 vs. 3.4±0.5 cm, p<0.001; thickness 3.3±0.7 vs. 2.8±0.6, p=0.005; volume 248.3±107.3 vs. 189.3±76.0 cm3, p=0.013).

CONCLUSION

There were significant differences in hepatic blood flow parameters between cirrhosis and normal liver. The coagulation range of RF ablation in cirrhosis liver was significantly larger than that in normal liver, especially for shortest length (7mm difference between cirrhosis and normal liver background).

CLINICAL RELEVANCE/APPLICATION

This data was clinical application related and could help to accurately ablate live tumors with RF ablation.

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VI267-SD-WEA5

Non-Contrast-Enhanced Renal MRA Using Multi-Shot Gradient Echo EPI at 3-T MR System

Wednesday, Dec. 4 12:15PM - 12:45PM Room: VI Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
Shogo Fukuda, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Takeshi Nakaura, MD, Amakusa, Japan (*Abstract Co-Author*) Nothing to Disclose
Kosuke Morita, Kumamoto , Japan (*Abstract Co-Author*) Nothing to Disclose
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Hiroyuki Uetani, Amakusa, Japan (*Abstract Co-Author*) Nothing to Disclose
Masataka Nakagawa, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masahiro Hatemura, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

The purpose of this study was to investigate the feasibility of non-contrast-enhanced renal magnetic resonance angiography (MRA) using multi-shot gradient (MSG) echo planar imaging (EPI) with a 3-T MR system.

METHOD AND MATERIALS

Experimental data were collected from 17 healthy male volunteers who underwent non-contrast-enhanced renal MRA using standard balanced turbo field echo (bTFE) sequence and MSG-EPI sequence with a 3-T MR system. We evaluated the signal-to-noise ratio (SNR) for the renal artery and the contrast ratio (CR) between the renal artery and erector spinae and acquisition time. Two radiologists independently recorded the image contrast, noise, sharpness, artifacts, and overall quality on a 4-point scale.

RESULTS

SNR and CR were significantly higher in the MSG-EPI than in the bTFE sequence (17.80 ± 3.67 vs. 10.84 ± 2.86 and 0.78 ± 0.04 and 0.67 ± 0.08, respectively; $p < 0.05$). The acquisition time was significantly lower in the MSG-EPI than in the bTFE sequence (164.5 ± 34.0 s vs. 261.5 ± 39.3 s; $p < 0.05$). Significant differences were found in the image contrast, noise, sharpness, and artifacts as well as overall image quality between the two sequences ($p < 0.05$).

CONCLUSION

The MSG-EPI sequence is a promising technique to shorten the scan time and to improve the image quality of the non-contrast-enhanced real MRA with a 3-T system.

CLINICAL RELEVANCE/APPLICATION

The MSG-EPI sequence can offer higher-quality non-contrast-enhanced renal MRA with a shorter scan duration than the standard bTFE.

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AI007-EC-WEB

Learning-Based MR-CT Registration for Guiding Thermal Ablation of Liver Tumors

Wednesday, Dec. 4 12:45PM - 1:15PM Room: AI Community, Learning Center Custom Application Computer Demonstration

FDA Discussions may include off-label uses.

Participants
Dongming Wei, Shanghai, China (*Presenter*) Nothing to Disclose
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Pu Huang, PhD, Jinan , China (*Abstract Co-Author*) Nothing to Disclose
Pew-Thian Yap, PhD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Zhong Xue, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
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CONCLUSION

A learning-based registration framework is proposed to align pMR and iCT images for guiding thermal ablation of liver tumor. Experimental results showed that our method can efficiently and effectively overlay pMR onto iCT during ablation with high registration accuracy.

Background

Accurate targeting of the tumor area is critical for ablating tumor tissues only and leaving the surrounding healthy tissues intact. CT imaging is typically used to guide the interventional procedure in thermal ablation, where planning CT (pCT) is used for planning, and interventional CT (iCT) is captured during the treatment to facilitate safe placement of the ablation probe and accurate targeting of the tumor. However, CT is relatively poor in tissue contrast (e.g., arteries) and is susceptible to artifacts introduced by the probe during the procedure. Therefore, high-resolution pCT and planning MR (pMR) images are typically aligned during planning and then registered onto the iCT image for more precise guidance in positioning the probe to the desired region of interest (ROI). In liver tumor ablation, accuracy and speed of such an alignment are both important as it can compensate for deformations caused by patient positioning and respiratory motion without delay.

Evaluation

The proposed registration framework consists of two stages: (1) Rigid and deformable registrations between pMR and pCT images in pre-procedural stage. We use MI based Cycle-GAN to generate synthesized CT (sCT) from pMR images to convert the cross-modality registration into a mono-modality problem; (2) Fast deformable registration of inpainted iCT (inpCT) image with the pCT image, using an unsupervised registration network (UR-Net). Finally, the pMR image is aligned to the iCT image by composing the two transformations estimated in the above two stages.

Discussion

Thirty-nine subjects undergoing liver tumor ablation were included in our experiment. Each subject was scanned with his/her own pMR, pCT and iCT images. We computed the target registration error (TRE) over several landmarks of livers and tumors, to evaluate the registration accuracy. Our proposed method can obtained 4.37mm TRE under 4.2 seconds.

AI008-EC-WEB

RIL-Contour: A Collaborative Medical Imaging Dataset Annotation Tool Designed to Accelerate Dataset Annotation for and With Deep Learning

Wednesday, Dec. 4 12:45PM - 1:15PM Room: AI Community, Learning Center Custom Application Computer Demonstration

Participants
Kenneth Philbrick, Rochester, MN (*Presenter*) Nothing to Disclose
Alexander Weston, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Zeynettin Akkus, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD, Rochester, MN (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FlowSigma, LLC; Officer, FlowSigma, LLC ; Stockholder, FlowSigma, LLC

CONCLUSION

RIL-Contour and the AID methodology accelerate dataset annotation and model development by facilitating rapid collaboration between analysts, radiologists, and scientists.

Background

Deep learning algorithms typically fall within the domain of supervised artificial intelligence and are designed to "learn" from annotated data. Deep learning models require large, diverse training datasets for optimal model convergence. The effort to curate these datasets is widely regarded as a barrier to the development of deep learning systems.

Evaluation

We developed RIL-Contour to accelerate medical image annotation. A major goal driving the development of the software was to create an environment which enables clinically-oriented users to utilize deep learning models to rapidly and collaboratively annotate medical imaging. RIL-Contour accelerates medical imaging annotation through the process of Annotation by Iterative Deep learning (AID). The underlying concept of AID is to iteratively annotate, train, and utilize deep learning models during the process of dataset annotation and model development. To enable this, RIL-Contour supports workflows in which multiple analysts annotate medical images, radiologists approve the annotations, and data scientists utilize these annotations to train deep learning models. To automate the feedback loop between data scientists and image analysists, RIL-Contour provides mechanisms enable data scientists to push deep newly trained deep learning models to other users of the software.

Discussion

We have utilized RIL-Contour for annotation of MRI, CT, and US imaging collected at the head, chest, and abdomen to generate annotations of brain, abdominal organs, tumors, and other tissues and to generate annotations that categorically classify the presence or absence of tumors in imaging or the contrast enhancement phase of a CT series. Our largest project to date involves segmenting 35 unique organs and tissues in CT volumes of the abdomen. Project staff consists of 17 image analysts, 5 radiologists, and 3 data scientists who coordinate solely through RIL-Contour. AID methodology has decreased the time required to annotate new series for this project by 80%.

AI032

Prediction of Clinically Significant Prostate Cancer from Only T2 Weighted Imaging Using Machine Learning

Wednesday, Dec. 4 12:45PM - 1:15PM Room: AI Community, Learning Center

Participants
Kirti Magudia, MD,PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
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Antonio C. Westphalen, MD, Medina, WA (*Abstract Co-Author*) Nothing to Disclose

PROGRAM INFORMATION

This invited poster is an example of the exciting work in the artificial intelligence domain being supported by the RSNA R&E grant program. Visit each one, AI027 through AI039, to learn about the latest updates.

Printed on: 10/29/20

AI036

An Artificial Intelligence Approach to Improve the Differentiation of Surgical from Non-surgical Cystic Renal Lesions

Wednesday, Dec. 4 12:45PM - 1:15PM Room: AI Community, Learning Center

Participants
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Aya Kamaya, MD, Stanford, CA (*Abstract Co-Author*) Royalties, Reed Elsevier; Researcher, Koninklijke Philips NV; Researcher, Siemens AG

PROGRAM INFORMATION

This invited poster is an example of the exciting work in the artificial intelligence domain being supported by the RSNA R&E grant program. Visit each one, AI027 through AI039, to learn about the latest updates.

Printed on: 10/29/20

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AI227-SD-WEB2

Association Rule Learning May Estimate Individual Risk for Contrast-Induced Acute Kidney Injury

Wednesday, Dec. 4 12:45PM - 1:15PM Room: AI Community, Learning Center Station #2

Participants
Martin J. Willemink, MD,PhD, Mountain View, CA (*Presenter*) Research Grant, American Heart Association; Research Grant, Koninklijke Philips NV; Consultant, Arterys Inc
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PURPOSE

Administration of iodinated contrast medium in patients with chronic kidney disease (CKD) is generally considered a risk factor for post-contrast acute kidney injury (PC-AKI). Individual PC-AKI risk quantification is highly desirable for better weighting risk against expected benefits of contrast administration. Association rule learning is a machine learning technique that determines associations between variables. This method has the potential to improve individual risk stratification, but has rarely been used in clinical research. We sought to assess individual associations of PC-AKI in patients undergoing contrast-enhanced computed tomography (CT).

METHOD AND MATERIALS

Patients who underwent a contrast-enhanced CT exam between May 2017 and November 2018 with at least one serum creatinine value 7 days before CT and one value 24-96 hours after CT were retrospectively included. Patient demographics including age, sex, ethnicity, and a range of pre and post-CT clinical and laboratory parameters were extracted from electronic medical records. PC-AKI was defined as >50% or >0.3mg/dL increase in serum creatinine 24-96 hours after CT. The Apriori association rule learning algorithm was used with the Arules package in R to evaluate associations of 2-5 variables that were present in >=40% (confidence) of subgroups with a minimum size of 3 (0.09%) patients (support).

RESULTS

3,450 patients were included with a median age (interquartiles) of 62.4 (49.5-72.4) years. 207 patients (6.0%) developed PC-AKI. PC-AKI was seen following CT in 43.8% of patients who were 60-80 years old with hypertension, increased average serum creatinine over 7 days before CT, but a normal eGFR>=90 at the latest measurement before CT (support 0.2%). The algorithm's confidence increased from 43.8% to 62.5% if these patients had atrial fibrillation independent of age (support 0.15%). All CKD stage 5 or end-stage CKD patients who received 300mg/mL concentration iodine and weighted 80-90kg had PC-AKI (support 0.09%).

CONCLUSION

Individual associations with PC-AKI can be determined using association rule learning, which may be used to estimate a patient's individual risk to develop PC-AKI.

CLINICAL RELEVANCE/APPLICATION

The association rule learning algorithm has the potential identify new associations/clusters of risk factors which may lead to individualized treatment/preventive strategies.

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AI230-SD-WEB1

Mobile Deployment of a Convolutional Neural Network Which Identifies Pacemakers and Implantable Defibrillators on Chest Radiographs

Wednesday, Dec. 4 12:45PM - 1:15PM Room: AI Community, Learning Center Station #1

Participants
Michael B. Wells, MD, Houston, TX (*Presenter*) Nothing to Disclose
Vaeman Chintamaneni, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Kim-Trang D. Ho, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Daniel Ocazionez-Trujillo, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Emma C. Ferguson, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

We have retrained a convolutional neural network to recognize the manufacturer of implantable defibrillators and pacemakers on chest radiographs. This network utilizes real time object detection and has been successfully deployed to iOS.

METHOD AND MATERIALS

In this retrospective IRB approved study we obtained 10,704 chest radiographs from 5,057 patients admitted to our institution between 2012-2018. These radiographs contained 22 morphologically distinct models of implantable defibrillators and pacemakers from four manufacturers. Device models were pooled into 9 classes and labeled bounding boxes were drawn around the region of interest on each radiograph. Radiographs were subsequently split into a training set containing 8,563 images and a validation set containing 2,141 images. We retrained Google's opensource convolutional neural network, SSD MobileNet, and deployed the network to iOS for real time object detection. Ongoing beta-testing is underway and two site clinical validation is planned.

RESULTS

The network localization loss was 0.04 and classification loss of 0.8. The network achieved excellent precision in its inferences with Mean Average Precision (MAP) for each of the 9 classes approaching 1. The MAP for each class and clinical validation results will be reported in subsequent publication.

CONCLUSION

Once clinical validation concludes, deployment of this retrained network onto iOS and Android platforms will significantly reduce the amount of time required for healthcare providers to identify the manufacturer of a pacemaker or defibrillator.

CLINICAL RELEVANCE/APPLICATION

Deploying this model to mobile devices will allow providers to directly identify device manufacturer, expedite vendor contact, and acquire interrogation data as well as MRI safety information.

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AI233-SD-WEB4

Disentangled Feature Representation of Pulmonary Diseases in the Latent Space of Progressive Growing of Generative Adversarial Networks in Chest PA X-Ray Images

Wednesday, Dec. 4 12:45PM - 1:15PM Room: AI Community, Learning Center Station #4

FDA Discussions may include off-label uses.

Participants
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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
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PURPOSE

Disentangled feature representation in the latent space of generative adversarial networks(GANs) can be useful for generating images in desired direction. To investigate whether it is possible to discover feature representation axes of various kinds of pulmonary diseases in the latent space of GANs that trained with abnormal chest X-ray images.

METHOD AND MATERIALS

We trained a progressive growing of GANs (PGGANs) model with 111,163 abnormal chest X-ray images and generated 30,000 fake abnormal images. The fake images were then classified into 6-classes by a classifier with convolutional neural networks (CNN) including normal, nodule, consolidation, interstitial opacity, pleural effusion, and pneumothorax. We tried to disentangle the five abnormal classes by performing regression of latent vectors to discover an axis of each disease. To confirm whether the axes are plausible for the generated images along the axis of each disease, we performed a visual scoring test on severity of each disease by an expert thoracic radiologist with three stages: mild, moderate, and severe and evaluated likelihood of each disease by the CNN classifier.

RESULTS

We found three axes of lung diseases including consolidation, interstitial opacity, and pleuraleffusion. Nodule was not discovered, presumably due to a high correlation withconsolidation. Pneumothorax images were not generated since its insufficient data in training dataset. The radiologist confirmed that generated images along each axis reflects an increment in severity of each pulmonary disease. The generated images on the axis ofconsolidation, interstitial opacity, and pleural effusion were scored from normal to severe, moderate and moderate stage, respectively. In addition, the likelihood of each disease evaluated by classifier increased from 0 to 0.97, 0.89, 0.99, respectively.

CONCLUSION

We were able to disentangle each axis of three pulmonary diseases in the latent space, with combination of GANs and CNN classifier.

CLINICAL RELEVANCE/APPLICATION

With the disentangled feature representation in the latent space of GAN, abnormal images in desired direction can be generated from any of normal images. This can be utilized for resolving data imbalance problem in aspect of data augmentation.

BR212-ED-WEB8

Stromal Fibrosis: A Diagnostic Challenge for Radiologists

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #8

Participants
Flavia B. Sarquis, MD, Villa Ballester, Argentina (*Presenter*) Nothing to Disclose
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Mariano Lamattina, MD, Capital Federal, Argentina (*Abstract Co-Author*) Nothing to Disclose
Paola Pucci, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Soledad Nocetti, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Florencia Melendez, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Stromal fibrosis of the breast is an increasingly benign condition with diagnostic difficulties both from the point of view mammographic and sonographic and the anatomic- pathological correlation. After reading this education exhibit the radiologist will know: Definition, classification and multiple terms used to describe this finding The imaging features of stromal fibrosis of the breast. The challenges of diagnosing an entity with multiple forms of manifestation, which makes the categorization many as BIRADS 4. The importance of histological characterization of this lesion in all cases.

TABLE OF CONTENTS/OUTLINE

Introduction Stromal fibrosis may present as a palpable mass or a clinically occult imaging-detected abnormality. The pathogenesis of stromal fibrosis remains unknown. Multimodality imaging features and Image Interpretation. Biopsy-proven cases: The major dilemma lies in the case of radiologic-pathologic discordance. Appropriate management and follow up. Conclusions.

BR213-ED-WEB9

Putting the Pieces Together: Multimodality Review of Puzzling Benign Breast Lumps

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #9

Participants
Brian J. Guarnieri, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Charmi Vijapura, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Rifat A. Wahab, DO, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Discuss the appropriate initial diagnostic work up and management for palpable breast lumps. Recognize common and rare causes of benign vascular, traumatic, systemic, and infectious breast lumps. Characterize mammographic and ultrasound imaging findings of these lesions.

TABLE OF CONTENTS/OUTLINE

Work Up: Clinical Presentation ACR Appropriateness Criteria for palpable breast lumps Discuss Cases and Imaging Findings Vascular True and false aneurysm Mondor's Disease Multiple skin hemangiomas Enlarged vessels Traumatic Fat necrosis/Oil cysts Epidermal inclusion cyst Keloids Systemic Neurofibromatosis Amyloidosis Diabetic Mastopathy Infectious Abscess Granulomatous mastitis Mammary duct ectasia

BR214-ED-WEB10

Trials and Tribulations in the Early Implementation of an Abbreviated Screening Breast MR Program

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #10

Awards
Magna Cum Laude

Participants
Samantha P. Zuckerman, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Katrina Korhonen, MD , Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Grant, Hologic, Inc; Consultant, Hologic, Inc; Grant, iCAD, Inc; Consultant, Advisory Panel, iCAD, Inc; Speaker, iiCME

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TEACHING POINTS

- Supplemental breast cancer screening with MR is more sensitive than supplementing digital mammography (DM) or tomosynthesis (DBT) with US. - For patients who do not meet the level of elevated lifetime risk to qualify for routine, screening breast MR, abbreviated MR (AB-MR) may be a cost effective alternative for supplemental screening. - Implementing an AB-MR screening program requires the cooperation of multiple stakeholders. - Reviewing true positive, false positive, and true negative biopsy cases from a clinically implemented AB-MR supplemental screening program may help inform others in their implementation efforts.

TABLE OF CONTENTS/OUTLINE

- Review the evidence for supplemental screening with AB-MR compared to other modalities (i.e., ultrasound, CEDM, MBI, and DBT). - Define patient criteria for a successful AB-MR clinical program. - Review lessons learned from the early implementation of a clinical AB-MR program including marketing, scheduling, operational and financial considerations. - Review early screening outcomes. - Present case-based examples of AB-MR (i.e., true negatives and positives, and false positives and negatives

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BR242-SD-WEB1

Role of the Anchoring and Adjustment Heuristic in Radiological Decision-Making

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #1

Participants
Fallon Branch, MS, Augusta, GA (*Presenter*) Nothing to Disclose
Jay Hegde, PhD,MS, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The anchoring and adjustment heuristic is a 'rule of thumb' that subjects, including medical experts, sometimes use in decision-making, where they start with an initial, anchoring judgment, and adjust it as necessary to accommodate the available perceptual and cognitive information. To elucidate the role of this heuristic in radiological decision-making, we characterized the relative influences of the visual evidence in mammograms vs. cognitive factors such as an a priori, anchoring effect of the belief that a given image contains a cancer.

METHOD AND MATERIALS

We used a task paradigm in which we systematically manipulated the aforementioned visual and cognitive factors. At the beginning of each trial, subjects (12 practicing radiologists, including 6 mammography specialists) were presented a random number that they were told was another radiologist's estimated probability (% chance) that the upcoming mammogram contained a cancer. Subjects then reported, using an on-screen slider, their perceived probability that the upcoming mammogram contained a cancer ('1st report'). Subjects then viewed the mammogram for various durations (200ms to 60s, depending on the trial) and used the slider to report the probability that the given mammogram actually contained a cancer ('2nd report'). We analyzed the contribution of various factors to the subjects' 2nd report.

RESULTS

We found that the 2nd report was highly correlated with the first (r= 0.39, df =142, p <<0.05). No other factor, including (but not limited to) the actual cancer status of the mammogram or viewing duration, significantly contributed to the 2nd report (general linear model; t<0 and p>0.05 for all other factors). Together, our results indicate that under certain circumstances, anchoring cognitive information such as a priori beliefs about a given image can have a biasing effect that adjustments based on the visual evidence in the mammogram cannot necessarily overcome.

CONCLUSION

Our results suggest that when a radiologist providing a second opinion is aware of the putative prior opinion, the prior opinion can have a significant anchoring effect, thus biasing the radiologist's decision.

CLINICAL RELEVANCE/APPLICATION

Blinding the radiologist providing a second opinion to the first opinion may help reduce the biasing effects of the anchoring and adjustment heuristic.

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BR243-SD-WEB2

Management and Outcomes of One-View Architectural Distortions Seen on Screening Breast Tomosynthesis

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #2

Participants
Hannan Saad, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Alexis Davenport, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
David M. Pinkney, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Gurpriya K. Gupta, MD, Birmingham, MI (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The objective of our study was to determine the outcomes of one-view architectural distortions described on screening Digital Breast Tomosynthesis (DBT).

METHOD AND MATERIALS

For this single institution retrospective study, screening Digital Breast Tomosynthesis reports from October 15, 2015 to January 1, 2019 that included one-view architectural distortion as a finding were reviewed. Associated additional imaging studies and pathology results, if available, were also reviewed. Patients were excluded if no diagnostic imaging was performed or if the patient was still undergoing active surveillance of the lesion.

RESULTS

106 cases met inclusion criteria. 61/106 (57.5%) were no longer seen at diagnostic workup and characterized as BI-RADS 1. 8 cases were assigned BI-RADS 3 initially, 5 of which were downgraded to BI-RADS 1 after follow up or MRI was performed, and 3 of which were eventually biopsied. 37 cases were assigned BI-RADS 4. In total, 34/106 (32.1%) cases ultimately underwent core needle biopsy (6 were canceled at the time of biopsy as the finding was no longer appreciated). Of these, 24 were benign (70.6%), 6 were high risk (17.6%; 0/6 upgraded at surgical excision), and 4 were malignant (11.8%). Overall malignancy rate was 4/106 (3.8%). 74 cases underwent sonographic evaluation. 2/4 (50.0%) malignancies had ultrasound correlates, and there was a higher likelihood of malignancy if an ultrasound correlate was present (2/24, 8.3%) versus without an ultrasound correlate (2/50, 4.0%).

CONCLUSION

One-view architectural distortions seen on screening tomosynthesis have a low malignancy rate (3.8%). Furthermore, the presence of an ultrasound correlate demonstrated a higher likelihood of malignancy as opposed to without an ultrasound correlate.

CLINICAL RELEVANCE/APPLICATION

One-view architectural distortions on screening tomosynthesis can present a diagnostic dilemma. Knowledge of malignancy rates and associated imaging findings will help guide management at workup.

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BR244-SD-WEB3

Correlation of Female Hormone Levels with Quantitative BPE and ADC Values in Breast Cancer Patients: The Effect of BPE and ADC Values on Cancer Detectability

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
Seulgi You, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Dayoung Kim, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate the relationship between female hormone levels and background parenchymal enhancement (BPE) or apparent diffusion coefficient (ADC) values of normal breast parenchyma and to analyze the effect of BPE and ADC values on cancer detectability.

METHOD AND MATERIALS

From November 2016 to December 2018, 237 malignant lesions in 164 breast cancer patients who underwent preoperative MRI and female hormone testing were included in our study. For quantitative analysis of BPE, we used semi-automated in-house software with MATLAB. From each voxels of whole breast, the software calculated BPE using following equations: [(signal intensity (SI) at 1 min 30 sec after contrast injection - baseline SI) / baseline SI] x 100 %. The detectability of breast cancer was scored 2 (excellent), 1 (fair), or 0 (not detectable) by two radiologists in consensus.

RESULTS

The progesterone level was significantly correlated with mean values ($r=0.226$, $p=0.004$), median values ($r=0.207$, $p=0.008$), 90th percentile values ($r=0.244$, $p=0.002$) and 10th percentile values ($r=0.171$, $p=0.029$) of quantitative BPE. There was no significant correlation between the estrogen and quantitative BPE parameters ($p>0.05$). ADC value was not significantly correlated with both estrogen and progesterone (all p values >0.05). Spearman rank test showed there was significant correlation between the detectability and BPE grade ($r= -0.36$, $p<0.001$) on contrast-enhanced image or ADC values ($r=-0.315$, $p<0.001$) on diffusion-weighted image. Of 5 lesions with score 0 on contrast-enhanced image, 3 lesions were score 2 on DWI and 1 lesion was score 1. Of 26 lesions with score 1 on contrast-enhanced image, 13 lesions were score 2 and 14 lesions were score 1 on DWI.

CONCLUSION

Quantitative BPE values were significantly correlated with progesterone level. The detectability of breast cancer depends on both BPE grade on contrast-enhanced image and ADC grade on DWI. DWI could be useful in the case of breast cancer that is not well visible on contrast-enhanced image.

CLINICAL RELEVANCE/APPLICATION

The detectability of breast cancer depends on both BPE grade on contrast-enhanced image and ADC grade on DWI. DWI could be useful in the case of breast cancer that is not well visible on contrast-enhanced image.

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BR277-SD-WEB4

Are There Differences in 18F-FDG PET-MRI Imaging Biomarkers of Contralateral Healthy Tissue between Patients with Benign and Malignant Breast Lesions?

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #4

Participants
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PURPOSE

To evaluate whether there are differences in multiparametric 18F-fluorodeoxyglucose positron emission tomography - magnetic resonance imaging (18F-FDG PET-MRI) biomarkers of contralateral healthy breast tissue between patients with benign and malignant breast tumors.

METHOD AND MATERIALS

In this IRB-approved HIPAA-compliant prospective single-institution study, 141 women with imaging abnormality on mammography or sonography (BI-RADS 4/5) were included and underwent combined 18F-FDG PET-MRI of the breast at 3T including dynamic contrast-enhanced MRI (DCE-MRI) and diffusion-weighted imaging (DWI). The following imaging biomarkers were recorded in all patients for the contralateral tumor-free breast: 18F-FDG breast parenchymal uptake (BPU), mean apparent diffusion coefficient (ADCmean), DCE-MRI background parenchymal enhancement (BPE) and amount of fibroglandular tissue (FGT), as well as BPU, BPE and FGT of the ipsilateral diseased breast. Appropriate statistical tests were used to assess differences in imaging biomarkers between patients with benign and malignant lesions.

RESULTS

There were 100 malignant and 41 benign lesions. BPE was minimal in 61, mild in 56, moderate in 19, and marked in 5 patients. BPE differed significantly ($P<0.001$) between patients with benign and malignant lesions, with patients with cancer showing decreased BPE in the contralateral tumor-free breast. A borderline significant difference was observed for FGT ($P=0.055$). BPU for patients with mild BPE was 1.5, for mild BPE 1.9, for moderate BPE 2.2, and for marked BPE 1.9. BPU differed significantly between patients with benign (mean, 1.9) and malignant lesions (mean, 1.8) ($P<.001$). ADCmean did not differ between groups ($P=0.19$). In both groups, no differences in imaging biomarkers between contralateral healthy and ipsilateral diseased breast were found, excluding a potential stealing phenomenon of the diseased breast with respect to vascularity and metabolic activity.

CONCLUSION

Differences in multiparametric 18F-FDG PET-MRI biomarkers, obtained from contralateral tumor-free breast tissue, exist between patients with benign and malignant breast tumors. Contralateral BPE, BPU, and FGT are decreased in breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

BPE and BPU may potentially serve as imaging biomarkers for the presence and risk of malignancy.

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BR278-SD-WEB5

Whole Breast Tissue Characterization with Ultrasound Tomography

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #5

Participants
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PURPOSE

Hand held ultrasound (HHUS) provides localized diagnostic information of tissue stiffness and elasticity. Screening requires global assessment of tissue properties for which HHUS is not suitable while automated breast ultrasound (ABUS) does not measure elasticity. This study is the first to evaluate imaging of tissue stiffness throughout the breast using the technique of ultrasound tomography (UST).

METHOD AND MATERIALS

Patients with findings on mammography and/or HHUS during the time period of January, 2018 to March 2018, were scanned with UST and with HHUS elastography. Patient were selected on the basis of having dense breasts and the most common benign breast masses, as well as cancers. A total of 50 women with breast masses were imaged with UST (16 cancers, 16 fibroadenomas and 18 cysts). HHUS was available for 26 of the 50 cases. Pathology and/or radiology reports were used as the ground truth for verifying lesion type and lesion location. Lesion localization on UST images was provided by a board-certified radiologist. The Spearman correlation coefficient was used to characterize agreement between the UST and HHUS measurements.

RESULTS

UST demonstrated the ability to measure tissue stiffness throughout the breast and to characterize lesion stiffness in all 50 patients. Examples are shown in Figure 1. Fifteen of the 16 cancers were characterized as "stiff" by the UST method. Eight fibroadenomas were found to be mixed (range of colors), 4 were stiff (red) and 4 were found to be soft (blue). Of the 18 cysts, 17 were found to be soft while 1 was found to be mixed. With HHUS elastography, 8 cancers and 3 fibroadenomas were found to be stiff, 5 fibroadenomas were mixed and all 10 cysts were soft. The Spearman correlation coefficient for the UST-HHUS comparison, for the subset of 26 cases, was 0.89.

CONCLUSION

The study demonstrates that stiffness characterization of lesions using UST is feasible and accurate. Furthermore, it is shown that this approach measures tissue stiffness throughout the volume of the breast, something that is currently not possible with other ultrasound devices.

CLINICAL RELEVANCE/APPLICATION

Measuring tissue stiffness throughout the whole breast is not currently available clinically. The addition of this information in a screening environment has the potential to reduce call backs and biopsies by utilizing stiffness to improve specificity.

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BR279-SD-WEB6

A Radiogenomics Approach to Predicting Immune and Stromal Cell Line Invasion in Breast Cancer Lesions

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #6

Participants
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Dooman Arefan, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Studies have shown that prognostic outcomes of tumors are not only linked with genetic and epigenetic factors within cancerous cells, but also with the extent of infiltrating immune and stromal cells in the tumor microenvironment. In this study, we aim to investigate machine learning models utilizing dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) features to predict the presence of eight immune and two stromal cell populations within breast cancer lesions.

METHOD AND MATERIALS

This study uses the paired imaging and genetic data of 73 breast cancer patients, from two different institutions, provided by The Cancer Imaging Archive and The Cancer Genome Atlas. Radiomic features were extracted from the tumor area of the DCE-MRIs. Tumor Segmentation was manually performed by a panel of experienced radiologists. The set of 199 radiomic features described size, morphological, kinetic, and textural properties of the tumors. Cell line infiltration was quantified using the gene expression profile with the MCP-counter software. Univariate linear relationships were measured for every radiomic feature cell line abundance combination. An extreme gradient boosting machine learning algorithm was used to predict high or low cell line infiltration using radiomic features as the predictive variables. Ten different models were created to predict each cell line. Classification performance was measured via area under the ROC curve (AUC) by 1) using leave one out cross validation on the 40 patients from Institution A and 2) independent test on the 33 patients from Institution B.

RESULTS

Several significant univariate relationships were found between radiomic features and the abundance of fibroblasts in the lesion. The machine learning models yielded cross-validation AUCs ranging from 0.5 to 0.83. The independent test on data from Institution B yielded AUCs ranging from 0.5 to 0.68.

CONCLUSION

Radiomics analysis of breast DCE-MRI is a promising approach to predicting infiltration of various immune and stromal cell lines into breast cancer lesions, with a varying range of accuracies. There appears to be links between macro radiomic phenotypes and microscopic cellular events occurring in breast cancer tumors.

CLINICAL RELEVANCE/APPLICATION

Nuanced radiological descriptors may be informative of microscopic properties of tumors. Breast DCE-MRI radiomics may provide a non-invasive biomarker to help identify responders to immunotherapy.

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BR280-SD-WEB7

Screening Mammography with Digital Breast Tomosynthesis in Women Aged 40-54: Is It Effective or Harmful?

Wednesday, Dec. 4 12:45PM - 1:15PM Room: BR Community, Learning Center Station #7

Participants
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PURPOSE

Appropriate starting age for mammogram screening has been a controversial subject in the recent years considering its potential harms and benefits. Digital breast tomosynthesis (DBT) reduces false positive recalls while increasing cancer detection and can be a more effective screening tool. In this study we present the performance metrics of DBT mammogram screening in women aged 40-54.

METHOD AND MATERIALS

We retrospectively reviewed all screening mammograms with DBT in women aged 40-54 in 4 breast imaging centers (one academic center and 3 outpatient sites) from 5/1/2012 to 4/3/2018. DBT was offered to all women at no additional cost. Screening performance metrics and characteristics of detected cancers were compared between 3 age groups of 40-44 (group A), 45-49 (group B), and 50-54 (group C).

RESULTS

Total of 52360 DBT screening mammograms (14757 in group A, 17649 in group B, and 19954 in group C) were included. Recall rate (RR) was 11.4%, 8.6%, 7.5% in groups A, B, and C, respectively with significant difference between all groups ($p<0.001$). However, RR of baseline mammograms in each group were not significantly different. Cancer detection rate (CDR) was 2.8, 4.1, and 4.6 per 1000 mammograms in groups A, B, and C, respectively without significant difference ($p>0.05$). Biopsy rates in 3 groups were not significantly different (1.4%, 1.5%, and 1.4% in groups A, B, and C, respectively). Cancers detected were 79%, 73%, and 75% invasive in groups A, B and C, respectively ($p>0.05$). Thirty percent of invasive cancers in group A were poorly differentiated compared to 11% and 17% in groups B and C ($p>0.05$). Thirty percent of invasive cancers in group A were HER2+ or triple negative for hormone receptors compared to 17% in each group of B and C ($p>0.05$). Of women with invasive cancers in group A, 80% did not have axillary lymph node metastasis which was similar to 79% in each group of B and C.

CONCLUSION

Screening mammogram with DBT in women aged 40-44 and 45-49 has CDR comparable with age 50-54. The RR is higher in younger women, but RR of baseline mammograms is similar between 3 age groups. The majority of screen-detected cancers in women aged 40-49 are invasive and high grade, but without axillary lymph node involvement.

CLINICAL RELEVANCE/APPLICATION

DBT screening in women aged 40-49 is effective with minimal false positives. Delaying screening may only shift higher RR of baseline mammograms to older women while losing the opportunity to detect aggressive cancers at early stage.

CA169-ED-WEB8

A Software Pipeline Taking 4D Cardiac Data to Dynamic AR/VR Models

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CA Community, Learning Center Station #8

Participants
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TEACHING POINTS

We demonstrate how to take 4D cardiac data (e.g. obtained from contrast-enhanced CT) from a set of DICOM images to a dynamically interactive, beating digital model, which can be viewed and manipulated in virtual or augmented reality using a phone, tablet, VR headset, or computer.

TABLE OF CONTENTS/OUTLINE

1.Semi-automated segmentation using open source Slicer software a.Custom module speeds blood pool segmentation in one cardiac phase b.Seed based chamber segmentation (if visualization/tracking/quantification of different chambers is desired) c.Custom module allows fully automated propagation of segmentation to all other cardiac phases d.Blood pool wrapping (if hollow models are desired) e.Cut plane definition (optional, if access to pre-defined anatomical planes are desired in final software, e.g. standard HLA, VLA, SA, or disease-specific planes) 2.Export of set of 3D models 3.Import of 3D models into Unity game development engine 4.Construct animation sequence and interactive controls to enable a.Play/Pause animation b.Show/Hide segmented chambers or pre-defined cut planes c.Interactively view the beating or paused models from any angle d.Interactively cut through models at any angle to enhance visual access to desired areas 5.Build application to desired platform (computer, phone, or tablet app, VR headset, AR platform)

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CA221-SD-WEB1

Quantitative Assessment of Left Ventricular Myocardial Strain in Patients with Myocarditis by Magnetic Resonance Myocardial Tissue Tracking

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CA Community, Learning Center Station #1

Participants
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PURPOSE

The aim of this study was to quantitatively evaluate the changes of left ventricular myocardial strain in patients with myocarditis by magnetic resonance myocardial tissue tracking technique(CMR-TT).

METHOD AND MATERIALS

Twenty patients diagnosed with myocarditis in our hospital and 37 healthy adult volunteers underwent cardiac cine imaging. Analysis of global peak strain radial(GPRS),global peak strain long(GPLS), global peak strain circumf(GPCS) and cardiac function of left ventricle was performed by using a dedicated software CVI42. The changes of global left ventricular peak strain and cardiac function between the patients with myocarditis and the volunteers were compared.

RESULTS

Compared with healthy adult volunteers, the end-diastolic volume(EDV) and ejection fraction(EF) of patients with myocarditis decreased significantly ($P < 0.001$), stroke volume, cardiac output and cardiac index decreased, too ($P < 0.05$); GPRS and GPLS were significantly lower than those of control group($P < 0.001$), and GPLS has the best discriminant effect, the area under the ROC curve is 0.818,the optimal threshold is -12.995, the sensitivity is 75% and the specificity is 75.7%.Moreover, there was a moderate negative correlation between GPRS and GPCS ($P < 0.001$),GPLS has lightly negative correlation with end-systolic volume (ESV)($P < 0.05$) and moderately positive correlation with EF ($P < 0.05$),also,GPCS has slight negative correlation with EF($P < 0.05$), moderate positive correlation with ESV($P < 0.001$), and slight positive correlation with EDV($P < 0.05$).

CONCLUSION

CMR-TT myocardial strain analysis might serve as a new tool for assessment of myocardial dysfunction in the diagnostic work-up of patients suspected of having myocarditis.

CLINICAL RELEVANCE/APPLICATION

Strain measurements can well distinguish patients with myocarditis from the normal, and detect early myocarditis to achieve early intervention.

CA222-SD-WEB2

Machine Learning to Evaluate Vulnerable Plaque on Coronary Computed Tomography with Spectral Imaging

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CA Community, Learning Center Station #2

Participants
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PURPOSE

Previous reports have suggested that beam hardening artifact and poor image contrast in cardiac computed tomography (CT) can be resolved by spectral imaging. Recent studies also reported that machine learning based on CT number histogram can offer superior diagnostic performance than the conventional mean CT number cut-off method for coronary plaque characterization. The purpose of this study is to determine whether spectral imaging with dual energy CT can improve the diagnostic performance of coronary plaque characterization.

METHOD AND MATERIALS

We retrospectively included 30 patients with coronary plaques who had undergone coronary CT angiography (dual-layer CT) and intravascular ultrasound (IVUS) studies. Based on IVUS findings, 17 patients were diagnosed to have vulnerable plaques, whereas 13 were diagnosed to have stable plaques. We calculated seven histogram parameters (minimum and mean value, standard deviation, maximum value, skewness, kurtosis, and entropy) of the plaque CT number of 120 kVp images and virtual monochromatic images (VMI) from 40-140 keV at 5-keV intervals. A prediction model was developed using a machine learning method (univariate logistic regression and Random Forest using all histogram parameters in 120 kVp images and all VMIs); the area under the receiver operating characteristic curve (AUC) of this model was calculated using 5-fold cross validation.

RESULTS

Using the univariate logistic regression model, peak diagnostic performance of each histogram parameters was observed at various energy levels (40-110 keV). Using the Random Forest model, peak diagnostic performance was observed at 65 keV. The AUC of the Random Forest model of the 65 keV (0.81) was significantly higher than the Random Forest model of the 120 kVp (AUC 0.72) and mean CT number (AUC 0.50) using 120 kVp images ($p < 0.05$).

CONCLUSION

Spectral imaging with dual energy CT can improve the diagnostic performance of machine learning using CT histogram for coronary plaque characterization.

CLINICAL RELEVANCE/APPLICATION

Spectral imaging and machine learning can be a promising technique to evaluate coronary plaque components.

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CA223-SD-WEB3

Analysis of Signal Intensity and Signal Intensity Ratio (SIR) in STIR Images in Patients with Suspected Myocarditis

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CA Community, Learning Center Station #3

Participants
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PURPOSE

Clinical diagnosis of myocarditis is often challenging and Magnetic Resonance Imaging (MRI) can facilitate myocardial inflammation detection. Patients often suffer from dyspnea and have a very limited compliance, thus, low scan times MR protocols for detecting myocardial edema are of paramount importance in patients with suspected myocarditis. Our purpose is to evaluate the diagnostic performance of STIR images in predicting late gadolinium enhancement (LGE) presence in myocardial segments in order to reduce scan times in patients with limited compliance.

METHOD AND MATERIALS

STIR and post contrast IR images for the detection of LGE of 14 patients who underwent MRI scan for suspected myocarditis were retrospectively analyzed by 1 expert cardiac imager. Signal intensity was sampled by placing ROIs in the area of maximal intensity in each myocardial segment following the American Heart Association (AHA) myocardial segmentation. STIR intensity ratio (SIR) was calculated as the ratio of the measured signal intensity and that of a muscle of the thoracic wall in the same imaged slice. LGE was visually assessed in post contrast phase sensitive inversion recovery images. ROC curves were drawn in order to assess diagnostic performance of signal intensity and SIR in predicting the presence of LGE. Area Under the Curve (AUC) and best threshold for sensitivity and specificity were calculated.

RESULTS

238 myocardial segments were analyzed. 75 segments showed LGE (53 subepicardial, 1 subendocardial, 12 mesocardial and 6 transmural).STIR signal intensity (mean=687±414.5) showed an AUC of 0.641 (confidence interval=0.56-0.71) with a sensitivity of 0.7 and a specificity of 0.61 (best threshold value=727.5); SIR (mean = 2.28±0.73) showed an AUC of 0.633 (confidence interval=0.57-0.71) with a sensitivity of 0.65 and a specificity of 0.6 (best threshold value=2.2). There was no statistically significant difference between AUCs (p=0.8).

CONCLUSION

In patients with suspected myocarditis signal intensity and SIR are useful parameters in predicting the presence of LGE and may be used to reduce scan times in non-compliant patients without reducing diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

SIR can reduce scan times and it can predict the presence of LGE in patients with suspected myocarditis.

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CA256-SD-WEB4

Extracellular Volume Analysis with Cardiac Magnetic Resonance in Patients with Scleroderma

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CA Community, Learning Center Station #4

Participants
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PURPOSE

To evaluate myocardial extracellular volume (ECV) in patients with scleroderma and the correlations with patient variables.

METHOD AND MATERIALS

Consecutive patients with scleroderma underwent cardiac magnetic resonance, including sequences for the evaluation of T1 values and T1 mapping both before and after contrast injection (0,1 mmol/kg of Gadobutrolo). Overall myocardial ECV was then obtained by placing regions of interest both in pre- and post-contrast T1 maps at the septum, anterior wall, lateral wall and posterior wall of the myocardium in short- and long-axis projections. T1 values obtained from the regions of interest were then averaged to calculate global ECV.

RESULTS

20 scleroderma patients with a median age of 63 years (IQR 51-67 years), of whom 3 were males (15%) were enrolled. Scleroderma patients had a higher global ECV (33.9%, IQR 35.9-39.2%), when compared to healthy subject reference values (25.6%, normality interval of 19.6-31.6%). Patients had a median LV end-diastolic indexed volume of 67 ml/m2 (IQR 56-78 ml/m2), end-diastolic indexed volume of 21 ml/m2 (IQR 17-26 ml/m2), stroke volume of 72 ml (IQR 56-85 ml), ejection fraction of 69% (IQR 64-72%), and mass index of 63 g/m2 (IQR 56-72 g/m2). There was a significant negative correlation between ECV and diastolic blood pressure (ρ=-0.731, P=0.007), and a borderline positive correlation between ECV and the presence of dyspnoea (ρ=0.508, P=0.053). There were no differences in ECV with regards to different types of scleroderma, or positivity to SCL-70 antibodies.

CONCLUSION

ECV is increased in scleroderma patients despite the normal LV function and it correlated with the presence of dyspnoea.

CLINICAL RELEVANCE/APPLICATION

ECV in scleroderma patients may reflect a diffuse myocardial fibrosis and should be helpful in the detection of early myocardial involvement n these patients.

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CA257-SD-WEB5

Correlation of Myocardial Tissue Characteristic, Strain, and Mass in Anderson-Fabry Patients

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CA Community, Learning Center Station #5

Participants
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PURPOSE

To investigate the relationship among the mass, strain and native T1 in the left ventricle of Anderson-Fabry disease (AFD).

METHOD AND MATERIALS

Nineteen genetically confirmed AFDs (Age = 51.2±16.1 years; 8 men) and 18 age and sex matched healthy controls were prospectively enrolled. Cardiac MR (CMR) included cine function, native T1 mapping and late gadolinium enhancement (LGE). Myocardial strains in longitudinal (LS), circumferential (CS), and radial (RS) and time to peak (TTP) in global and AHA segment were derived using feature tracking method by CMR42 (Circle Cardiovascular Imaging, Calgary, Canada).

RESULTS

AFD group had higher LV mass index (LVMI) than the controls (p=0.03), while only 7 (36.8%) met the criteria of LV hypertrophy (LVH). AFD had impaired global LS (p=0.04) and global CS (p=0.048) than the control. The impairment of global LS (r=0.888, p<0.001), global CS (r=0.556, p=0.013) and global RS (r=-0.696, p=0.001) were proportionate to an increase in LVMI, respectively. AFD had augmented coefficient of variation (COV) of TTP in the segmental LS (p=0.026) and in RS (p=0.023). In addition, COV of TTP in the segmental LS (r=0.621, p=0.005), CS (r=0.552, p=0.014) and RS (r=0.713, p=0.001) were proportional to increase in LVMI, respectively. None of the above correlation of strain and LVMI was noted in the controls. AFD had decreased native T1 value (1060.95±106.14ms) than the control (1084±59.35ms) (p=0.008), while only 10 cases of AFD showed presence of LGE.

CONCLUSION

In CMR of AFD patients, global myocardial strain, COV of segmental TTP strain and native T1 mapping could detect early functional and tissue abnormality before the presence of LVH and LGE. Myocardial strain and native T1 mapping should be performed in patients with unexplained LVH or confirmed AFD to evaluate the nature and severity of LV myocardial pathophysiology, which may be important to determine the initiation of enzyme replacement therapy of AFD.

CLINICAL RELEVANCE/APPLICATION

The feature tracking and native T1 value show promise as a potential future biomarker to detect early cardiac involvement in AFD, and potentially to guide patient selection and timing of therapy.

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CA258-SD-WEB6

Simulated Enhancement Ratio of Myocardium to Aorta for the Identification of Obstructive Coronary Artery Disease Using Dynamic Myocardial Computed Tomography Perfusion

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CA Community, Learning Center Station #6

Participants
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PURPOSE

The purpose of this study was to evaluate the feasibility of simulated enhancement ratio of myocardium to aorta (SER) using stress dynamic computed tomography perfusion (CTP) for the detection of obstructive coronary artery disease (CAD) assessed by invasive coronary angiography (ICA) and fractional flow reserve (FFR).

METHOD AND MATERIALS

The study group consisted of 38 patients who underwent dynamic CTP and ICA for suspicion of CAD. CTP was performed using 256-slice CT (Brilliance iCT, Philips Healthcare) with prospective ECG gated mode. SER was calculated as the ratio of myocardial enhancement (ME) to the simulated peak enhancement in the ascending aorta (SPE). ME was obtained from one static image at sub-optimal phase for detecting myocardial ischemia. SPE was calculated from aortic peak enhancement at test bolus scan using the estimation equation which was obtained from the validation study in the other population. Severe stenosis (>=70%) or moderate stenosis (50-69%) with FFR<=0.8 were defined as obstructive CAD. myocardial CT attenuation (HU) and SER on a vessel basis were compared between normal and ischemic territory by student t-test. The diagnostic performance of myocardial CT attenuation and SER for detecting obstructive CAD was compared by receiver operating characteristic (ROC) analysis.

RESULTS

Of 114 vessels in 38 patients, 43 vessels (38%) were diagnosed with obstructive CAD. SER and myocardial CT attenuation in ischemic myocardium was significantly lower than that in normal myocardium (SER; 12.0±3.5% vs. 16.9±2.7%, CT attenuation; 100±21.1HU vs. 122±15.2HU, $p < 0.05$ in each). The area under the ROC curve of SER was significantly higher than that of myocardial CT attenuation in the detection of obstructive CAD (0.85 vs. 0.75, $p < 0.05$).

CONCLUSION

SER had higher diagnostic performance for detecting obstructive CAD compared with conventional myocardial CT attenuation.

CLINICAL RELEVANCE/APPLICATION

SER can be used as a semi-quantitative parameter assuming static CTP, which contributes to the reduction of radiation exposure dose.

CA259-SD-WEB7

Characterization of Coronary Arterial Plaque Composition with Dual Energy Computed Tomography: A Simulation Study

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CA Community, Learning Center Station #7

Participants
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PURPOSE

To investigate the feasibility of quantifying the chemical composition of coronary artery plaque in terms of water, lipid, protein, and calcium contents using dual-energy computed tomography (CT) in a simulation study.

METHOD AND MATERIALS

A CT simulation package was developed based on physical parameters of a clinical CT scanner. A digital thorax phantom was designed to simulate coronary arterial plaques in the range of 2-5 mm in diameter. Both non-calcified and calcified plaques were studied. The non-calcified plaques were simulated as a mixture of water, lipid, and protein, while the calcified plaques also contained calcium. The water, lipid, protein, and calcium compositions of the plaques were selected to be within the expected clinical range. A total of 95 plaques for each lesion size were simulated using the CT simulation package at 80 and 135 kVp. Half-value layer measurements were made to make sure the simulated dose was within the range of clinical dual energy scanning protocols. Dual-energy material decomposition using a previously developed technique was performed to determine the concentration of water, lipid, protein, and calcium contents in each plaque. For non-calcified plaque, the total volume conservation provides the third constrain for three-material decomposition with dual energy CT. For calcified plaque, a fourth criterion was introduced from a previous report suggesting a linear correlation between water and protein contents in soft tissue.

RESULTS

For non-calcified plaque, the root mean-square error (RMSE) of the image-based decomposition was estimated to be 0.7%, 1.5%, and 0.3% for water, lipid, and protein contents, respectively. As for the calcified plaques, the RMSE of the 5 mm plaques were estimated to be 5.6%, 5.7%, 0.2%, and 3.1%, for water, lipid, calcium, and protein contents, respectively. The RMSE increases as the plaque size reduces.

CONCLUSION

The simulation results indicate that chemical composition of coronary arterial plaques can be quantified using dual-energy CT.

CLINICAL RELEVANCE/APPLICATION

A reliable non-invasive assessment of the chemical composition of arterial plaque may provide valuable insight for the assessment and stratification of coronary artery disease.

CH233-ED-WEB7

Atypical Pneumonias: What is Atypical After All?

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CH Community, Learning Center Station #7

Awards
Identified for RadioGraphics

Participants
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TEACHING POINTS

The term atypical in the setting of pneumonia has become vague and nonspecific. There is currently a lack of consistency on how to use it and a poor definition of what it entails. Excellent reviews of specific entities within this group are available in multiple journals across specialties, although the topic has not been revisited in the radiologic literature in the past 20 years or more. With new diagnostic tests, increased knowledge of pathogens, and advances in the understanding of the imaging evolution of diseases, we are due to a review of a group of entities that is now more typical than atypical. After reviewing this exhibit, the learner will be able to: • Recognize the modern definition of atypical pneumonia • Identify an appropriate imaging approach for atypical pneumonias by adjusting the ACR Appropriateness Criteria® • Recognize the main clinical syndromes and imaging findings associated with atypical pneumonias

TABLE OF CONTENTS/OUTLINE

• Revised definition of atypical pneumonias • Proposed diagnostic algorithm of atypical pneumonia in immunocompetent patients based on ACR Appropriateness Criteria® • Pictorial review of main atypical pneumonias, namely: non-zoonotic pneumonias (Chlamydia pna, Mycoplasma pna, Legionella pna), zoonotic pneumonias (Q fever, Tularemia and brucellosis), and viral pneumonias (Influenza, Rhinovirus, others)

CH234-ED-WEB8

Evaluation of Lung Transplant Complications on a Timeline: What the Radiologist Should Know

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CH Community, Learning Center Station #8

Participants
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TEACHING POINTS

1.Review history, epidemiology, and surgical techniques of lung transplantation. 2.Highlight expected and unexpected imaging findings after lung transplantation. 3.Present a concise imaging approach to evaluation of transplant- & treatment-related complications

TABLE OF CONTENTS/OUTLINE

1.History, epidemiology, and surgical techniques of lung transplantation. 2.Immediate Complications (<24 Hours). -Donor-Recipient Size Mismatch -Hyperacute Rejection 3.Early Complications (24 Hours to 1 Week). -Ischemia-Reperfusion Injury -Acute Pleural Complications 4.Intermediate Complications (8 Days to 2 Months). -Acute Rejection -Bronchial Anastomotic Complications -Infections 5.Primary Late Complications (2-4 Months). -Bronchial Stenosis and Bronchomalacia -Vascular anastomotic complications -Viral Infection -Aspergillus Infection -Pulmonary Embolism and Infarction 6.Secondary Late Complications (>=4 Months). -Mycobacterial Infection -Chronic Rejection -Cryptogenic Organizing Pneumonia -Posttransplantation Lymphoproliferative Disorder -Upper-Lobe Fibrosis -Recurrence of Primary Disease

Printed on: 10/29/20

CH264-SD-WEB2

Pilot Study: Dual Energy CT (DECT) for Evaluation of Tumor Response to Immune Checkpoint Inhibitor Immunotherapy for Stage 4 Non-Small Cell Lung Cancer (NSCLC) Patients

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CH Community, Learning Center Station #2

Participants
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PURPOSE

Compare the effectiveness of Dual Energy CT (DECT) parameters to conventional RECIST criteria, to assess response to an immune checkpoint inhibitor immunotherapy clinical trial in Stage 4 Non- Small Cell Lung Cancer (NSCLC) patients.

METHOD AND MATERIALS

: IRB-approved prospective pilot study included 13 eligible patients who were Stage IV NSCLC enrolled in a dose-escalation, immune checkpoint inhibitor trial between Dec 2016 and June 2018. Baseline DECT scan was obtained prior to therapy, followed by the first post-therapy scan 6-8 weeks after the first treatment dose. The images were transferred to a Gemstone Spectral Imaging (GSI) GE workstation for post-processing and further analysis. According to RECIST criteria, a target lesion was chosen and longest diameter (LD) was measured. DECT parameters that is Net value (High Kv minus Low Kv) and Relative iodine (Aorta minus Lesion iodine) were analyzed for the same target lesion, by drawing regions of interest (ROI) and obtaining Hounsfield Units on target lesions and adjacent aorta.

RESULTS

Of the 13 patients enrolled in the initial phase of the clinical trial, 7 had both pre- and post-treatment scans within the timeframe stated of whom there were 2 RECIST-defined partial responders. Among the partial responders, both the change in Size and Net Value consistently decreased (10-36% and 3-46% respectively) and the remaining 5 non-responders demonstrated consistent increase in Size and Net Value (12-32% and 8-45% respectively) in the first post-treatment scan. The Spearman correlation between size and the DECT parameters was analyzed. Size and Net value correlation is 0.85 indicating high positive correlation, however the Size and Relative iodine correlation was 0.32 indicating low positive correlation.

CONCLUSION

Dual energy CT with tumor iodine density parameter (Net value) is a feasible method to determine response to immunotherapy. Further study is ongoing.

CLINICAL RELEVANCE/APPLICATION

Although not conclusive in this PILOT study, the DECT Net Value of tumor iodine density parameter may be a potential early surrogate biomarker to identify responders and non-responders in patients undergoing immunotherapy for Stage 4 NSCLC.

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CH265-SD-WEB3

Evaluating Real-World Performance of a Chest X-Ray TB Screening AI Tool versus Radiologists and Bacteriological Confirmatory Tests

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CH Community, Learning Center Station #3

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PURPOSE

Chest X-rays are a sensitive Tuberculosis screening tool but regions with high TB prevalence often lack radiology expertise. In this study, we prospectively evaluate the performance of an AI algorithm deployed through mobile vans for TB screening in a high prevalence country. We also evaluate the possibility that AI can be trained to identify signs of microbiological positivity from chest X-rays.

METHOD AND MATERIALS

A deep learning algorithm was trained to detect signs of tuberculosis on chest X-rays, using radiologist opinions and the WHO-recommended DNA-based confirmatory sputum test (GeneXpert). The algorithm was deployed for 90 days in 2 mobile vans as part of a TB screening program conducted by a program in Philippines. As part of this program, all X-rays were reviewed by the algorithm and by radiologists. Subjects who screened positive on the X-ray, either by AI or through the radiologists' read were recommended a confirmatory GeneXpert test. We compare the performance of our algorithm and reporting radiologists on 426 cases for which GeneXpert results are available. 286 patients are registered as Female, 128 as Male, 7 as other and 5 are unregistered. Mean age of patients was 56.9 years and standard deviation was 18.2 years. 404 of these cases were reported as GeneXpert negative and 22 cases are GeneXpert positive.

RESULTS

The algorithm showed higher sensitivity 0.91(0.71-0.99) and specificity 0.69(0.64-0.74) than radiologists 0.86(0.65-0.97) and 0.65(0.60-0.70) when detecting microbiologically confirmed TB. Algorithm AUC was 0.87 versus the GeneXpert ground truth. The algorithm identified 15 fewer false positives, 1 less false negative, 1 more true positive and 15 more true negatives compared to the radiologists. Agreement % and cohen's kappa between the radiologists and algorithm is 78.3% and 0.421 respectively.

CONCLUSION

AI algorithms can accurately screen chest X-rays for tuberculosis in a high prevalence population. Real-world evidence paves the way for the use of AI for cost-effective TB screening with quicker turnaround times.

CLINICAL RELEVANCE/APPLICATION

In TB, Large turnaround times due to overburdened radiologists can lead to increased reporting time and thus delaying start of treatment. AI can significantly introduce productivity gains by reducing the turn around time to minutes and facilitating start of TB treatment on the same day.

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CH291-SD-WEB4

Comparison in Pulmonary Small Vessel Area and Association with Pulmonary Emphysema between Lower and Standard Energy Data Acquisition: Quantitative Assessment with Dual-Energy Computed Tomography

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CH Community, Learning Center Station #4

Participants
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PURPOSE

To investigate the merit of lower energy data acquisition on computed tomography(CT) for the quantification of pulmonary smaller vessels and emphysema

METHOD AND MATERIALS

The institutional review board approved this study and consents from patients were waived because of retrospective study design. A hundred and fifty patients underwent chest CT by using fast kVp switching dual-energy scanner (80/140 kVp) with scan parameters to secure target standard deviation(SD) 11 (Revolution GSI, General Electric Medical Systems, Milwaukee, WI, USA). Scan data were converted to virtual monochromatic images (VMI) at 3 tube voltages; 40, 55 and 70 KeV. Low attenuation area < -950 HU (% LAA-950) was quantified with dedicated software as emphysema extent. By using a free software Image J, percentage of cross-sectional area of pulmonary vessels < 5 mm2 to total lung field (%CSA<5) was calculated as pulmonary small vessel area at predefined 3 trans-axial levels; aortic arch, bronchial bifurcation and right pulmonary veins orifice, and SD in CT density in 10 mm-quadrangular region of interest inside descending aorta was measured as objective image noise (OIN) at the bronchial bifurcation level. %LAA-950 and %CSA<5 in total and each of the 3 levels were compared among the 3 tube voltages by using Friedman and Wilcoxon signed rank test. Spearman's rank correlation analyses were performed to assess the associations of the %LAA-950 and %CSA< 5, and analyses of covariance were performed to assess the similarity of slope of regression lines among the 3 tube voltages.

RESULTS

%CSA<5 on VMI at 40 KeV in total as well as the 3 levels was the largest (1.96±0.32), followed by that at 55 (1.34±0.30) and 70 KeV (0.85±0.27). %LAA-950 on VMI at 40 KeV was also the largest (14.6±8.9 %), followed by that at 55 (5.9±7.6 %) and 70 KeV (2.8±6.6 %). Negative correlation was found between %CSA<5 and %LAA-950 all in the 3 tube voltages ($r = -0.529$, $p < 0.001$ at 40 KeV). Slope of regression line at 40 KeV was similar to that at 55 KeV irrespective of OIN increase.

CONCLUSION

Data acquisition at 40 KeV can be useful for quantification of pulmonary smaller vessels closely-associated with emphysema on CT.

CLINICAL RELEVANCE/APPLICATION

Data acquisition at 40KeV may be potential to play an important role for early detection of peripheral vessel impairment leading to pulmonary hypertension in combination with iterative reconstruction.

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CH293-SD-WEB6

Implication of Tuberculosis Sequelae on Lung-RADS Categorization and Lung Cancer Risk in a Tuberculosis-Endemic Country: Results of a Nationwide Lung Cancer Screening Project (K-LUCAS)

Wednesday, Dec. 4 12:45PM - 1:15PM Room: CH Community, Learning Center Station #6

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PURPOSE

To investigate the implication of tuberculosis (TB) sequelae on Lung CT Screening Reporting and Data System (Lung-RADS) categorization and diagnosis of lung cancer in a -nationwide lung cancer screening project (K-LUCAS).

METHOD AND MATERIALS

This study analyzed 10,045 participants (M:F=9,772:273; median age, 63 years) enrolled in the K-LUCAS, which is a population-based single arm trial. All participants underwent baseline low-dose CT screening. Multivariable logistic regression analyses using maximum penalized likelihood were performed to reveal the effect of TB sequelae on the positive rate of Lung-RADS and the diagnosis of lung cancer. Inclusion of the variables, which were age, sex, smoking intensity (pack-years), body mass index, family history of lung cancer, nodule count, presence of emphysema, and TB sequelae, was based on a priori knowledge for the risk factors of lung cancer.

RESULTS

Positive screen (category 3 and 4) was found in 16.2% (1,629/10,045). In detail, positive result was observed in 20.6% (282/1,372) of the participants with TB sequelae and 15.5% (1,347/8,673) of those without. Among the positive-screenees, lung cancer was found in 3.2% (9/282) of the participants with TB sequelae and 3.6% (48/1347) of those without. Multivariable-adjusted logistic regression revealed that the positive screen was not associated with TB sequelae (adjusted odds ratio [OR], 1.13; 95% confidence interval [CI]: 0.96, 1.33). However, adjusted odds of being classified as category 4 was 1.34 (95% CI: 1.12, 1.73; P=0.003) times higher for the participants with TB sequelae compared to those without. TB sequelae was not an affecting factor for the diagnosis of lung cancer among the positive-screenees (adjusted OR, 0.74; 95% CI: 0.31, 1.50; P=0.427) and among the participants with category 4 (adjusted OR, 0.77; 95% CI: 0.32, 1.55; P=0.479).

CONCLUSION

TB sequelae had a significant, positive association with Lung-RADS category 4, with no influence on the lung cancer risk, among the screening participants, which may lead to unnecessary further diagnostic work-ups.

CLINICAL RELEVANCE/APPLICATION

In a TB-endemic country, adaptation of Lung-RADS is required to reduce false-positive category 4. A new category indicating putative benign nodules may help enhance the efficacy of the CT screening.

ER171-ED-WEB6

Imaging Findings in Intimate Partner Violence

Wednesday, Dec. 4 12:45PM - 1:15PM Room: ER Community, Learning Center Station #6

Awards
Identified for RadioGraphics

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TEACHING POINTS

To provide an overview of the public health problem of intimate partner violence (IPV) and of the human and social challenges associated To define the role of radiologist in diagnosis of IPV To illustrate imaging findings associated with IPV

TABLE OF CONTENTS/OUTLINE

Overview of IPV Epidemiology according to US data Description of human and healthcare costs of IPV Limitations of current identification methods Health consequences Demographic and clinical factors associated with IPV Role of radiologists in diagnosis Radiologists often first providers who can identify IPV victims Value of serial imaging evaluation System-based description of imaging findings associated with IPV Craniofacial injuries Brain injuries Thoracic injuries Abdomen and obstetric-gynecologic injuries Musculoskeletal injuries For each system Reported prevalence and clinical correlation Mechanism of injuries Description of imaging findings with representative examples Differential diagnosis with other non-IPV injuries Current needs and future perspective Raise awareness of radiologists for IPV diagnosis Value of imaging findings in conjunction with clinical evaluation to improve IPV diagnosis Inclusion of radiologists in multidisciplinary teams for IPV diagnosis

ER172-ED-WEB7

The Dark Side of Postpartum: A Pictorial Review of Puerperal Complications

Wednesday, Dec. 4 12:45PM - 1:15PM Room: ER Community, Learning Center Station #7

Awards
Identified for RadioGraphics

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TEACHING POINTS

To know the spectrum of normal imaging findings during the postpartum To make a list with the most uncommon as well as the most common complications of the postpartum and posttermination patients. To provide a plain list of imaging key findings to face these challenging conditions

TABLE OF CONTENTS/OUTLINE

Background B asic anatomy Imaging techniques Normal imaging findings Postpartum complications Infectious: endometritis, parametritis, pyometra, septic pelvic thrombophlebitis, perineal/episiotomy infections Vascular:Thrombotic: Ovarian vein thrombophlebitis, aortic thrombosis, acute pulmonary embolism, Amniotic fluid embolism, Uterine arterio-venous malformations, HELLP syndrome Postpartum Hemorrhage: Retainded products of conception, Atonic uterus--> Hematoma: pelvic, rectus sheath hematoma, periuterine , abdominal wall, Active bleeding, Pseudoaneurysms Uterine rupture-dehisence, vaginal rupture Cesarean delivery and Iatrogenic complications: abdominal wall hematoma-abscess, uterine rupture-perforation, urinary complications (vesico-vaginal fisutla, ureteral section). Neurological complications: vascular complications, PRES, hypofisary complications Other complications: pyelonephritis, appendicitis, cholecystitis gastric ulcer, necrotic uterine myomatosis Conclusion

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ER218-SD-WEB1

MAPAC Imaging Project: Value of a Clinical Decision Support System (CDSS) for the Worthiness of Carrying Out an Abdominal Angio-CT for the Diagnosis of Acute Mesenteric Ischemia (AMI)

Wednesday, Dec. 4 12:45PM - 1:15PM Room: ER Community, Learning Center Station #1

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PURPOSE

To evaluate the utility of the algorithm used in our emergency department for the suitability of performance of an abdominal angio-CT on patients with suspicion of AMI, and the association of the variables included in this algorithm with the radiological findings.

METHOD AND MATERIALS

An algorithm-based radiological approach was developed for clinical use of the CDSS. The algorithm considers two main groups of variables: data from the medical history and clinical presentation. The presence of at least one variable from each group recommends performing CT directly. We reviewed medical records of patients with abdominal angio-CT performed at our emergency department between April 2016 and July 2018 requested under suspected AMI. Scan reports were classified as normal, non-acute or relevant findings, according to clinical suspicion or with other acute diseases. To evaluate the association among the variables included in the decision algorithm and the findings in the CT, Chi-2 test and multinomial logistic regression were performed.

RESULTS

We found 213 patients meeting the established criteria. 14 patients (6.6%) had acute mesenteric ischemia, 131 patients (61.5%) had another acute disease and the rest were normal or had non-related/acute pathology (31.9%). We obtained statistically relevant results for the variable clinical presentation of occlusive AMI (sudden and severe abdominal pain, chills lasting 3 to 6 hours, with pain-free interval, followed by peritonitis). In patients with OAMI clinical presentation, the probability of getting an appropiate finding according to the suspicion was 7 times higher [RRR = 6.9 CI.95% (2; 24)]. Secondly, patients under vasoactive medication had a probability 5 times higher [RRR = 5.5 CI.95% (0.7; 42)] of obtaining AMI findings on CT, but this computation was not so statistically important.

CONCLUSION

In the emergency department, the use of an algorithm that includes clinical presentation and risk factors is not a clearly useful tool to optimize the diagnosis of AMI, despite the fact that the clinical presentation may have some value. Further investigations and more extensive sample of patients are needed to establish a truly beneficial algorithm.

CLINICAL RELEVANCE/APPLICATION

A clinical decision support system can be useful for determining the suitability of carrying out an abdominal angio-CT on patients with suspicion of acute mesenteric ischemia.

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ER219-SD-WEB2

Performance Evaluation of Deep Learning Algorithm in Measuring the Volume of Cerebral Hematoma

Wednesday, Dec. 4 12:45PM - 1:15PM Room: ER Community, Learning Center Station #2

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PURPOSE

Hematoma volume is a powerful predictor of 30-day mortality after spontaneous intracerebral hemorrhage (ICH). Timely and accurate measurement of intracranial hematoma is critical to provide reference for clinical treatment option selection.To evaluate the performance of deep learning algorithm in measurement of hematoma volume for patients with spontaneous cerebral hemorrhage using head CT images.

METHOD AND MATERIALS

200 patients with cerebral hemorrhage from July 2017 to December 2018 were retrospectively collected in our hospital and 60 patients with acute sICH were finally included in this study. According to whether intracranial hemorrhage broke into the ventricle, 60 patients were divided into two groups: 28 cases of hemorrhage broke into the ventricle (group A) and 32 cases of hemorrhage did not break into the ventricle (group B). Two radiologists with more than 10 years' working experience used the Philips post-processing workstation software (Extended Brilliance Workstation) to delineate the intraparenchymal hematoma region (excluding the region of intraventricular and subarachnoid hemorrhage) for area calculation. Delineation time was also recorded. The volume of hematoma was calculated according to V=Σ hematoma area × layer thickness. The average of hematoma volume measured by two radiologists was used as gold standard volume. A deep learning-based artificial intelligence (AI) diagnostic system (InferRead CT Stroke Research, Infervision, Beijing) was used to measure the hematoma volume. The matched t-test was used to analyze the volume and delineation time between gold standard and deep learning algorithm.

RESULTS

In group A, the hematoma volume was (46.44±8.27) ml for gold standard and (55.78±9.02) ml for deep learning algorithm with statistically significant difference ($p<0.05$). In the group B, the hematoma volume was (22.80±3.99) ml for gold standard and (22.42±4.05) ml for deep learning algorithm without statistically significant difference ($P>0.05$). Delineation time was (11.63±7.62) min for gold standard and (1.06±0.11) min for deep learning algorithm with statistically significant difference ($p<0.05$).

CONCLUSION

AI can accurately and quickly measure the volume of hematoma that does not break into the intraventricular in head CT images. AI is also powerful in timely recognition of intraparenchymal hematoma although volume measurement compromised.

CLINICAL RELEVANCE/APPLICATION

It is recommended to use AI in clinical work to quickly and accurately measure the volume of intraparenchymal hematoma of patients with acute spontaneous cerebral hemorrhage for better treatment option selection.

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ER220-SD-WEB3

Can Obstructive Urolithiasis Be Safely Excluded on Contrast-Enhanced CT?: A Retrospective Noninferiority Analysis Between Contrast-Enhanced and Non-Contrast CT

Wednesday, Dec. 4 12:45PM - 1:15PM Room: ER Community, Learning Center Station #3

Participants
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PURPOSE

The purpose of this study is to determine if contrast-enhanced CT is noninferior to noncontrast CT (the current reference standard) in ruling out obstructive urolithiasis.

METHOD AND MATERIALS

We performed a retrospective noninferiority cohort analysis to determine the negative predictive value (NPV) of contrast-enhanced CT vs noncontrast CT for the detection of obstructing urolithiasis. We defined obstructing urolithiasis as one or more calculi within the ureters. We hypothesized that the NPV of contrast-enhanced CT for obstructive urolithiasis would be noninferior to the NPV of noncontrast CT. We identified all noncontrast and contrast-enhanced CT studies of the abdomen and pelvis ordered by the ED at a single academic medical institution with an indication of flank pain from 2017. The prevalence of obstructive urolithiasis in each group was calculated. We then identified 200 consecutive studies from each of these groups that were reported negative for obstructive urolithiasis by the original interpreting radiologist. We used PACS follow up at 7 days as a reference standard for analysis. Cases in which patients were discharged from the ED and did not re-present with flank pain within 7 days were designated as true negative. Conversely, for patients that returned with flank pain within 7 days and were found to have an obstructing stone on follow up CT, the original CT study was designated false negative.

RESULTS

Among the 200 consecutive noncontrast CT studies that were initially read as negative for obstructive urolithiasis, 1 study was a false negative (NPV = 99.5%). Among the 200 consecutive contrast-enhanced CT studies that were initially read as negative for obstructive urolithiasis, there were no false negatives (NPV = 100%). The prevalence of obstructive urolithiasis was 351/797 (44.0%) across all noncontrast CTs for flank pain in 2017 and 86/459 (18.7%) across all contrast-enhanced CTs for flank pain in 2017. The purpose of calculating prevalence in both groups was to demonstrate that neither prevalence was close to 0%. Thus, the difference in prevalences would not affect the inherent ability of a CT study to rule out obstructive urolithiasis.

CONCLUSION

Contrast-enhanced CT is noninferior to noncontrast CT in excluding obstructive urolithiasis.

CLINICAL RELEVANCE/APPLICATION

Our study suggests contrast-enhanced CT may be able to supplant noncontrast CT as the standard imaging study for evaluating patients with flank pain.

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ER239-SD-WEB4

Assessment of CT Scan Need for Patients with Delayed Presentation of Head Trauma

Wednesday, Dec. 4 12:45PM - 1:15PM Room: ER Community, Learning Center Station #4

Participants
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PURPOSE

The National Institute for Health and Care Excellence (NICE) guidelines are commonly used to triage patients presenting with head trauma for need of CT scan. This tool was validated and developed with data for patients presenting within 24 hours of trauma. Thus it is not clear whether these guidelines hold true for patients with head trauma presenting after 24 hours of injury. The purpose was to estimate the proportion of CT scans done for late presenters, compare their rate of abnormalities on CT with early presenters, and compare the sensitivity of NICE guidelines in both groups. The objective of the study was to determine incidence of significant injury in patients with delayed presentation (> 24 hrs)) despite survival beyond 24 hours and compare the rate of intracranial abnormalities with patients who present earlier (<24 hrs).

METHOD AND MATERIALS

This was a retrospective cohort study, conducted at Aga Khan University Hospital. All adult patients referred to for CT scan from ER for evaluation of head injury in the period July 2014-July 2016 were included. Of the 2009 eligible patients, 7 were excluded due to lack of medical records. The final study population consisted of 2002 patients. The medical records were searched to establish time of injury for all patients. Patients were then grouped into two. Patients who underwent CT within <24 hrs were grouped as early presenters. Patients who underwent CT > 24 hrs after innjury grouped as late presneters.

RESULTS

Overall, 52% there was evidence of traumatic injury in 52 % of cases. The overall mortality rate was 2.3%. 32.2% of study population underwent CT after > 24 hours of trauma. Tramatic injury was seen in 46.7% of early presenters and 63% of late presenters. The sensitivity of NICE guidelines for intracranial injury was 93% for early and 83% for late presenters

CONCLUSION

Patients presenting after 24 hours of head injury form a significant proportion. NICE guidelines have low sensitivity in patients who present after 24 hours of head injury. As these patients constitute a significant proportion of trauma patients, injuries may be missed if CT is not obtained.

CLINICAL RELEVANCE/APPLICATION

CT head may reveal significant abnormalities in patients who present after later than 24 hours onset of head injury.

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ER240-SD-WEB5

Impact of Added CT Venography Performed in Combination with CT Pulmonary Angiography on the Detection of Deep Venous Thrombosis and Relevant Occult CT-Findings

Wednesday, Dec. 4 12:45PM - 1:15PM Room: ER Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To assess the additional diagnostic value of CT venography (CTV) simultaneously performed with CT pulmonary angiography (CTPA) in thromboembolic disease for the detection of deep venous thrombosis (DVT) and other relevant occult CT findings.

METHOD AND MATERIALS

We retrospectively and consecutively included all patients admitted to the emergency room for suspected pulmonary embolism (PE) who underwent CTPA combined with CTV over 2 years. Two blinded radiologists independently analyzed CTV images in view of DVT of the lower extremities and other, yet unknown, pelvic findings, which were classified into non-relevant or major. The latter were further divided according to therapeutic consequences. One radiologist reviewed patients' clinical records. Inter-observer agreement for the detection of DVT was calculated using the Cohen's kappa coefficient.

RESULTS

The final cohort consisted of 696 patients. PE was present in 119 (17.1%) patients and DVT in 54 (7.8%) patients: 38 (5.5%) had both PE and DVT, 81 (11.6%) had only PE and 16 (2.3%) had only DVT, of which 0.1% (n=1) had thrombi in the inferior vena cava or pelvic veins alone without distal involvement. CTV led to the diagnosis of major incidental findings in 40 (5.7%) patients. No therapeutic consequences were observed in 26 (1.4%) of them, but in 8 (1%) patients the incidental finding triggered further diagnostic imaging. In 14 (1.9%) patients, incidental findings had therapeutic consequences: such findings included tumors (n=4), infections (n=4), vascular diseases (n=2) or progression of already known tumors (n=4). Patients with DVT had a 1.4-fold higher risk for incidental findings than patients without DVT, irrespective of PE.Overall, additional CTV to CTPA lead to a change of therapeutic management in 30 (4.3%) patients, consisting in anticoagulation therapy (n=16, 2.3%) because of DVT without PE, and change of treatment (n=14, 2.0%) due to the incidental detection of relevant pelvic findings.

CONCLUSION

CTV in patients with suspected PE rarely leads to the detection of isolated DVT. However, incidental pelvic findings may be seen, especially in patients with DVT, being at higher risk for incidental findings than other patients.

CLINICAL RELEVANCE/APPLICATION

CTV simultaneously performed with CTPA provides limited incremental value regarding the detection of DVT but can reveal other relevant CT-findings, which may change the therapeutic management.

GI313-ED-WEB15

How to Navigate Out of Complex Fistulas on Pelvic MRI

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #15

Participants
Manohar Roda, MD, Jackson, MS (*Presenter*) Nothing to Disclose
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Marvell Saint-Victor, MD, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1) How to delineate anatomical course of complex fistulas on pelvic MRI. 2) How to classify fistulas on the basis of etiology, location and grading to facilitate clinical management. 3) High resolution MRI technique with emphasis on 3D T2 Space, post contrrast T1 FS and DIffusion imaging

TABLE OF CONTENTS/OUTLINE

MRI Technique: We will discuss the importance of mulitplanar high resolution 3D-T2, T2 fat sat, post contrast T1 VIBE and diffusion imaging. Pelvic Anatomy: We will dicuss key anatomical landmarks to classify and grade pelvic fistulas . Delineating primary /secondary tracts of fistulas with empahsis on relationship to internal-external sphincters, puborectlais sling, levator ani muscle, connections with pelvic organs like anus, bowel, bladder, vagina, bladder, prostate, ovaries, scrotum, penis and exclusion of abscesses is very helpful. Sample cases: We will review fistulas related to perianal abscesses, pilonidal sinus, inflammatoty bowel disease (Crohn's/Ulcerative colitis), diverticulitis, pelvic cancers, post radiation/post surgical, post TRUS biopsy complications, sex change, ileal-anal pouch surgery and fistulas post seton placement/drainage. Summary:Dedicated MRI evaluation helps in anatomical localization, grading and treatment of fistulas to guide the sphincter/muscle sparing procedures, preserve continence and prevent recurrence.

GI314-ED-WEB13

Retroperitoneal Masses: A Pattern-Based Approach

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #13

Participants
Bhavana Budigi, MBBS, MD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
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Orpheus Kolokythas, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Cross sectional imaging serves as a roadmap for characterization of the broad spectrum of retroperitoneal masses which can aid a clinician in the variable management of these masses. Several overlapping features of these masses tend to confuse the interpreter which results in a tendency to provide a broad differential diagnosis. We discuss a simplified classification of these masses into multiple categories that will allow a radiologist to accurately narrow the differential diagnosis based on anatomical location, imaging characteristics and spread patterns.

TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Diagnostic clues of retroperitoneal origin: beak sign, invisible organ sign, embedded organ sign, prominent feeding artery sign. 3. Pattern of spread. 4. Primary and secondary retroperitoneal masses: classification based on location, tissue characteristics; neoplastic/non-neoplastic. 5. Role of CT, MRI and nuclear medicine. 6. Characterization of different retroperitoneal masse: a) Cystic lesions b) Solid lesions: Fat containing and non fat containing lesions. 7. Descriptors: Location, origin, consistency, age/gender, tissue characteristics, clinical history, clinical laboratory clues, neoplastic/non neoplastic, vascularity, and imaging characteristics. 8. Conclusion.

GI316-ED-WEB11

Spectral Detector CT Applications in Advanced Liver Imaging

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #11

Participants
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Manish Dhyani, MBBS, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
Diana Murcia, MD, Burlington, MA (*Abstract Co-Author*) Nothing to Disclose
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Christoph Wald, MD,PhD, Nahant, MA (*Abstract Co-Author*) Advisor, Koninklijke Philips NV
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TEACHING POINTS

1. Spectral detector CT (SDCT) is a technology with a number of applications in advanced liver imaging. If appropriately utilized, this technology has the potential to improve image quality, provide new diagnostic information, and allow for decreases in radiation dose. 2. Low keV virtual monoenergetic imaging can significantly improve iodine contrast to noise ratio. This has the potential to improve detection of liver lesions, and to allow for better delineation of vascular anatomy prior to liver donation. This can also be used to decrease contrast dose. 3. Iodine selective imaging allows for direct quantification of iodine content within lesions, which can distinguish enhancement from other dense material (bone, hematoma) on post contrast acquisitions, and assess iodine content within liver tumors pre and post-treatment. 4. The use of virtual non-contrast imaging allows for potential dose reduction by eliminating the non-contrast phase in multi-phase studies.

TABLE OF CONTENTS/OUTLINE

- Overview of spectral detector CT technique and physics, and common post-processing techniques. - Case based review of applications of SDCT in advanced liver imaging. - Review of integration of SDCT into routine clinical workflow in liver imaging. - Challenges, pitfalls, and future applications.

GI317-ED-WEB12

Pancreatic Injury: Multimodality Imaging and Updated Review of Management

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #12

Awards
Certificate of Merit

Participants
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TEACHING POINTS

1. Pancreatic injuries comprise less than 2% of blunt trauma cases. Early diagnosis is difficult, overlooked or not readily appreciated on initial clinical examination, and missed on initial imaging studies. This results in delayed treatment associated with high morbidity and mortality. Delayed presentation or clinical deterioration may be the first clue of an underlying occult or undetected pancreatic injury. 2. Common mechanism of pancreatic injury are motor vehicle accidents, fall from height or fall of heavy objects over the abdomen, and direct assault in adults. 3. The most common site of pancreatic trauma is at the junction of the body and tail. Main pancreatic ductal injury should be carefully assessed as these are associated with delayed complications like pancreatic fistula, traumatic pancreatitis, pseudocyst formation, abscesses, and duct stricture. 4. Multiphasic CT is the modality of choice to evaluate pancreatic injuries. Portal venous phase CT is more sensitive for pancreatic ductal injuries. MRI with MRCP can be a problem solving tool in pancreatic trauma, particularly to evaluate pancreatic duct.

TABLE OF CONTENTS/OUTLINE

1. Brief anatomy of pancreas 2. Mechanism of pancreatic injury 3. Review of imaging modalities to evaluate pancreatic trauma with emphasis on CT, staging of pancreatic injury, and updated review of management.

GI318-ED-WEB14

Oncological Applications of Diffusion Kurtosis in the Gastrointestinal System: How, When and Why

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #14

Participants
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Teodoro M. Noguerol, MD, Jaen, Spain (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD, Santiago De Compostela, Spain (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Describe the physical basis and technical adjustments of diffusion Kurtosis Review the clinical applications of Diffusion Kurtosis in the assessment of focal lesions of the gastrointestinal system Highlight the added value of diffusion kurtosis to clinical MRI protocol in gastrointestinal imaging

TABLE OF CONTENTS/OUTLINE

1. Introduction 2.Definition of Diffusion Kurtosis 3. Technical adjustments 3. Advanced modeling of diffusion signal decay 4. Clinical applications of Kurtosis in the gastrointestinal system - Hepatocellular carcinoma and other liver masses - Pancreatic neoplasms - Rectal carcinoma pre- and post-treatment and and detection of lymph nodes 5. Conclusions

GI355-SD-WEB1

Clinical Benefit of Portography on the Spectral CT with Fast kVp-Switching Single-Source Dual-Energy CT Scanning: Comparison with Conventional Helical Scan on the Different Volume of Contrast Medium Injection Protocol

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #1

Participants
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PURPOSE

In conventional 120 kVp helical scan, maintaining image quality of CT Portography is more difficult than arterial CT angiography (CTA). However, with the use of fast kVpswitching single-source dual-energy (ssDE) CT spectral mode the monochromatic (MONO) images can provide suitable keV imags while maintaining image quality of portography. The purpose of this study is to assess clinical benefit of portography on the spectral ssDECT.

METHOD AND MATERIALS

In this study, 5 groups (total 161 patients) were designed with different scan modes and volume of contrast medium injection protocols: A(650mgI/kg, 31 patients), B(600 mgI/kg, 30 patients) and C(520 mgI/kg, 30 patients) for POLY scan mode (0.984pitch ; 120kVp, 0.5 sec; Noise Index(5mm):10, 30% ASiR); D(600 mgI/kg, 35 patients) and E(520 mgI/kg, 35 patients) for MONO (66keV, optimal. keV) scan mode (ssDECT scanner, Discovery CT750 HD, GE Healthcare, USA). CT attenuation value(HU) of portal vein and the standard deviation (SD) were measured to calculate contrast-to-noise ratio (CNR). Image quality of the three-dimensional portography was assessed by 3 radiologists independently). Using a 5-point score (1: poor; 3: diagnosable, 5 excellent).

RESULTS

The CT attenuation value (HU) of different modes (A, B, C, D(66keV, Opt.keV), E(66, Opt.keV.)) for the portal vein (PV), average CNRs and scoring results were reported as follows: (223.0± 25.0 HU, 203.4 ± 23.6, 187.1 ± 14.1, 246.4 ± 27.4, 449.6 ± 61.4, 231.8 ± 26.8 and 401.2 ± 51.4), (4.4± 1.3, 4.1 ± 1.4, 3.6 ± 1.0, 6.1 ± 1.7, 6.6 ± 1.8, 5.8 ± 1.3 and 6.1 ± 1.5), and (3.4± 1.0, 3.1 ± 1.1, 2.3 ± 0.7, 4.2 ± 0.8, 4.3 ± 0.8, 4.0 ± 0.7 and 4.1 ± 0.8), respectively.The low contrast injection protocol with MONO image (E-520mgI/kg) had image quality than high contrast injection protocol (A-650mgI/kg) with conventional 120 kVp helical scan.

CONCLUSION

From this study, ssDE GSI scan mode can essentially reduce injection volume of contrast material with same or higher image quality comparing to conventional 120kVp helical scan mode.

CLINICAL RELEVANCE/APPLICATION

This study is useful for reducing volume of contrast material by using GSI (gemstone spectral imaging) scan mode.

GI357-SD-WEB3

Liver Imaging Reporting and Data System: Comparison in Diagnostic Performance between Computed Tomography and Gadoxetic Acid-Enhanced Magnetic Resonance Imaging

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #3

Participants
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PURPOSE

To determine the consistency of major features of hepatocellular carcinoma (HCC) in Liver Imaging Reporting and Data System (LI-RADS) v2018 between CT and gadoxetic acid-enhanced MRI and to investigate the additional value of hepatobiliary phase (HBP) MR images.

METHOD AND MATERIALS

Patients who underwent dynamic CT and gadoxetic acid-enhanced MRI within one month were included. Two radiologists respectively evaluated the presence or absence of major HCC features (arterial phase hyper-enhancement, washout appearance and capsule appearance) and categorized observations using the LI-RADS v2018 algorithm. Additionally, each observation was recorded as hyper-, iso- or hypo-intensity on the HBP image.

RESULTS

Sixty-one patients with 110 observations were included. Among the 88 observations classified as LR-3, 4 or 5, arterial phase hyper-enhancement and a washout appearance showed higher frequencies on CT than on MRI (75.0% [66/88] vs. 58.0% [51/88], P<0.001; 60.2% [53/88] vs. 44.3% [39/88], P=0.014), whereas the frequency of capsule appearance was not significantly different between CT and MRI (14.8% [13/88] vs. 10.2% [9/88], P=0.343). Of the 47 LR-3 observations categorized on CT (HCC=22, non-HCC=25), 71.4% (20/28) of observations with hypo-intensity on HBP images were HCCs, whereas 89.5% (17/19) of observations with iso- or hyper-intensity on HBP images were non-HCCs (P<0.001). Similarly, of the 59 LR-3 observations categorized on MRI (HCC=30, non-HCC=29), 70.0% (28/40) of observations with hypo-intensity on HBP images were HCCs, whereas 89.5% (17/19) of observations with iso- or hyper-intensity on HBP images were non-HCCs (P<0.001).

CONCLUSION

The frequencies of arterial phase hyper-enhancement and washout appearances were higher on CT than on gadoxetic acid-enhanced MRI. For the LR-3 observations, adding the hepatobiliary phase hypo-intensity to major HCC features improved the diagnostic performance of LI-RADS for distinguishing HCCs from benign liver lesions.

CLINICAL RELEVANCE/APPLICATION

Gadoxetic acid-enhanced MRI has an important role in the surveillance for HCC because adding the HBP hypo-intensity to major HCC features can improve the diagnostic performance of LI-RADS for HCCs.

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GI409-SD-WEB10

CT and MRI of Diffuse Liver Disease: Roadmap to an AI-Based Algorithm for Multiparametric Categorization of Parenchymal Disease Differentiating Steatosis, Steatohepatitis, and Cirrhosis from Normal Parenchyma

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #10

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PURPOSE

To determine various quantitative parameters to be used iteratively for discrimination of liver parenchyma status, eventually creating a roadmap for an AI based algorithm differentiating different types of diffuse liver disease.

METHOD AND MATERIALS

249 multiphase CT and 119 MRI with appropriate histopathological correlation were included in this retrospective study. Histopathological diagnosis, laboratory parameters, and quantitative imaging parameters were noted for each imaging timepoint. Quantitative parameters were derived from regions of interest (ROIs) placed in the liver segment of biopsy. ADC value, T1 VIBE Dixon in- and opposed phase signal change and HU and signal intensity(SI) values on non-contrast, arterial, portalvenous and equilibrium images were noted. Contrast-enhancement-ratios were calculated from the HU or SI values between all contrast timepoints as HU/SI-timepoint1/(HU/SI-timepoint1 + HU/SI-timepoint2). Multiparametric prediction models were employed, finding optimal parameter combination to discriminate between the different states of liver parenchyma. Diagnostic accuracy was indicated by the ROC AUC.

RESULTS

For CT the algorithm used 11 dichotomous splits to identify normal parenchmya (AUC =0.90, sensitivity 82%, specificity 84%), steatosis (AUC = 0.98, sensitivity 41%, specificity 100%), steatohepatitis (AUC =0.95, sensitivity 20%, specificity 100%) and cirrhosis (AUC = 0.91, sensitivity 86%, specificity 74%). With MRI the algorithm performed 9 dichotomous splits to discriminate between normal parenchmya (AUC =0.89, sensitivity 86%, specificity 95%), steatosis (AUC = 0.95, sensitivity 71%, specificity 98%), steatohepatitis (AUC = 0.88, sensitivity 36%, specificity 100%) and cirrhosis (AUC = 0.86, sensitivity 86%, specificity 96%).

CONCLUSION

An algorithm performing multiparametric dichotomous testing, scrutinizing established quantitative CT and MRI parameters and contrast-enhancement-ratios may successfully categorize liver parenchyma and suggest underlying parenchymal disease. Simple semiquantitative dichotomous decision trees as utilized in clinical routine may not unleash the full diagnostic power of multiparametric imaging compared with automated multi-bifurcated decision trees.

CLINICAL RELEVANCE/APPLICATION

Liver cirrhosis is associated with life threatening complications. Imaging parameters identifying cirrhosis and its potentially reversible precursors will have major impact on patient management.

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GI411-SD-WEB4

Severity Assessment of Acute Pancreatitis by Iodine Mapping with Dual-Energy Computed Tomography

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #4

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PURPOSE

To investigate usefulness of visual and quantitative evaluation by iodine mapping with dual energy computed tomography (DECT) for severity assessment of acute pancreatitis (AP).

METHOD AND MATERIALS

20 patients with severe acute pancreatitis (SAP) and 20 patients with mild acute pancreatitis (MAP) were analyzed retrospectively. All patients underwent contrast enhanced CT scan by DECT. Visual evaluation: iodine mapping and pancreatic perfusion CT (PPCT) imaging were compared in same SAP patient. Quantitative evaluation: pancreatic iodine concentration was measured venous phase and compare between SAP and MAP. Clinical application: Iodine concentration analysis of SAP patients misdiagnosed as MAP from conventional CT images of onset date.

RESULTS

Iodine mapping can provide hemodynamics related to pancreatic necrosis, a characteristic of severe acute pancreatitis as same as Pancreas Perfusion CT imaging. Iodine-concentration in the patients with severe acute pancreatitis were lower than mild acute pancreatitis significantly ($p<0.001$ as t-test). when the cut-off value of iodine concentration is 39.4%, the sensitivity is 95.2%, the specificity is 70.2%, and the area under the curve by ROC analysis is 0.84. The iodine concentration of SAP misdiagnosed as MAP is lower than cut-off value.

CONCLUSION

Iodine mapping with DECT can provide hemodynamics images like a PPCT imaging and assess severity of AP quantitatively.

CLINICAL RELEVANCE/APPLICATION

Iodine mapping with DECT shows high diagnostic value in the severity assessment of acute pancreatitis (AP) and will help decide treatment policy.

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GI412-SD-WEB5

Differentiating New Hepatic Metastases from Focal Hepatopathy in Patients During Treatment for Malignancy

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #5

Participants
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PURPOSE

To differentiate between liver metastases versus benign focal hepatopathy (FH) that develops over the course of medical or surgical treatment of malignancy.

METHOD AND MATERIALS

Between 2010 and 2018, there were 1179 consecutive biopsies (1069 patients) of hepatic lesions suspicious for malignancy. 924 were True Pos, 169 True Neg (TN), 43 False Neg and 43 lost to follow up. Among the TN were 22 FHs defined as new lesions following oncologic treatment and histologically as steatosis, sinusoidal and biliary congestion/obstruction or inflammation. Cirrhotic patients, primary hepatic tumors and abscesses were excluded. Patients with FH and metastases were matched for age, malignancy-type and treatment regimen. 3 abdominal radiologists (1, 1, 3 y post-fellowship) blinded to pathology reviewed pre-biopsy MR (40 malignant: 13 FH) and CT (53: 12); 3 FH pts had both MRI and CT. A 5-point Likert scale (1: definitely benign, 5: definitely malignant) and imaging characteristics were assessed. A training data set for readers was provided to introduce a common lexicon. Univariate analyses (Chi-Sq, T-test), logistic regression and inter-rater reliability (kappa, spearman, ICC) were performed.

RESULTS

Characteristics of patients with FHs included: pancreatobiliary malignancies (68%), hepatobiliary/GI surgery or stent (77%) and chemotherapy within 1y prior to biopsy (50%). Results for MR: Likert 2.3-2.5 for FH vs 3.6-4.4 for metastases ($p<.05$, correlation=.49). Compared to FH, metastases were associated with multiplicity (>3 lesion/liver), larger size, arterial rim-enhancement, portal venous rim-enhancement/central hypoenhancement and restricted diffusion ($P< 0.05$, all readers, univariate, k=.48-.81 except arterial rim k=0.22, ICC=.91). Lesion multiplicity was associated with metastasis on multivariate analysis. For CT: Likert 2.3-4.0 for FH vs 3.8-4.9 for metastases ($p<.05$, correlation .47-.58). Only non-spherical shape was associated with FH ($p<.05$, all readers, k=.33-.89 except arterial rim .08-.22, ICC .97-.99).

CONCLUSION

Multiplicity, size, enhancement and diffusion characteristics may be helpful to distinguish FH from metastases on MR whereas only non-spherical shape was helpful on CT.

CLINICAL RELEVANCE/APPLICATION

Identification of FH could increase confidence in radiologic-pathologic correlation and limit biopsies following the medical-surgical treatment of malignancy. MRI may be more helpful than CT in distinguishing FH from metastases.

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GI413-SD-WEB6

CT Radiomics to Predict Chemotherapy Tumor Response in Metastatic Colorectal Cancer

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #6

Participants
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PURPOSE

To evaluate whole lesion pre-therapy CT radiomic features of liver metastases for predicting response to chemotherapy in patients with metastatic colorectal cancer.

METHOD AND MATERIALS

Retrospective cohort of 75 subjects (44 males, age 58 ± 12) with treatment-naïve, colorectal adenocarcinoma liver metastases and measurable disease by RECIST v1. Revelant radiomic (n= 111) features were extracted with Healthmyne QIDS (Healthmyne, Madison, WI) and a custom MATLAB (The Mathworks Inc., Natick, Massachusetts) routine from selected target lesions on venous phase contrast-enhanced pre-chemotherapy CTs. Simple logistic regression and receiver operating characteristic (ROC) analysis were performed and values were compared between RECIST responders and non-responder groups at 1st and 2nd follow up imaging after initiation of chemotherapy post standard of care chemotherapy initiation. Multivariate analysis included 12 radiomic features ($p<0.1$ from simple logistic regression) which were used to build a model to evaluate response after chemotherapy.

RESULTS

While no significant pre-chemotherapy CT liver lesion features corresponded with RECIST response at initial follow up, 4 radiomic features were predictive by the 2nd follow up CT($p<0.05$). These textural or morphologic features include: Gray level size zone matrix (GLSZM), Zone size non uniformity normalised OR(95% CI): 2.32 (0.16-0.79) p=0.017, Surface¬ to volume ratio 0.38 (0.17-0.85) p=0.019, Neighborhood Gray Tone Difference Matrix (NGTDM) Strength 0.02 (<0.001-0.75) p=0.035, and 3D Wavelet P2 L2 C12 0.26(0.07-0.99) p=0.049. Multivariate logistic regression analysis to predict response by 6 months using principal component analysis yielded an AUROC (95% CI) 0.75 (0.61-0.89), p=0.04.

CONCLUSION

CT radiomic analysis may potentially serve as an adjunct to predict liver metastasis response to chemotherapy in patients with metastatic colorectal cancer over time. Future prospective studies with larger cohorts may prove worthwhile to determine the role of radiomics in clinical decision making for patients where chemotherapy may not be well tolerated.

CLINICAL RELEVANCE/APPLICATION

Radiomic analysis of tumor features on CT could potentially serve as an adjunct to predict tumor response to chemotherapy in patients with metastatic colorectal cancer over time. This could help clinical decision making in patients where chemotherapy may not be well tolerated.

GI414-SD-WEB7

Readers' Preferences and Objective Analysis of DECT in Acute Appendicitis

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #7

Participants
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PURPOSE

To evaluate quantitively and qualitatively whether low monoenergetic images at 50 keV demonstrate improved quality compared to conventional images for imaging of acute appendicitis and to assess reader's preferences.

METHOD AND MATERIALS

A retrospective study of 42 clinically indicated CT exams conducted on a single source DECT (IQON, Philips, Eindohoven) was performed. The patient population male: female ratio was 1.4:1, average age was 44 (18-82), all were pathologically proven inflamed appendix. A single representative image was chosen from each study and an ROI was drawn along the appendix wall for HU, CNR and SNR values measurements. Comparison of these parameters on the conventional and low monoenergetic images was performed. In addition, all 84 images were randomized, anonymized and presented to two abdominal radiologists; for a 5-point scale quality grading evaluating of the bowel wall thickening, enhancement, conspicuity and mucosal visualization. Lastly, bowel wall enhancement visibility assessment was conducted on conventional and monoenergetic images side-by-side by 3 abdominal radiologists. Paired samples t-tests, a-parametric Wilcoxon test, McNemar test and kappa statistics were used for statistical analysis.

RESULTS

Attenuations of the bowel wall were significantly higher in the monoenergetic images compared to the conventional images, showing increase by a ratio of 1.7 ($P<0.05$). Significant increase was seen in the SNR (8.88, SD-3.27 vs 5.37, SD-1.84) and CNR (20.96, SD-4.91 vs 14.9, SD-3.04) on the low monoenergetic images as well ($p<0.05$) compared to the conventional images, by a ratio of 1.4 and 1.6 respectively. In the quality grading mucosal visualization, enhancement and conspicuity showed significantly higher scores by both readers ($P<0.05$), while bowel wall thickening showed a trend ($p=0.229$). There was clear preference of the monoenergetic images among all the visibility assessments by all readers.

CONCLUSION

There is significant and consistent increase in CNR and SNR in the 50KeV monoenergetic images compared to the conventional ones. The monoenergetic images showed significant better visualization of most characteristic active inflammation properties in appendicitis and abdominal radiologists clearly preferred them.

CLINICAL RELEVANCE/APPLICATION

The use of low monoenergetic images should be considered in clinical practice to assist accurate diagnosis of active bowel inflammation.

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GI415-SD-WEB8

Evaluation of Small Equivocal Cystic Lesions of the Pancreas Using Contrast-Enhanced Spectral-Detector CT: Single Institution Study in 25 Lesions

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #8

Participants
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PURPOSE

Dual-energy CT has shown its potential to improve evaluation of smaller cystic renal lesions. In this study, we evaluated if this approach can be transferred to the pancreas to improve diagnostic assessment of equivocal small cystic lesions using a novel dual-energy spectral-detector CT (SDCT).

METHOD AND MATERIALS

For this retrospective study, we reviewed the reports of 1192 contrast-enhanced late venous-phase SDCT-scans of the abdomen that were conducted between May 2017 and January 2019. 25 small (<=1.5 cm) cystic pancreatic lesions of 22 patients (mean age: 74.9±7.8 years and comprising 12 women and 11 men) were identified that received additional short-term CT follow-up or dedicated MRI because lesions were evaluated as equivocal in the report. Conventional images (CI) and spectral images (SI) including virtual monoenergetic images at 40 keV (VMI), iodine density and iodine overlay were reconstructed. Two readers indicated lesion conspicuity and diagnostic certainty for presence of cystic nature and fluid content of the lesion on 3-point scales. The reading was conducted in a two-step approach: first, solely CI were evaluated, while in a second reading after a 4-week interval, the combination of CI and corresponding SI was reviewed. Quantitatively, mean attenuation was measured ROI-based in CI and VMI at 40 keV. Signal-to-noise (SNR) and contrast-to-noise ratios (CNR) of the lesion were calculated. Interobserver agreement was assessed using intraclass-correlation-coefficient (ICC). Wilcoxon signed-rank test was used to test for any difference.

RESULTS

In the subjective reading, SI significantly improved lesion conspicuity (CI: 2[1-2], SI, 3[2-3], $p<0.001$) and diagnostic certainty regarding presence of cystic nature (CI: 2[1-2], SI: 3[3-3], $p<0.001$). Interobserver agreement improved considerably from 0.51 to 0.85 when the combination with SI was used. Further, VMI displayed significantly higher SNR and CNR ratios for the cystic lesions (SNR, CI: 1.4±1.5 versus VMI: 3.5±2.4, $p<0.001$; CNR, CI: 2.5±0.7 versus VMI: 4.5±1.9, $p<0.001$).

CONCLUSION

Compared with CI, the combination with SI from SDCT significantly improved visualization and diagnostic certainty for evaluation of small incidental cystic pancreatic lesions.

CLINICAL RELEVANCE/APPLICATION

Implemented in clinical workflow SI could help for improved detection and evaluation of this challenging lesion type, potentially reducing the amount of additional short-term imaging.

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GI416-SD-WEB9

Comparative Quantification of Liver Iron Concentration at 1.5T and 3T: Standardization Proposal

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GI Community, Learning Center Station #9

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To analyze the difference in quantification of liver iron concentration (LIC) obtained by different methods, at 1.5T and 3T.

METHOD AND MATERIALS

40 patients, included prospectively after providing written consent, underwent two MR studies (GEMS 1.5T MR450 and Siemens 3T Prisma) performed consecutively using a manufacturer's sequence, yielding an R2* map, and a standardized multi-echo GRE (ME-GRE) sequence obtained with the body coil and surface coil. UTE sequences were added to the 3T studies. MRQuantif software, validated at 3T, was used to calculate R2* (truncation and extrapolation method with simple and complex exponential modeling) and SIR-LIC (Alustiza and Gandon methods), and provide ref-LIC. A standardized R2*-LIC (R2*/magnetic field) was also used for analysis, performed by linear regression (r^2) and Bland and Altman's method.

RESULTS

The r^2 correlation between R2*-LIC calculated at 1.5T and 3T was 0.85 with the two maps and 0.99 with the ME-GRE sequence. The bias was respectively 15µmol/g [8µmol/g; 23µmol/g] and 4µmol/g [2µmol/g; 6µmol/g] ($p = 0.001$). Compared with ref-LIC, R2*-LIC bias was +0.2 µmol/g [-4 µmol/g;4 µmol/g] and -4 µmol/g [-8 µmol/g;1 µmol/g] at 1.5T and 3T, respectively. At 1.5T, the bias between SIR-LIC and ref-LIC was -14.3µmol/g [-24µmol/g; -4.9µmol/g] ($p=0.004$) and +25µmol/g [+18µmol/g; 32µmol/g] for the Alustiza and Gandon methods, respectively. At 3T, two high overloads were only correctly quantified with R2* calculated from the body coil, allowing calculation of R2* by extrapolation, or with the UTEs. Despite this, the r^2 correlation between the two coils was 0.97.

CONCLUSION

The bias between the 1.5T and 3T results is reduced by using 1) a generic ME-GRE sequence obtained with the body coil, 2) a unique tool for R2* calculation, and 3) the same conversion formula (MR-LIC = R2*/magnetic field).

CLINICAL RELEVANCE/APPLICATION

A robust and accurate quantification of the LIC by MRI is necessary for appropriate therapeutic management and monitoring of efficacy.

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GU221-SD-WEB1

Assessment of Diagnostic Performance of Two Pelvic Organ Prolapse Grading Systems in MR Defecography

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #1

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PURPOSE

To evaluate the diagnostic performance of currently commonly used MRD grading systems of rule of II and rule III for POP.

METHOD AND MATERIALS

63 volunteers with an average age of 33.5 ± 2.5 years and 30 patients with an average age of 47.5±14.1 years and who had MRD for POP symptoms for more than one year were recruited from 2012 to 2017. Magnetic resonance imaging was performed with a GE Optima 360 1.5T optical fiber magnetic resonance scanner. Measurements of the height of the urethrovesical junction (UVjnct), uterovaginal junction (UCjnct) and anal rectal junction (ARJ) at the perpendicular distance to the PCL were taken on R, L and D phase. The Bonferroni method was used for intra-group comparison. ROC curves for diagnosing POP were drawn. Diagnostic performance was compared between grade of II and grade of III systems. Grade of III criteria are organ reference points UVjnct, UCjnct and ARJ prolapse <3 cm (I), 3 to 6 cm (II), >6 cm below the PCL (III) for POP in the anterior, middle and posterior compartments. Grade of II criteria are ARJ prolapses 3 to 5 cm (I), >5 cm (II) below the PCL for the posterior compartment.

RESULTS

UVjnct and UCjnct lines were positive in the R, L and D phases. Its value increased from R to L, and decreased from R to D. ARJ line were positive in L phase and negative in the R and D phases. Its value increased from the negative to positive from R to L, meaning it moved from below to above the PCL. The absolute value increased from R to D phase, meaning it moved further away below the PCL. ROC for diagnosing POP showed UVjnct AUC of 0.894 for anterior compartment POP, UCjnct AUC of 0.897 for middle compartment, and ARJ AUC of 0.807 for posterior compartment. In grade of III system, in posterior compartment, 1.6%, 44.4%% and 54% of healthy volunteers were normal, grade I and grade II POP respectively; 100% of symptomatic patients were grade II POP. In grade of II system, in posterior compartment, 31.2%, 42.9%, and 11.1% of healthy volunteers were normal, grade I and grade II POP respectively; 53.3% and 46.7% of symptomatic patients were grade I and grade II POP.

CONCLUSION

For the anterior and the middle compartments grade of III system has good diagnostic performance for POP. For the posterior compartment, the rule of II is superior than the rule of III criteria.

CLINICAL RELEVANCE/APPLICATION

Rule of II is superior than rule of III in diagnosing posteriro pelvic organ prolapse in the posteriro compartment.

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GU222-SD-WEB2

Dynamic MRI in Assessment of Female Urinary Incontinence

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #2

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PURPOSE

To assess the merit of static & cine MRI in evaluation of SUI in females aiming to understand normal pelvic floor function-structure relationship

METHOD AND MATERIALS

This study had institutional review board approval& informed consent obtained from all participants. There were 77 women:37 continent control women & 40 patients, who were divided into 3 groups according to their ALPP. Static T2-weighted turbo spin-echo images, STIR and FATSAT images were used in evaluating structural derangements. Functional dynamic T2 WIs were used in detecting functional abnormalities &recording measurements of supporting structures. Findings of MRI were analyzed to determine the predominant defect & correlate with findings in ALPP

RESULTS

The 40 cases of study group were sub-divided into: Group A(<60cm H2O): 5 cases, Group B(60-90cm H2O): 20 cases &Group C (>90cm H2O): 15 cases. In the patient group, the mean urethral thickness was 4.43±0.58 mm, in control group it was 4.89±0.65mm. The mean urethral thickness in group A was 3.70±0.49mm with statistical significance between group A & control group. No statistical significance could be detected in between control & cases groups as regard urethral length. In patient groups, level II endopelvic fascia defect in 13 cases (32.5%). Significant statistical difference between control & patients groups as regard urethral supporting system. Group B took the upper hand in structural defects on static sequences as 7cases (35%)show level III endo pelvic fascial defect & 10 cases (50%) with multi factorial defect in static sequences , while no structural defects in group A cases. 18 cases(45%) in patent group show bladder neck funneling with significant statistically difference between control & pateint groups. urethral hypermobility presented in 31 cases (77.5%) of pateint group with statistical significance in between control & pateint groups. 8 cases (90%)in group B show UH. The mean width of levator hiatus in pateint group was 5.37±1.78cm &4.32±1.33cm in control group with Statistically significant inbetween. WLH was the maximum at group C as it ranges from 3.50-9cm with mean width 5.75±1.5cm

CONCLUSION

Combined static & dynamic MRI of patients with SUI allow identification of certain structural abnormalities and predict the predominant factor so the therapeutic approach could be a pathology-based rather than symptom-based.

CLINICAL RELEVANCE/APPLICATION

static&cine MRI allow identification of pelvic floor structural abnormalities & predict the predominant factor.

GU223-SD-WEB3

Magnetic Resonance Imaging of Endometrial Stromal Nodule

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #3

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PURPOSE

Endometrial stromal nodules are a rare benign uterine stromal tumor. ESN patients have a good prognosis and can be treated by local resection of the tumor to retain reproductive function. It's important to accurate diagnosis before surgery for reproductive needs Women. Previous reports have mostly described the pathological features of ESN , characteristic magnetic resonance imaging of this tumor has not been described. In this report, we describe and summarize the imaging of 5 ESN and explore the correlation between MR imaging and pathological findings

METHOD AND MATERIALS

Five patients aged 43-60 years (mean 48 years) were treated with L.5-T superconducting magnetic resonance pelvic MRI. Axial, sagittal and coronal T2WI images, axial T1WI and DWI images were acquired to analyze lesion size, location, growth pattern, signal intensity, internal structure, presence of hemorrhage and necrosis, and invasion of surrounding structures. The intensity is compared to the myometrial and endometrial signal intensity. Find the correlation between these radiological findings and pathological findings

RESULTS

All ESN were single and located in the myometrium,which showed cystic changes with clear boundaries. On T1WI, the mass signal is similar to the myometrial. On T2WI, a discontinuous low signal band was observed at the edge of the tumor. The solid part was higher than the myometrium, slightly lower than the endometrial and the cystic part was higher than the myometrium. On DWI, the solid part is higher than the myometrium, and the cystic part is low. An enhanced scan showed that the enhancement around the mass was consistent with the myometrium

CONCLUSION

ESNs are mainly endometrioid cells which are dense and visible mitotic figures, MRI shows a clear lumps of borders similar to endometrial signals. On DWI lesions are higher than the myometrium, similar to malignant lesions, which can be distinguished from other benign uterine masses. The distribution of myometrial fiber bundles in the lesions is consistent with the low-signal band in the lesions. The margins of the masses and the large blood vessels in the septum are the tissue basis for the dynamic enhancement of the endometrium. These may be ESN's characteristic performance

CLINICAL RELEVANCE/APPLICATION

Magnetic resonance imaging of endometrial stromal nodules is associated with pathology, and imaging features are likely to provide accurate preoperative diagnosis of the disease.

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GU255-SD-WEB4

Use of 3D Arterial Spin Labeling to Evaluate Renal Perfusion in Patients with Chronic Kidney Disease

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #4

Participants
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PURPOSE

To evaluate the effectiveness of 3D pulsed arterial spin labeling (PASL) and 3D pseudo-continuous spin labeling (pCASL) in assessment of renal blood flow (RBF) in both the renal cortex and medulla of chronic kidney disease (CKD) patients and healthy volunteers.

METHOD AND MATERIALS

CKD patients Stage 1(S1) to Stage 4 (S4) (n = 4, 9, 11 and 7 , total n = 31) and healthy volunteers (n = 10) underwent MRI on a 3T MR scanner (Skyra) using a dedicated 18-channel body coil and an integrated spine coil. Prototype sequences of PASL and pCASL with 3D motion correction were used to generate perfusion maps. Image quality of both PASL and pCASL images were scored. RBF of the renal cortex and medulla were measured on three central slices of every RBF map. RBF values were compared between CKD patients and volunteers and between CKD patients at different stages. Pearson correlation test was used to evaluate correlations between RBF at the renal cortex and medulla and estimated glomerular filtration rate (eGFR) and between at the renal cortex and medulla and serum creatinine level (SCr) for CKD patients.

RESULTS

The image quality scores (median [P25, P27]) were significantly higher with pCASL (CKD: 2[1, 3], volunteers: 3[2, 3]) than those with PASL (CKD: 1[0, 1], volunteers: 1[1.5, 2.75]) for both CKD patients ($P < 0.001$) and volunteers ($P = 0.005$). Thus, only the pCASL RBF maps were used for further analyses. RBF values in the cortex were significantly higher than those in the medulla for both CKD patients ($P < 0.001$) and volunteers ($P < 0.001$). RBF values in both the cortex and medulla of CKD patients of S2 to S4 were significantly lower than those of volunteers. RBF values in CKD S1 and S2 patients were significantly higher than those of S3 and S4 patients in both the cortex ($P < 0.05$) and medulla ($P < 0.05$). A significant positive correlation between RBF and eGFR was demonstrated in both the cortex and the medulla of CKD patients (cortex: $r = 0.822$, $P = 0.000$; medulla: $r = 0.790$, $P = 0.000$). A significant negative correlation was found between RBF and SCr (cortex: $r = -0.712$, $P = 0.000$; medulla: $r = -0.653$, $P = 0.000$).

CONCLUSION

pCASL can be used as a non-invasive and non-contrast MRI technique to assess renal perfusion for CKD patients.

CLINICAL RELEVANCE/APPLICATION

A non-invasive, non-contrast, convenient and high reproducible ASL technology to evaluate the RBF is essential for establishing accurate CKD staging and appropriate treatment.

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GU256-SD-WEB5

Zoomed EPI versus Conventional EPI DWI in Prostate Imaging: Impact on PIRADS Scoring and Cancer Detection

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #5

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PURPOSE

Conventional echoplanar (EPI) diffusion-weighted imaging (DWI) is prone to susceptibility artifacts. One possible alternative is zoomed EPI DWI, which has already been shown to reduce distortion artifacts compared to conventional DWI. The aim of this study was to evaluate the impact of zoomed EPI DWI on prostate cancer detection and lesion classification in multiparametric prostate MRI.

METHOD AND MATERIALS

Seventy-two patients (mean age 65 y, age range 46 - 84 y) with suspected prostate cancer who underwent prostate MRI at 3T were included in this retrospective study. Besides T2-weighted and dynamic contrast-enhanced (DCE) sequences, each exam included both conventional EPI DWI and zoomed EPI DWI. All patients had micro-enema before prostate MRI. Lesions were classified according to PIRADS v2. All 72 patients had prostate biopsy (combined systematic prostate biopsy and TRUS-guided prostate biopsy) and 14/72 patients also underwent prostatectomy. The sensitivity and specificity of mpMRI with conventional EPI (mpMRIc) or zoomed EPI DWI mpMRIz) were evaluated and compared using receiver operating characteristic (ROC) analysis, with the histopathological workup as the standard of reference.

RESULTS

75 lesions (in 52 patients) were identified on mpMRI (PIRADS 3 or higher). 32/75 lesions (42.7%) were located in the peripheral zone. Based on mpMRIc, 43/75 lesions (57.3%) were classified as PIRADS 3, 21/75 (28.0%) as PIRADS 4 and 11/75 (14,7%) as PIRADS 5. Based on mpMRIz, 52/75 lesions (69.3%) were rated as PIRADS 3, 14/75 (18.7%) as PIRADS 4 and 9/75 (12.0%) as PIRADS 5. No lesions were detected in 20 patients; in this case, the PIRADS score was set to 2. mpMRIc had a lesion-based sensitivity of 77.8% and a specificity of 93.7%, while mpMRIz DWI had a sensitivity of 55.6% and specificity of 95.2%. The accuracy of mpMRIz was significantly lower when compared to mpMRIc ($p = 0.0064$).

CONCLUSION

The accuracy of mpMRI with conventional EPI DWI for prostate cancer detection is superior to the accuracy of mpMRI with zoomed EPI DWI. Zoomed EPI DWI cannot be currently recommended for routine clinical prostate examinations.

CLINICAL RELEVANCE/APPLICATION

Our study shows that diffusion restriction in prostate cancer is less pronounced on zoomed EPI DWI when compared to conventional EPI DWI with identical b-values, leading to lower PIRADS scores and lower diagnostic accuracy.

GU257-SD-WEB6

Co-Trained Convolutional Neural Networks Analysis for Assessment of the Diagnostic Accuracy of Biparametric Magnetic Resonance Imaging of the Prostate

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #6

Awards
Trainee Research Prize - Resident

Participants
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PURPOSE

The study aimed to apply convolutional neural networks (CNNs) to biparametric magnetic resonance imaging (MRI) and to evaluate the diagnostic values of the prediction model generated from training CNNs in prostate cancer.

METHOD AND MATERIALS

This study evaluated 56 patients with prostate cancer (PCa) and 58 benign prostatic hyperplasia (BPH).A total of 116 PCa and 148 BPH lesions were devided into a training set and a test set. Prediction models of prostate MRI were developed through a novel called CNN40bottleneck based on four different improved methods --bottlenecks, batch normalization, global average and pooling, namely, CNN40bottleneck_gap, CNN40bottleneck_nobn, and CNN40bottleneck_nogap framework. T2 weighted images and ADC images are used as training data in the post-network part. Accuracy, sensitivity, specificity and areas under the receiver operating curve (AUC) were calculated to compare the diagnostic performance of CNNs models based on T2WI, ADC and the combination of T2WI and ADC (T2WI-ADC).

RESULTS

The six models trained with T2WI had significantly higher AUCs (0.862, 0.844, 0.854, 0.813, 0.821, 0.854) than those with ADC (0.724, 0.695, 0.702, 0.715, 0.668, 0.765) in distinguishing between PCa and BPH. When A deep CNN40bottleneck model, the product resulting from jointly combining T2WI with ADC, was adopted, the differential diagnostic efficiency (0.934) was significantly improved. It was remarkably obvious that CNN40bottleneck possessed simliar diagnostic performance and accuracy with ReNet and Inception , but the CNN40bottleneck framework took less training time (T2WI:5391.54s, 3574.32s, 5450.79s; ADC: 4141.76s, 2842.54s, 4220.37s) and needed fewer parameters (16.80MB, 16.50MB, 17.40MB) than the latter two(T2WI:6416.36s, 61241.32s, 10675.32s; ADC: 5085.01s, 21646.21s, 51315.27s; Parameters: 40.70MB, 180.00MB, 315.00MB).

CONCLUSION

The Co-trained deep CNNs framework based on MRI can effectively differentiate PCa from BPH. In adition, combining both T2WI and ADC (biparametric MRI) in the CNN40bottleneck framework can provide increased diagnostic accuracy. Compared with ResNet and Inception, CNN40bottleneck is a better choice for its advantage of taking less training time and needing fewer parameters.

CLINICAL RELEVANCE/APPLICATION

Prediction models of prostate MRI were developed through a novel called CNN40bottleneck and combined mutimodal imformation from both ADC and T2W images of an mp-MRI sequence.

HP127-ED-WEB6

2019 MRI Safety Updates for Radiologists: Are We Too Careful or Careless?

Wednesday, Dec. 4 12:45PM - 1:15PM Room: HP Community, Learning Center Station #6

FDA Discussions may include off-label uses.

Awards
Certificate of Merit

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TEACHING POINTS

1. To review recent evidence on the safety of magnetic resonance imaging in patients with cardiac devices 2. To expose the risk and safety precautions for pregnant patients requiring magnetic resonance imaging3. To highlight the current literature and guidelines on gadolinium brain deposition and the risk of nephrogenic systemic fibrosis in the context of severe renal failure

TABLE OF CONTENTS/OUTLINE

We present : 1) Updates on cardiac devices and MRI : MRI interactions with cardiac devices, recent evidences, specific safety considerations for non dependent and dependent patients with implantable cardioverter-defibrillator, presentation of different cardiac devices and their compatibility with MRI (stents, implantable loop recorder, leadless pacemaker, mitraclips, subcutaneous cardioverter defibrillator and left-ventricular assist device), MRI contraindications in 2019 and protocol for patients with cardiac devices undergoing MRI. 2) Updates on gadolinium-associated complications: Types of gadolinium-based contrast and their associated risks, nephrogenic systemic fibrosis, gadolinium-associated plaques and gadolinium brain deposition. 3) Updates on pregnant and breastfeeding patients and MRI with or without gadolinium.

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HP221-SD-WEB1

Improving Metrics of Acute Stroke with Critical Care Nursing - Radiology, Neurology and Nursing Based Interdisciplinary Management

Wednesday, Dec. 4 12:45PM - 1:15PM Room: HP Community, Learning Center Station #1

Participants
Tej I. Mehta, BS, Sioux Falls, SD (*Presenter*) Nothing to Disclose
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PURPOSE

Stroke is the fifth leading cause of death in the United States and despite major advancements in recent years remains a significant cause of morbidity and mortality worldwide with an associated financial burden. Metrics such as door-to-needle time have improved significantly in recent years, but modifiable external factors remain open to further improvement. According to the National Stroke Association, acute stroke treatment begins with triaging the patient to determine appropriate stroke treatment. Over time, specialized interprofessional teams for specific conditions, such as stroke, have been developed for enhanced critical care. The purpose of this article is to describe the innovation and redesign of the interprofessional stroke code team that places nursing staff as the central leader. The goals of the redesign were to maximize available resources, enhance the efficiency of the team, expedite triage of the stroke patient, improve communication amongst all members of the stroke team, determine rapid treatment methods, and improve delivery of treatment to the stroke patient.

RESULTS

Over the two years of data collection there were 95 patients with a mean age of 72.82, an approximately equal sex distribution, a mean NIHSS of 15.96, mean mRS score at discharge of 3.71, means mRS score at 90 days post-discharge of 3.55 and mean length of stay of 5.98 days. Of the two cohorts, 26 patients of ischemic stroke were controls (year preceding program) and 69 experimental cases (year following program). There was a significant difference in mean NIHSS scores between the two groups (control: 13.15, cases: 17.04; p=0.041). Unadjusted analysis did not identify significant differences between mRS outcomes. Multivariate analysis controlling for age, sex and NIHSS found a significant effect during off hours for discharge mRS score difference (cases: -0.71, p = 0.045) but not for mRS score at 90 days post-discharge. There were significant differences in time measures (minutes) between arrival time to CT start (control: 17.8, cases 8.52; p=0.001) , emergency room physician evaluation to CT start (control: 12.64, cases: 5.68; p=0.008), neurology physician evaluation to CT start (control: 10.16, cases: 2.57; p=0.001), and neurology physician evaluation to tissue plasminogen activator (controls: 57.94, cases: 33.11; p=0.05). No significant difference during this period was seen for other metrics: time for neurologist assessment, emergency department physician assessment, arrival to tissue plasminogen activator start, arrival to groin puncture, nor length of patient stay. However, for the latter two times were reduced and had smaller standard deviations amongst cases.

CONCLUSION

Interdisciplinary care of patients suffering acute stroke remains an area for significant improvement of stroke management. The program described herein uses a synergistic approach of nursing and physician care to significantly improve stroke metrics and outcomes. These data highlight the intersectional abilities of nurses, radiologists and neurologists in acute stroke management and how a team-based approach can significantly improve stroke metrics.

METHODS

To enhance the communication, resources, and efficiency of the acute stroke management team, we implemented a nurse-led interprofessional stroke code team. We hypothesized that this program would enhance the synergistic management of stroke from radiological, neurological and nursing perspectives. In a retrospective review, we analyzed stroke metrics including patient arrival time to the following: emergency department assessment, assessment by a neurologist, head CT scan and delivery of tissue plasminogen activator or puncture for mechanical thrombectomy. Outcome measures included modified Rankin scale (mRS) score at discharge, mRS score at 3-month follow-up and length of hospital stay. We compared these data on all acute stroke patients at our institution in the one-year prior to the start of this program (controls) and in the one-year after the start of this program (cases). We additionally collected demographic data including age, gender and race as well as NIHSS at arrival. Statistical analysis was performed using R. For univariate analyses, differences in continuous mean scores of demographic data and explanatory measures between the dichotomous summary measures of in-house vs. no in-house neurologist/neurointerventionalist hours (between 800 -1700 and between 1701 - 799 respectively) and pre- vs. post- stroke nurse triage program institution were examined using independent t tests for normally distributed data and the Mann-Whitney U test for skewed data. Multivariate models adjusted for age, gender and NIHSS were generated to determine the significance and effect size of the stroke nurse triage program on the primary outcomes of mRS score at discharge, mRS score at 90 days post-discharge and length of hospital stay.

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HP222-SD-WEB2

Radiological and Clinical Outcomes of Emergent Spine MRI Scans Performed for Spinal Cord Compression

Wednesday, Dec. 4 12:45PM - 1:15PM Room: HP Community, Learning Center Station #2

Participants
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PURPOSE

Suspected Spinal Cord Compression-SCC is a medical emergency with potential for serious adverse outcomes if not diagnosed or treated immediately. Imaging for SCC requires total spine MRI making them resources intensive and disruptive of normal workflow. Our purpose was to evaluate the radiological and clinical outcomes of emergent MRIs performed for suspected SCC to determine their clinical impact.

METHOD AND MATERIALS

Consecutive spine MRI studies requested by the Emergency Department (ED) at our institution for SCC over 2 ½-year period without a history of recent trauma or surgery were evaluated. A positive radiological outcome was: SCC (compression of the spinal cord and lack of surrounding CSF), Cauda Equina Compression-CEC (>75% narrowing of the lumbar spinal canal and lack of CSF within the thecal sac) or Other Significant Findings-OSF (findings clinically important such as cord lesion/infection/tumor without SCC/CEC). The clinical outcome was considered positive if a patient was treated with surgery, radiation or IV antibiotics or steroids within 24 hours. Patients were classified into those with specific history-SH (cancer, infection, coagulopathy, suspected cord lesions) and those with no specific history-NSH (only neurologic signs and/or back pain) as provided by the ED.

RESULTS

215 patients had MRI scans performed for suspicion of SCC, 101/215(47.0%) with SH, and 114/215(53.0%) with NSH. Radiological outcome was positive in 84/215 (39.1%): 49/101(48.5%) with SH and 35/114(30.7%) with NSH (p=0.008). Clinical outcome was positive in 21/215(9.8%):14/101(13.9%) with SH and 7/114(6.1%) with NSH (p=0.057). None of the patients with negative radiological outcome 131/215 (60.9%) had a positive clinical outcome.

CONCLUSION

A high radiological yield was seen for MRI scans performed for SCC despite using strict diagnostic criteria, but the immediate clinical impact was lower. Patients with specific history had a higher likelihood of a positive radiological and clinical outcome compared to those with no specific history. Further stratification of clinical data of patients suspected of SCC can be possible to reduce emergency MRI scans likely to have no immediate clinical impact.

CLINICAL RELEVANCE/APPLICATION

Emergent MRI for cord compression are resource intensive and disruptive of normal workflow; stratification of patients' clinical data may reduce MRIs likely to have no immediate clinical impact.

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HP223-SD-WEB3

Patterns of Use, Effectiveness, and Safety of Gadolinium-Enhanced MR in a Multicenter European Setting: An Interim Report

Wednesday, Dec. 4 12:45PM - 1:15PM Room: HP Community, Learning Center Station #3

Participants
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PURPOSE

Medicine authorities state that gadolinium-based contrast agents (GBCA) should be used only when essential diagnostic information cannot be obtained with unenhanced scans. The entry into the European market of a new GBCA (Clariscan (gadoterate), GE Healthcare) created an opportunity to study whether the pattern of use fulfils the demands of the authorities. This prospective multicentre study (NCT03455283, EUPAS21473) aims to evaluate pattern of use, effectiveness and safety in around 5000 patients from 11 European sites.

METHOD AND MATERIALS

The indications as described by organ/body part were recorded. Effectiveness of the GBCAs commonly used in the respective hospitals was recorded in terms of image quality and diagnostic confidence improvement. Safety was assessed as number of spontaneously reported adverse events and classified as immediate or delayed. The data were descriptively analysed with simple comparative statistics.

RESULTS

As of March 27th, 2019, 667 subjects (of which 37% elderly and 1% paediatric) from 5 centres were included. 76% of the patients received Clariscan, 14% Gadovist and 11% Dotarem. The most common indications were organ/whole body (54%) and CNS (44%). Routine referrals were 75% cases, follow-up cases 24%, and emergency cases 1%. Doses given were between <=0.1 mmol/kg and 0.3 mmol/kg. Image quality was rated as excellent in 54%/69% of subjects for all GBCAs/Clariscan respectively, good in 39%/24%, fair in 7%/7% and poor in 0.4%/0.2%. In 98% of the GBCA-MR examinations, confidence of the diagnosis improved by a mean point increase of 36% (starting from a 58% mean) on a 0-100% confidence scale. One out of the 667 patients reported an immediate serious adverse event (0.15%).

CONCLUSION

The European patterns of GBCA use following introduction of Clariscan into clinical routine were captured in this prospective study including data from patients across different demographics. Interim data show predominant GBCA use in organ/body and CNS indications. In 98% cases improved diagnostic confidence following GBCA-MR was reported, with >93% good/excellent image quality procedures and 0.15% adverse event rate.

CLINICAL RELEVANCE/APPLICATION

This prospective study showed macrocyclic GBCA usage patterns including Clariscan and in light of recent EU regulatory changes. High safety and effectiveness standards were recorded for all GBCAs.

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HP237-SD-WEB4

Impact of Text Message Reminder on Patient No-Show Rate in Scheduled Radiology Examination

Wednesday, Dec. 4 12:45PM - 1:15PM Room: HP Community, Learning Center Station #4

Participants
Felice A. Burn, MD, Aarau, Switzerland (*Presenter*) Nothing to Disclose
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PURPOSE

To test whether a text message service as a friendly reminder can reduce the no-show rate of outpatient radiology appointments.

METHOD AND MATERIALS

A retrospective search of the RIS database of our teaching hospital was performed from January 2018 to March 2019 for successfully attendance as well as no-show of patients for an imaging appointment. The imaging appointments included CT, MRI, ultrasound as well as mammography. On July 9, 2018 a text message service, built in the RIS system, was introduced and patients with an available cell phone number received automatically a reminder 24 hours before the appointment. To evaluate the effect of the text message service, a no-show rate sample set before the launch was compared with the no-show rates after the launch. The sample sets were collected on a weekly basis. The reduction of the financial loss due to the text message service was calculated by the difference of the no-show rate before and after text message service introduction using average examination costs per modality. A two-sample t-test was used for statistical analysis.

RESULTS

During the entire study period 64 760 patient appointments were recorded. After the launch of text message service, 67% of patients received a text message. For all modalities, an average no-show rate of 2.5% was measured before and 1.5% after the introduction of the text message service ($p<.001$). The highest average no-show rate over the whole study period was measured in MRI and the lowest in CT. In MRI, the mean no-show rate dropped by 30% from 3.7% to 2.6% after the launch of the text message service ($p=.0134$). In CT, the mean no-show rate dropped by 42% from 1.2% to 0.7% ($p<.001$). In mammography, the mean no-show rate dropped from 3.1% to 1.6% ($p=.0018$) and in ultrasound from 2.0% to 1.1% ($p<.001$). The reduced no-show rate leads to an financial optimization of approximately 9200 USD per month.

CONCLUSION

Reminding patients with a text message a day before the appointment significantly reduces patient no-show rates and financial loss. To integrate an effective reminder system, data quality and availability of cell phone numbers is essential. Best results can be achieved when IT specialists, radiologists and administrators are working closely together.

CLINICAL RELEVANCE/APPLICATION

The introduction of a text message service leads to an improved patient engagement and optimized modality usage.

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HP238-SD-WEB5

Evaluating the Performance of Lung Nodules Follow-Up Assistance Systems on the Workflow Efficiency in Follow-Up of Solitary Pulmonary Nodules

Wednesday, Dec. 4 12:45PM - 1:15PM Room: HP Community, Learning Center Station #5

Participants
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PURPOSE

To explore the influence of lung nodules follow-up assistance (LNA) systems on workflow efficiency in follow-up of solitary pulmonary nodules.

METHOD AND MATERIALS

The baseline and follow-up images in lung CT of 43 patients with solitary pulmonary nodules were retrospectively evaluated by two ways blindly, the traditional way was that an experienced radiologist use PACS to compare the images of patents' baseline and follow-up(control group), the other way was that after 1month the same radiologist evaluated those images under the lung nodules follow-up assistance systems(LNA, IntelliSpace Portal, Philips healthcare) (LNA group). The long axis, short axis, the change rate of long axis and the change rate of long axis multiplied by the short axis of the target lesion for baseline and follow-up were manually calculated in control group and automaticly generated in LNA group. The time cost of evaluation for each case was recorded. The consistency of change rate of long axis and long axis multiplied short axis in two groups were compared by Bland-Altman test, the time cost of two groups were compared by student T test.

RESULTS

The time cost of LNA group(124.5±46.3s) was shorter than that of control group(272.5 ±57.6s)($P<0.01$). The upper limit of 95% confidence interval of the long axis change rate: 0.15mm, and the lower limit: -0.09; The upper limit of 95% confidence interval for the rate of change of long axis * short axis: 1.25, and the lower limit: -0.49. The physicians and lung nodules follow-up assistance systems had good consistency in the baseline and follow-up measured for long axis, short axis, long axis * short axis, long axis change rate .

CONCLUSION

the use of lung nodules follow-up assistance systems can significantly save the time for physicians to reading the images of patients in the follow-up, and there is a good consistency between the changes of the anatomical diameter line of nodules and the diagnosis by physicians.

CLINICAL RELEVANCE/APPLICATION

Semi-automatic analysis of lung nodules follow-up assistance systems can significantly improve the efficiency of physicians in the follow-up of solitary pulmonary nodules and change the traditional pattern of follow-up of pulmonary nodules. The graphic and text structured report in the assistance systems can provide comprehensive and accurate visual image data for the follow-up process of patients.

IN013-EB-WEB

Essential Operations and Workflow in the 3D Printing Anatomic Modeling Lab

Wednesday, Dec. 4 12:45PM - 1:15PM Room: IN Community, Learning Center Hardcopy Backboard

Participants
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Jonathan M. Morris, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Understand operational components of a 3D printing anatomic modeling lab 2. Appreciate the workflow from beginning to end of model creation 3. Learn about documentation in the medical record

TABLE OF CONTENTS/OUTLINE

1. Essential components of a Medical 3D Printing Lab A.Staff 1)radiologist 2)segmentation technologists 3)physicists 4)maintenance technician/engineer 5) administration B. Equipment 1) hardware a)3D printers b) surface scanner c)cleaning and post processing equipment 2) software a)segmentation b)CAD c)data file system C. Space 1) safety a)adequate ventilation and water supply b)isolate possible toxic exposures 2) proximity to surgical/clinical practice 2. Workflow A. Electronic order B.Imaging data 1)imaging protocols 2)reconstruction techniques 3) IV contrast C. Segmentation D. CAD processing E. 3D printing F. Post processing and cleaning G. Documentaiton in medical record H. Delivery of model F. Followup survey 3. QC program essentials 4. Funding options A. Grants B.Category III CPT C. Philanthropy D. Collaborations 5.Clincal value A. survey and feedback forms B. prospective measurement of decreased OR time, planning and informed consent times 6. Educational projects A. applies to all levels of medical learners B. simulation models for traning C)files used for AR/VR 7. Cross departmental research collaborations

IN147-ED-WEB4

PACS Replacement Parts II: Steps to Successful Implementation - From Contract to Go-Live

Wednesday, Dec. 4 12:45PM - 1:15PM Room: IN Community, Learning Center Station #4

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TEACHING POINTS

Succesful implementation of new PACS requires months of intense preparation. Key considerations during this phase include: Detailed articulation of scope of implementation and of the needed resources for an attainable go- live date; a project manager to set and track timelines; a dedicated team of champions representing all networks and subspecialties meeting regurlaly; a strategy for communication and education of the entire health organization.

TABLE OF CONTENTS/OUTLINE

The PACS implementation phase begins as soon as contracts with vendors are finalized. The following steps will help ensure succesful implementation and go-live 1.Convert the PACS selection team in to an implementation team; edit members according to expertise and proven commitment 2.Scope of the project: Will all networks, all subspecialties go live together or wil this be a phased implementation? will all features and modules of applications be deployed at go-live ? will the clinical viewer be part of this go-live?.3.PACS committee and vendors agree on implementation strategy and go-live date.4.Designate a project manager to coordinate meetings, vendors visits, and adherence to timelines.5.Allow ample time to build and live-test all worklists and hanging protocols 5.Prepare awareness and training campaign to reach all constituents.6.Imagine the go-live day and plan for it.

IN206-SD-WEB3

Tofu: For Stir-Fry and Ultrasound Procedural Training

Wednesday, Dec. 4 12:45PM - 1:15PM Room: IN Community, Learning Center Station #3

Participants
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CONCLUSION

Firm tofu is a cheap US training medium that trainees at all reported improved their skills and confidence at minimal cost. Use of these blocks in a standard curriculum may be of benefit early on in resident education.

Background

Despite the availability of commercial simulations, training new residents in procedures has traditionally been on patients who present with a need for treatment. This "trial-by-fire" experience, can be stressful for supervising physicians and trainees, and often deleterious to patients. Commercial ultrasound (US) phantoms are extremely costly for limited utility. We postulated that a cheap non-anatomic simulation could still greatly improve procedural skills and trainee confidence at a low cost in time and money. Based on prior publications, the use of tofu was suggested as a tissue simulation due to similar propagation speed to soft tissue. Internal echogenicity was noted to be similar to some soft tissues.

Evaluation

Blocks of tofu were initially evaluated by both an attending interventional radiologist and a diagnostic radiologist to establish parameters. 11 trainees of varying levels of experience were asked to fill out a survey documenting their perceived experience, level of training and comfort with ultrasound guided procedures on a 10-point scale before completing testing. Trainees were randomized to initial testing on a tofu model or a commercially available phantom, and then completed a survey asking to evaluate change in the previously evaluated findings on a -5 to 5 point scale. Testing consisted of basic ultrasound guidance tasks including identification of target in multiple projections along with real-time needle guidance. Participants then underwent testing on the other model followed by a second survey.

Discussion

Although no statistically significant trend could be identified on pre-testing surveys, trainee confidence demonstrated an overall positive improvement after use of the tofu-based model by 3.4 points. Use of the commercial phantom resulted in an improvement of 2.2 points, with most of the trainee concerns raised by more experienced residents, including excessive stiffness and residual tracts from prior training.

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IN246-SD-WEB2

Study on the Detection Capability Alteration of AI Assisted Software in Detecting Subsolid Pulmonary Nodules by Residents in Radiology Department

Wednesday, Dec. 4 12:45PM - 1:15PM Room: IN Community, Learning Center Station #2

Participants
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PURPOSE

BACKGROUND: Subsolid nodules (SSN) including pure ground-glass nodules and part-solid nodules have a high probability of lung cancer. PURPOSE: To evaluate the detection capability of artificial intelligence (AI) assisted lung nodule diagnostic software in the detection of subsolid pulmonary nodules by resident .

METHOD AND MATERIALS

A total of 105 patients were collected in our hospital. One senior radiologist with more than 10 years' experience read CT images based on the initial diagnosis of another senior radiologist with similar experience and a final decision was subsequently conducted by deputy chief radiologist with more than 15 years' experience to determine the ground truth lung nodules. All readings were performed on 1 mm slice thickness CT images with the assistance of AI software (InferRead CT Lung Research, Infervision, Beijing, China).One resident read the images without AI software (group A) and the same resident read CT images with AI software (group B) after two weeks' washout period.The number of subsolid pulmonary nodules and location were recorded. The number of true positive nodules and false positive nodules in group A and B were compared with the gold standard nodules to calculate sensitivity and false positive rate.

RESULTS

Group A detected 132 nodules including 112 true positive nodules and 20 false positive nodules with a sensitivity of 0.341±0.36. Group B detected 246 nodules including 231 true positive nodules and 15 false positive nodules with a sensitivity of 0.774±0.47. The sensitivity of group B was 43.3% higher than that of group A ($p<0.001$).The false positive rate of group A(0.190,20/105) and B (0.142,15/105) have no statistical difference($p>0.001$).

CONCLUSION

Compared with resident without AI software, the AI-assisted resident achieved higher detection sensitivity and equal false positive rate of the subsolid pulmonary nodules.

CLINICAL RELEVANCE/APPLICATION

It is recommended to use AI to assist resident to achieve desirable detection rate for subsolid nodules which are the most common imaging manifestations of early lung cancer.

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IN270-SD-WEB1

Automated Pancreas Segmentation Based on Multi-Modal Fusion of Dual-Energy CT Images

Wednesday, Dec. 4 12:45PM - 1:15PM Room: IN Community, Learning Center Station #1

Participants
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PURPOSE

Accurately segmenting pancreas from CT images remains highly challenging even using advanced deep learning techniques due to the extremely high variability in pancreas' shape and volume among patients. Our study aims to investigate the feasibility of fusing multimodal images as an effective mechanism for improving the accuracy of deep learning based pancreas segmentation.

METHOD AND MATERIALS

We collected 40 dual-energy CT scans of both the arterial and portal venous phase. For each CT scan, we generated 11 sets of portal venous phase recombinant monochromatic images from 40keV to 180keV. For those smaller than 100keV, the reconstruction stride was set to 10keV, and for those greater than 100keV the stride was 20keV. We refer to the images of different contrast as modalities. We employed the Recurrent Saliency Transformation Network (RSTN), which is a state-of-the-art deep learning network for automated pancreas segmentation. RSTN adopts a two-stage network to realize coarse-to-fine segmentation. The first-stage identifies a ROI containing the pancreas, and the second stage aims to produce accurate pancreas segmentation within the ROI. We trained the RSTN model using the 82 portal vein CT volumes from the NIH Pancreas-CT Dataset. We registered our CT images of the arterial and the venous phase via the non-rigid registration method. We applied the segmentation model to each portal venous registered CT volume of our dataset and obtain the corresponding segmentation result. We fused the segmentation results from different modalities to obtain the final results.

RESULTS

The average accuracy (DSC) of our conventional portal vein dataset is 81.8%. Modalities of arterial phase and 50keV, 60keV, 70keV, 80keV are found to yield more complementary information for portal vein than other keVs. By fusing portal vein and the five modalities, the accuracy of the RSTN segmentation model increases to 89.1%, which is 7.3% higher than the result of the portal vein.

CONCLUSION

Multi-modalities fusion can obviously improve the segmentation accuracy of pancreas and the improvement mainly lies in the miss segmented region of the portal vein, such as the head and tail of pancreas.

CLINICAL RELEVANCE/APPLICATION

Automated pancreas segmentation in medical images is a prerequisite for quantitative and qualitative analysis and for surgical assistance. It could be generalized to assisting early detection of pancreatic cancer and so on.

MI212-SD-WEB1

The Slow Component Apparent Diffusion Coefficient (ADC) is Replaced by Washout of the Dynamic Contrast Enhancement (DCE) Study for Prostate Cancer

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MI Community, Learning Center Station #1

Participants
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PURPOSE

A purpose of this study is to obtain relations of the slow component ADC and the wash out index of dynamic contrast enhanced imaging of prostate cancer.

METHOD AND MATERIALS

Diffusion-weighted and dyanmic contrast enhanced image were obtained from 39 patients with prostate cancer from 4 different institutions. The fast component ADC was calculated at b-values from 0 and 1000 s/mm2. and the slow component ADC was caluculated at b-values from 1000 and 2000 s/mm2. Regions of interest were set to the tumor legion and the contralateral normal lesionn, and slow component ADC index and wash-out index were calculated. The correlations between the wash-in and wash-out rates for dyanamic contrast enhanced imaging, and the fast and sloe ADCs for DWI were compared.

RESULTS

The coefficient of correlation of wash-out index and slow component ADC was 0.73, and the fast component ADC was 0.35.

CONCLUSION

A high correlation was shown between slow component ADC and the wash-out index. It has been already reported that there is a high correlation between IVIM and the fast component ADC. Therfore, the IVIM index and the slow component ADC by multi-b-values DWI can be substituted by the indices for dynamic contrast enhanced imaging. However, the choice for the b-values is important and optimal b-values should be chosen for an effective numerical value, in terms of diagnosis and shortening imaging time.

CLINICAL RELEVANCE/APPLICATION

This research indicates that patients can obtain equvalent diagnosis results without the contrast media on the examination of the prostate. This is extremely usuful in safety and the costs of the patients.

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MI225-SD-WEB2

18F-FMISO PET May Be Applicable in The Evaluation of Colorectal Cancer Liver Metastasis

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MI Community, Learning Center Station #2

Participants
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PURPOSE

Positron emission tomography (PET) imaging is a non-invasive functional imaging method used to reflect tumor spatial information, and to provide biological characteristics of tumor progression. The aim of this study was to focus on the application of 18F-fluoromisonidazole(FMISO) PET quantitative parameter of maximum standardized uptake value (SUVmax) ratio to detect the liver metastatic potential of human colorectal cancer in mice.

METHOD AND MATERIALS

Wound healing assays were performed to examine the ability of cell migration in vitro. 18F-FMISO uptake in CRC cell lines was measured by cellular uptake assay. 18F-FMISO-based micro-positron emission tomography imaging of colorectal liver metastasis and tumor-bearing mice was performed and quantified by tumor-to-liver SUVmax ratio. The correlation between the 18F-FMISO SUVmax ratio, liver metastases number, hypoxia-induced HIF-1a and serum starvation-induced GLUT-1 was evaluated using Pearson correlation analysis.

RESULTS

Compared with HT29 and HCT116, LoVo-CLM mice had significantly higher liver metastases ratio and shorter median survival time. LoVo cells exhibited stronger migration capacity and higher radiotracer uptake compared with HT29 and HCT116 in in vitro. Moreover, 18F-FMISO SUVmax ratio was significantly higher in both LoVo-CLM model and LoVo-bearing tumor model compared to models established using HT29 and HCT116. In addition, a linear regression analysis revealed a significant correlation between 18F-FMISO SUVmax ratio of CLM-mice and number of liver metastases larger than 0.5cm, as well as between 18F-FMISO SUVmax ratio and HIF-1a or GLUT-1 expression in tumor-bearing tissues.

CONCLUSION

18F-FMISO parameter of SUVmax ratio may provide useful tumor biological information in mice with CRC liver metastasis, thus allowing for better prediction of CRC liver metastasis and yielding useful radioactive markers for predicting liver metastasis potential in CRC.

CLINICAL RELEVANCE/APPLICATION

Better prediction of CRC liver metastasis and yielding useful radioactive markers for predicting liver metastasis potential in CRC.

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MI226-SD-WEB3

Knowing the Unknown-Utility of FDG PET CT in Evaluation of Pyrexia of Unknown Origin-PUO

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MI Community, Learning Center Station #3

Participants
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PURPOSE

This study aims to study the utility/ diagnostic performance of FDG PET CT in patients with PUO.

METHOD AND MATERIALS

Retrospective review of PET CT scans of 74 patients with PUO (mean age- 24 to 60) from jan 2017 to jan 2019 was performed . FDG PET CT was performed in these cases after inconclusive conventional imaging. FDG PET-CT was performed after injecting the FDG contrast and scan done after 60 minutes. FDG uptake was evaluated based on SUV max. Final diagnosis was based on Laboratory tests ,biopsy and imaging follow-up.

RESULTS

Out of 74 cases, FDG showed positive findings in 61 cases (82.4%). The FDG PET CT findings in positive cases were - 23 infection, 15 malignancy, 15 noninfectious inflammatory diseases and 8 other non specific findings. PET CT scan was done on an average at day 10(+/-5 days).Most commonly seen infection was tuberculosis in 70% of cases. Most commonly seen malignancy was lymphoma in 12 out of 15 cases (80%). Other malignancies identified included hematologic malignancies and multiple myeloma. Amongst the non infective inflammatory conditions like sarcoidosis, Castleman s disease and other granulomatous diseases were seen. Other non specific findings on PET CT included colitis, thyroiditis, vasculitis etc. Results Table: True Positive in 52 /74 cases. False Positive lesions in 9/74, due to reactive nodes confirmed with subsequent CT. True Negative lesions in 9/74, clinically self-limiting conditions with full spontaneous recovery. Such spontaneous recovery took 14 days on average (+/- 18 days) after hospital admission. False Negative lesions in 4/74. The sensitivity of PET CT was 92%, PPV was 85%.

CONCLUSION

Thus 18F-FDG PET-CT could help in identifying the cause in 85% of cases. A negative PET-CT with no spontaneous recovery still requires further investigations in order to exclude various causes such as non FDG avid small gastrointestinal/renal/pancreatic malignancies.

CLINICAL RELEVANCE/APPLICATION

FDG PET CT is one of the most valuable imaging tool in finding the unknown in PUO.

MK319-ED-WEB11

Not All 'Green' is Tophi - Focusing on the False Negatives and False Positives of DECT for Diagnosis of Gout

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #11

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TEACHING POINTS

Recently, there are reports focusing on false negatives(FN) and false positives(FP) of DECT for diagnosing gout. Here in this presentation, we introduce examples of FN and FP cases. Finally, we introduce ways to reduce FNs and FPs.

TABLE OF CONTENTS/OUTLINE

1. Introduction of DECT in diagnosis of gout 2. Sensitivity and specificity of DECT 3. The reason of FNs of DECT 4. The reason of FPs of DECT 5. Case based review 6. Strategies to reduce FN and FP optimizing DECT 7. Summary

MK334-ED-WEB8

Carpal Injury from a Fall on the Outstretched Hand

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #8

Awards
Certificate of Merit
Identified for RadioGraphics

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Myung Jin Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review radiographic and functional anatomy of the normal wrist. 2. To understand essential pathomechanism of the most common wrist injury, which is a fall on the outstretched hand. 3. To present imaging findings of carpal fracture and instability related to hyperextension injury, with emphasis on different features of each injury depending on severity and distribution of forces involved.

TABLE OF CONTENTS/OUTLINE

1. Radiographic anatomy; how to know properly obtained PA and lateral views, normal arrangement of carpal bones, three carpal arcs, scapholunate angle and distance, zone of vulnerability 2. Functional anatomy and kinematics of the wrist; Link, Column and Rows concepts. Distribution of extrinsic, intrinsic forces in the wrists of normal and hyperextension status 3. Imaging findings of carpal injuries on plain radiography, corresponding CT and MRI, presented with schematic drawings of pathomechanisms using animations - Carpal fracture; fracture of scaphoid, capitate. Resulting common complications of non-union, AVN of scaphoid, SNAC wrist, with descriptions based on patho-anatomy - Carpal instability; scapholunate dissociation, associated SLAC wrist and DISI, spectrum of perilunate injuries including perilunate dislocation, perilunate fracture-dislocation, lunate dislocation

MK335-ED-WEB9

Recent Update on Whole Body MRI for Musculoskeletal Imaging

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #9

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TEACHING POINTS

1. To understand the role of whole-body MRI and whole-body diffusion-weighted image (DWI) 2. To explain the updated knowledge of whole-body MRI techniques 3. To review the clinical applications in musculoskeletal tumors and rheumatic disease

TABLE OF CONTENTS/OUTLINE

1. Role of WB-MRI and WB-DWI - Whole body evaluation at a single scan: time and cost-effective than multiple regional MRIs - Disease extent, treatment response monitoring 2. Technical advances in WB-MRI and WB-DWI - Improving scan speed, image resolution, and contrast - Incorporation of DWI for WB-MRI - Current standard sequences of WB-MRI 3. Clinical applications for musculoskeletal tumors and rheumatic diseases - Tumors: Multiple myeloma, bone metastasis, malignant fracture - Rheumatic diseases: ankylosing spondyloarthritis, psoriatic arthritis, rheumatoid arthritis 4. Future direction - Quantitative biomarker: standardization and qualificiation

Printed on: 10/29/20

MK337-ED-WEB7

Muscle MRI in Neuromuscular Disorders

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #7

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TEACHING POINTS

Neuromuscular disorders (NMDs) include a heterogeneous group of neuropathies, myopathies, mitochondrial and inflammatory disorders with remarkable variability in genetic abnormalities and overlapping clinical phenotypes. Onset of symptoms may be early or as late as in adult life. Investigation with initial diagnostic tests like creatine kinase and electrophysiologic studies lack specificity. Neuromuscular imaging plays an important role in the evaluation of muscle dystrophy. Muscle involvement patterns may be helpful in identifying the specific type of NMD. The purpose of this exhibit is to 1. Review of types of NMDs 2. Discuss muscle imaging techniques 3. Highlight findings and muscle involvement patterns in various NMDs

TABLE OF CONTENTS/OUTLINE

The exhibit will be organized under the following topics: Introduction: Classification of NMDs as congenital and acquired, and based on lesion location within the upper or lower motor neuron Imaging in identifying muscle edema, atrophy and quantification of changes. Muscle imaging techniques: MRI protocol employed in our institution and the rationale Representative cases with discussion of imaging findings and muscle involvement patterns in various NMDs Summary and conclusion

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MK370-SD-WEB1

Chondral Lesions of the Wrist: A Meta-Analysis Comparing Performance of MRI, MRA and CTA

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #1

Participants
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PURPOSE

Due to the complex anatomy of the wrist joint, wrist arthroscopy is often required for the assessment of patients with wrist pain. Advanced imaging modalities such as magnetic resonance imaging (MRI), MR arthrography (MRA), and CT arthrography (CTA) have shown promising results in detecting chondral lesions of the wrist. However, the optimal imaging modality remains to be determined. In this study, we intend to evaluate the diagnostic performance of MRA, MRI and CTA in detecting chondral lesions of the wrist, with arthroscopy as the standard of reference

METHOD AND MATERIALS

A comprehensive literature search (until March 2019) was performed by two investigators independently and original studies on diagnostic performance of MRI, MRA or CTA in detecting chondral lesions of the wrist were included. Pooled values of sensitivity and specificity were obtained using fixed or random effect models based on the level of heterogeneity. To compare the diagnostic odds ratio (DOR) of these three modalities, DOR was regressed against their category and relative DOR (rDOR) was obtained

RESULTS

Our literature search yielded 767 related records. Of these, 15 eligible studies were read at the level of full text and 7 studies were included. Results of 109 CTA exams, 241 MRA exams and 191 MRI exams were pooled in three separate categories. All MR imaging was performed by 1.5 T scanners. The pooled estimates of sensitivity of CTA, MRA and MRI were 94% (95% confidence interval: 80%-99%), 63% (49%-75%) and 45% (35%-55%), respectively. The pooled estimates of specificity of CTA, MRA and MRI were 98%(94%-100%), 97% (94%-99%) and 83%(79%-87%), respectively. A high degree of heterogeneity was observed (I2>50%). Comparing DOR of all 3 modalities, CTA provided the highest performance (rDOR=3.2, P-value=0.006). MRA performed better than MRI (rDOR=9.1 P=0.04).

CONCLUSION

For detection of chondral lesions of the wrist, CTA appears to be more accurate than MRA and MRI utilizing 1.5 T scanners. MRA was more accurate than MRI performed with similar magnetic field

CLINICAL RELEVANCE/APPLICATION

Further studies are warranted to determine the accuracy of 3T MRA/MRI and compare its performance with CTA

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MK371-SD-WEB2

Skeletal Muscle, Visceral and Subcutaneous Fat Area Measurements Inter-Reader Variability Assessment

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #2

Participants
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CONCLUSION

Inter-reader reproducibility in measuring skeletal muscle, VFAT and SUBQ on CT axial images at the mid-L3 level, using the proposed technique, were highly consistent amongst readers. There was no observable impact of age, CT contrast or gender on the measurements.

Background

Area measurements of skeletal muscle, visceral (VFAT) and subcutaneous fat (SUBQ) have proven to be useful in clinical studies for diagnosis and monitoring treatment efficacy. These measurements are typically performed on computerized tomography (CT) abdominal images at the axial L3 level. For a measurement to be useful in a clinical setting, precision and reproducibility is critical. The aim of this study is to assess the inter-reader reproducibility of quantifying the muscle, VFAT and SUBQ by a single CT slice at mid-L3.

Evaluation

CT scans from 10 patients were randomly selected from a cohort of liver transplant evaluations. Three of the patients analyzed were female with an average age of 59.1 years. Four patients' scans were with contrast. All CT scans were obtained with 5.0mm slice thickness. Analysis was performed by two senior radiologists and three trained technicians blinded to each other's measurements. Axial mid-L3 level was determined by identifying the intersection of lines connecting the superior anterior to inferior posterior and the superior posterior to inferior anterior vertebra endplate on the sagittal view. Area measurements were acquired for muscle, VFAT and SUBQ. The most senior radiologist's results were used as a reference.

Discussion

Inter-class correlation (ICC) and Bland-Altman analysis were used to evaluate the results. One subject's data was excluded due to scanner inconsistencies. The mean and standard deviation area measurements of muscle, VFAT and SUBQ were 121.6 ± 23.7 cm2, 88.1 ± 60.8 cm2 and 212.7 ± 121.0 cm2, respectively. The ICCs between the reference reader and the others ranged from highest 0.99 (muscle) to lowest 0.79 (SUBQ). The average Bland-Altman limits of agreement were 23.9 to -22.4 for muscle, 82.6 to -66.8 for VFAT, and 230.8 to -168.9 for SUBQ.

MK372-SD-WEB3

Detecting Mild Fatigue of Lower-Limb Skeletal Muscle Using Stimulated Echo in Q-Space Imaging

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #3

Participants
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PURPOSE

Q-Space Imaging (qsi) helps characterizing restricted diffusion of water molecules and determining parameters like cell diameter and membrane permeability.Stimulated echo (STE) preparations can extend the diffusion time by adjusting the mixing time (TM) without extending the echo time (TE), which has proved useful in DTI. T2-values increase after skeletal muscle activity. qsi can capture water-molecule diffusion in more detail than conventional methods and allows obtaining micro-structural information. It is speculated that qsi is more sensitive to changes in muscle cells than T2-values. We evaluated the usefulness of STE-qsi for lower-limb skeletal muscles and possibilities of capturing mild fatigue due to exercise.

METHOD AND MATERIALS

A 3T MRI scanner was used to measure DWI using a STE-EPI prototype sequence. T2-maps were calculated based on images with different TE's using vendor software.Seven approved subjects were asked not to exercise for one week. Then, they were asked to perform one set (100 repetitions) of heel-up exercise by standing on one-leg (right foot) on the test day, immediately before MR imaging.Analyzed skeletal muscles included anterior tibialis muscle (TA), soleus muscle (SOL), and gastrocnemius (GM), with left and right lower limbs as the control (CG) and stress groups (SG), respectively. Estimates of the signal-to-noise-ratio (SNR) were calculated from DWI intensities.A customized program (Embarcadero Technologies, Inc., Austin, TX, USA) was used for qsi calculations. Fractional anisotropy (FA) of zero-place displacement images (ZP), and full width at half-maximum images (FWHM) was determined based on qsi and evaluated using Wilcoxon signed rank sum test and effect size.

RESULTS

Figure 1 shows SNR estimates of the control group. SE exhibits the highest SNR. For STE, SNR declined with increasing TM.Figure 2 shows FA values of the control group, where both FWHM and ZP showed significantly different FA values between TA and SOL. Figure 4 shows representative images for one subject.Figure 3 shows FA and T2 values of the control and stress groups in GM. For FWHM, a significant difference was noted in STE TM400 [p0.05/d = large].

CONCLUSION

The usefulness of STE qsi was confirmed using long diffusion time in ZP. STE captures changes in fine muscle cells, which are not detected in T2 maps.

CLINICAL RELEVANCE/APPLICATION

Capturing minute muscle fatigue contributes to treatment policy decision.

MK407-SD-WEB4

Cryoablation for Advanced and Refractory Desmoid Tumors: A Promising Treatment?

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #4

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PURPOSE

To assess efficacy and safety of percutaneous cryoablation (CA) for advanced and refractory extraabdominal desmoid tumors

METHOD AND MATERIALS

This retrospective study reviewed 31 consecutive patients with painful desmoid tumors (EVA>5) evolving despite well-managed medical treatment treated by CA between 2007 and 2019. Pain reduction, progression free survival (PFS) (clinical or radiographics), tumor shrinkage rate (TSR) (volume of the tumor at 1 and 3 years compared to the volume before treatment) and complications were collected. Clinical efficacy of treatment was defined by VAS<3 after CA. Kaplan Meier method was used to outline PFS. Paired sample t-test was used to compare volume of tumors before treatment and at 1 year and 3 year.

RESULTS

With a median follow-up of 30 months (range 1- 98 months, IQR: 8-54), the PFS was 82.6% (CI95%: 69.2, 95.9) at 1 year and 75.7% (CI95%: 60.6, 90.8) at 3 years. Clinical efficacy of treatment was obtained for 89.6% (CI 95%: 78.6,100) of patients. Median volume of desmoid tumor before treatment was 92.4mL (range 2.1-1727.9 mL, IQR: 49.7- 298.5). TSR was 48.2% (CI95%: 37.2, 72.3; p=0.002) at 1 year and 74,4% (CI95%: 59.1, 89.8; p=0.002) at 3 year. Thermo protective measures for critical structures closed to the tumor were used in 74,2% of cases. Five patients (16.2%) required 2 sessions of CA for total control. Adverse events rate was 31.2%, the most common was oedema and temporary increase of pain in the days following CA.

CONCLUSION

CA is an effective treatment for advanced and refractory extraabdominal desmoid tumor, that induces durable responses. Safety profile is acceptable but requires a good mastery of protective measures for surrounding organs.

CLINICAL RELEVANCE/APPLICATION

Among patients with progressive, refractory and symptomatic desmoid tumors, CA is an effective treatment that induces durable responses.

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MK408-SD-WEB5

Deep Learning-Based Automatic Fat Quantification of Supraspinatus Muscle: Quantitative Comparison of a Single Slice at Y-View versus Total MR Slices

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To develop a deep learning-based automatic fat quantification from 6-point Dixon sequence (6-Dixon) and to determine whether the standard assessment for muscle fatty infiltration using a single image slice is indicative of the total fat fraction in supraspinatus muscle (SSm).

METHOD AND MATERIALS

This study retrospectively analyzed 72 MR images with (a) extended oblique sagittal T1-weighted images (T1WI) and (b) fat fraction (FF) map generated from 6-point Dixon sequence including total SSm. A deep learning model-based on the U-Net convolutional network architecture was developed to perform automatic segmentation. Subjects were divided into 3 groups (score 0, n=49; score 1, n=17; score 2, n=6) according to the Fuchs scores of SSm based on T1WI. Deep learning-derived FFs of SSm on a single slice at Y-view (FFy) and total MR slices (FFt) were compared in 3 groups. Performance of the automatic segmentation was evaluated on Dice coefficient overlap with the manual segmentation.

RESULTS

The models produced strong Dice coefficient of 0.828 and accuracy of 0.996. The average of FFy and the average of FFt for each group were as follows: score 0, 17.38 and 19.81%; score 1, 17.02 and 28.56%; score 3, 16.14 and 43.11%. FFy was statistically different from FFt in all groups (score 0, p=.011; score 1, p=.001; score 2, p=.028). The difference between FFy and FFt was up to 41.7% in Fuchs score 2 group.

CONCLUSION

A deep learning-based fat quantification can achieve fully automated and accurate evaluation for muscle fat fraction in SSm. A single sagittal slice at Y-view is not indicative of the total fat fraction in SSm, especially in group with severe fatty infiltration.

CLINICAL RELEVANCE/APPLICATION

Deep learning-based automatic quantification could allow accurate and rapid fat quantification of total SSm, not only a single MR slice. It could be a more accurate preoperative factor to predict surgical outcome.

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MK409-SD-WEB6

Novel 3D Cone-Beam CT Scan Mode on a Multipurpose X-Ray System: Evaluation of Image Quality in Cadaveric Elbow Scans Compared to Third Generation Dual-Source CT

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MK Community, Learning Center Station #6

Participants
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PURPOSE

To assess image quality (IQ) provided by the new prototype version of a twin robotic X-ray system's 3D cone-beam CT (CBCT) mode for human cadaveric elbow studies.

METHOD AND MATERIALS

A multifunctional X-ray system with novel prototype CBCT mode and a third-generation dual-source CT (3rd Gen. DSCT) were used to examine 16 cadaveric elbows obtained from body donors. Imaging was performed with equivalent low-dose (LD; CTDIvol 16cm = 3.3 mGy) and regular clinical protocols (RD; CTDIvol 16cm = 13.8 mGy). IQ was subjectively evaluated by two independent radiologists on a seven-point Likert scale (1 = very poor; […] 6 = very good; 7 = excellent). For quantification of interrater reliability, we report the intraclass correlation coefficient (ICC) based on absolute agreement in a 2-way random-effects model. In addition to observer ratings, we conducted computer-assisted estimation of spatial resolution in cancellous bone by quantifying the pixel amount within 20% from the maximum and minimum grey values inside a region of interest. Good resolution between trabecula and fatty marrow is indicated by high pixel counts inside the defined ranges.

RESULTS

Observers agreed that CBCT imaging delivered superior IQ in comparison to DSCT scans (all $p<=0.004$ for RD; all $p<=0.001$ for LD). IQ was evaluated to be very good or excellent in 100%/100% (reader 1/ reader 2) of RD CBCT, 100%/93.8 of LD CBCT, 62.5%/43.6% of RD DSCT and 0.0%/0.0% of LD DSCT studies. Single measure ICC was 0.945 (95% confidence interval, 0.912-0.966; $p<0.001$), implying excellent reliability. In objective assessment of IQ, RD CBCT studies (median pixel count 1227 [IQR 692;1651]) provided higher pixel counts in the defined ranges than LD CBCT (663 [421;874] $p<0.001$), RD DSCT (646 [343;1018]; $p=0.001$) and LD DSCT scans (313 [231;445]; $p<0.001$), indicating better resolution of trabecula and bone marrow. No substantial difference was found between LD CBCT and RD DSCT, suggesting equal IQ in cancellous bone.

CONCLUSION

In cadaveric elbow studies, the prototype CBCT mode of the twin robotic X-ray system provides superior subjective and objective image quality compared to a 3rd Gen. DSCT scanner at equivalent radiation dose levels.

CLINICAL RELEVANCE/APPLICATION

With superior image quality of the new 3D CBCT scan mode compared to 3rd Gen. DSCT, the multipurpose X-ray system may hold potential to be a future one-stop-shop device for elbow imaging in trauma.

MS004-EB-WEB

High Resolution Ultrasound of the Face in the Assessment of Cosmetic Fillers: The Role of the Radiologist

Wednesday, Dec. 4 12:45PM - 1:15PM Room: MS Community, Learning Center Hardcopy Backboard

Awards
Certificate of Merit

Participants
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TEACHING POINTS

To outline the normal appearance and anatomy of the skin on high resolution ultrasound (HRUS). To explain the usefulness of HRUS in the identification and quantification of different cosmetic fillers, describing different sonographic patterns. To review the new role of the radiologist in the diagnosis and recognition of complications derived from cosmetic filling agents.

TABLE OF CONTENTS/OUTLINE

Introduction Technical requirements for HRUS of the face Normal anatomy of the skin on HRUS Types of cosmetic fillers (Resorbable and Non-resorbable) Sonographic patterns of different filling agents (Vacuolar, Snow Storm, Acoustic Shadowing and Cottony) Assesment of the most common complications of cosmetic fillers injections Face mapping for reporting Summary and conclusions (HRUS of the skin is a useful tool for diagnosing the type of CF, its location and quantity, as well as local blood flow. The ideal is to make diagnosis with just the ultrasound examination, avoiding the need for a biopsy or additional imaging studies. It is also an effective tool either for diagnosis as well as for management and detection of complications or adverse reactions)

NM137-ED-WEB6

A Pictorial Review of Positron Emission Tomography with 18F-FDG in Rheumatoid Arthritis

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NM Community, Learning Center Station #6

Participants
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TEACHING POINTS

Rheumatoid arthritis (RA) is a chronic autoimmune multi-systemic inflammatory disease which predominantly affects the synovial tissues and joints. Positron emission tomography (PET) is a potential technique for the detection and quantification of inflammation in vivo. This exhibit describes the role of 18F-fluorodeoxyglucose (18F-FDG) PET on the assessment of RA in clinical practice This exhibit also describes some other PET tracers for imaging RA

TABLE OF CONTENTS/OUTLINE

1. Introduction Rheumatoid arthritis Diagnosis of RA Imaging modalities in RA 2. Present role of FDG PET in RA Diagnostics (Differential Diagnosis) Assessment of disease activity Evaluation of treatment response Prediction of joint destruction Detection of RA-associated disease 3. Other PET imaging tracer in RA 4. Summary

NM138-ED-WEB7

Nuclear Scintigraphy in Adult Congenital Cardiovascular Diseases

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NM Community, Learning Center Station #7

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TEACHING POINTS

To describe the role of nuclear scintigraphy in the diagnosis and management of adult congenital heart and vascular diseases (ACHD).To review the different scintigraphy imaging features in patient with ACHD, with focus on ventilation/ perfusion (V/Q) and myocardial perfusion scans.To illustrate the different technical consideration in nuclear imaging in patients with ACHD

TABLE OF CONTENTS/OUTLINE

Role of pulmonary and myocardial nuclear scintigraphic imaging in the diagnosis and management if patients with ACHD.An overview of scintigraphic imaging appearances in patients with ACHD.Specific scintigraphic imaging appearances in postoperative adult patients with congenital heart diseases.Technical challenges and consideration in scintigraphy imaging of patients with ACHD.Differential diagnosis and imaging pitfalls.

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NM215-SD-WEB1

Correlation of Wall Shear Stress on MR Angiography with 18F-FDG and 18F-NaF Uptake on PET/CT in Patients with Carotid Artery Stenosis

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NM Community, Learning Center Station #1

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PURPOSE

Arterial stenosis and vulnerable plaque in carotid artery are the important causes of stroke. The purpose of this study was to evaluate the correlation of wall shear stress by computational fluid dynamics on MR angiography with 18F-FDG and 18F-NaF uptake on PET/CT in patients with carotid artery stenosis.

METHOD AND MATERIALS

A total of 30 carotid arteries in 15 patients with carotid artery stenosis were examined with MR angiography, 18F-FDG PET/CT and 18F-NaF PET/CT. In one patient, only one carotid artery was analyzed because the stenosis was too narrow to analyze. The maximum wall shear stress (WSS) of the carotid artery was quantitatively assessed by computational fluid dynamics analysis on MR angiography. 18F-FDG and 18F-NaF uptake in carotid arteries were semiquantitatively assessed using maximum standardized uptake value (SUVmax).

RESULTS

The mean (±SD) maximum WSS was 25.14±18.16 Pa. On 18F-FDG PET/CT, the mean (±SD) SUVmax was 2.76±1.40. On 18F-NaF PET/CT, the mean (±SD) SUVmax was 2.53±0.97. A significant correlation was observed between the maximum WSS and the 18F-FDG SUVmax ($r = 0.77$, $p < 0.001$). There was no significant correlation between the 18F-NaF SUVmax and the maximum WSS or between the 18F-NaF SUVmax and the 18F-FDG SUVmax.

CONCLUSION

Based on the results of this preliminary study, it was found that WSS on MR angiography was associated with the 18F-FDG uptake on PET/CT in carotid artery stenosis patients.

CLINICAL RELEVANCE/APPLICATION

Wall shear stress on MR angiography was associated with the 18F-FDG uptake on PET/CT in carotid artery stenosis patients.

NM222-SD-WEB2

FDG Uptake of Bone Marrow on PET Has Prognostic Potential for Predicting Distant Recurrence in Breast Cancer Patients After Surgical Resection

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NM Community, Learning Center Station #2

Participants
Sang Mi Lee, Cheonan, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

FDG uptake of bone marrow (BM) on PET/CT is known to be related with systemic inflammatory response to cancer. Considering the significant association of host inflammatory response to tumor progression and metastasis, parameter that reflects the degree of systemic inflammatory response could be used to predict the risk of distant recurrence. The aim of this study was to assess the prognostic value of FDG uptake of BM as well as metabolic parameters of primary tumor on PET/CT for predicting distant recurrence in patients with breast cancer.

METHOD AND MATERIALS

FDG PET/CT images of 345 breast cancer patients without distant metastases were retrospectively evaluated. Maximum standardized uptake value (SUV), metabolic tumor volume (MTV), and total lesion glycolysis (TLG) of primary breast cancer and bone marrow-to-liver uptake ratio (BLR) on PET/CT were measured. A cox proportional hazard regression model was used to evaluate prognostic potential of parameters for predicting recurrence-free survival (RFS) and distant RFS.

RESULTS

BLR was significantly correlated with T stage, serum inflammatory markers, and recurrence pattern ($p<0.05$). Patients with high BLR and TLG showed worse RFS and distant RFS than those with low BLR and TLG. On multivariate analysis, BLR and TLG were significantly associated with both RFS ($p=0.002$ and hazard ratio 3.19 for BLR; $p=0.010$ hazard ratio 3.30 for TLG) and distant RFS ($p=0.009$ and hazard ratio 5.38 for BLR; $p=0.015$ and hazard ratio 8.42 for TLG) along with T stage and estrogen receptor status. None (0%) of the patients with TLG <9.00 g and BLR <0.81 experienced distant recurrence, but, the distant recurrence rate of patients with TLG >=9.00 g and BLR >= 0.81 was high at 21.0%.

CONCLUSION

BLR on pretreatment FDG PET/CT were significant predictors for RFS and distant RFS in patients with breast cancer.

CLINICAL RELEVANCE/APPLICATION

By combining FDG uptake of BM and volumetric PET/CT index of primary cancer, the risk of distant recurrence could be stratified in patients with breast cancer after curative resection.

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NM223-SD-WEB3

Early-Phase F-18 Florbetaben PET as an Alternative Modality for Diagnosis of Dementia

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NM Community, Learning Center Station #3

Participants
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PURPOSE

Early-phase FBB (E-FBB) brain PET has recently been identified as a surrogate for brain perfusion and can provide complementary 18F-fluorodeoxyglucose (FDG)-like information by semi-quantification analysis. To prove the competitiveness of FBB, we investigated the diagnostic performance between E-FBB PET and FDG brain PET with visual scoring system and uptake pattern analysis.

METHOD AND MATERIALS

This prospective study included 40 patients with clinical suspicion of dementia due to neurodegenerative disease. The amyloid brain PET was acquired in dual time-point with FBB; E-FBB PET was acquired for the initial 5 minutes after injection, and late-phase (L-FBB) at 90 minutes after injection. FDG PET was also acquired in all subjects. E-FBB and FDG PET data were reviewed by 3 expert nuclear medicine physicians, and were analyzed with visual scoring system from the segmented cerebral regions. The uptake patterns were analyzed to specify the disease and the determined diseases by both PET scans were statistically compared with using concordance correlation coefficient. Furthermore, regional standardized uptake value ratio (SUVR) with whole brain mean normalization were calculated for E-FBB and FDG PET, and analyzed the relationship between E-FBB and FDG PET scans.

RESULTS

Among the 40 patients (mean age 68.5 ± 9.8 years), 19 were amyloid-positive, and 21 were amyloid-negative on L-FBB PET. The rated scores from E-FBB and FDG PET were significantly correlated ($r=0.664$, $p < 0.0001$). According to the sub-analysis in each cerebral region, the best correlation between two PET scans was achieved in frontal lobe (0.752, $p < 0.0001$), followed by occipital and parietal lobes (0.730 and 0.696, respectively). The rated scores from both E-FBB and FDG PET were statistically correlated with R2 value of 0.4464 ($p < 0.0001$). The rated score values were relatively higher in FDG PET. Disease types, specified by E-FBB and FDG PET, were statistically correlated (concordance correlation coefficient=0.9035). On the analysis about VOI-based comparison of E-FBB and FDG PET, all brain regions showed significant correlations ($p < 0.0001$).

CONCLUSION

E-FBB PET images were well correlated with FDG PET images. The results of differential diagnosis of dementia were similar with both PET scans. E-FBB PET could potentially be a useful biomarker for diagnosis of dementia in place of FDG PET.

CLINICAL RELEVANCE/APPLICATION

Diagnosis of Dementia

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NM246-SD-WEB4

18 F-PET/MRI versus Contrast-Enhanced MRI in Detecting Loco-Regional HNSCC Nodal Metastases

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NM Community, Learning Center Station #4

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PURPOSE

To evaluate the accuracy of established dimensional and morphological criteria for MRI vs integrated 18 F-PET/MRI for the identification of loco-regional lymph node metastases in patients affected by newly diagnosed head and neck squamous cell carcinoma (HNSCC).

METHOD AND MATERIALS

we retrospectively reviewed 26 patients affected by histologically proven HNSCC who underwent gadolinium-enhanced 18F-FDG PET/MRI as part of their staging. All neck lymph nodes were classified using dimensional, morphological and dimensional/morphological criteria based on contrast- enhanced MR images. Then, lymph nodes were evaluated using integrated 18F-PET/MRI images by a nuclear medicine physician and a radiologist in consensus. ROC curves were drawn to compare the different techniques. Lymph node histopathology was considered the reference standard.

RESULTS

35/865 lymph nodes were malignant at histopathology (3 with micro-metastases). Sensitivity and specificity were 48.6% and 99.5% for MRI using dimensional criteria, 60.0% and 99.6% for MRI using morphological criteria, 60.0% and 99.4% for MRI using dimensional or morphological criteria and 74.3% and 97.6% for integrated PET/MR respectively. AUC for PET/MRI (0.859) was higher than for dimensional (0.740; $p<0.05$), for morphological (0.798; $p<0.05$) and dimensional/morphological criteria (0.797; $p<0.05$). SUVmean of the 26 true positive lymph nodes identified by PET/MRI was significantly higher than SUVmean of the 20 false positive lymph nodes (5.69 +–3.50 vs 2.64 +– 0.62; $p=0.0001$).

CONCLUSION

Integrated PET/MR improved diagnostic accuracy in detection of metastatic lymph nodes in patients affected by HNSCC compared to traditional contrast-enhanced MR.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/MRI can improve regional nodal metastases detection in HNSCC patients

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NM247-SD-WEB5

Using Artificial Intelligence to Quantify Simultaneous FDG and [68Ga]DOTATATE Neuroendocrine Tumor PET Imaging

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NM Community, Learning Center Station #5

Participants
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PURPOSE

Both FDG and [68Ga]DOTATATE PET-CT are routinely used in clinical for quantitative imaging neuroendocrine tumors (NET) glucose metabolism and somatostatin receptor subtype 2 (SSTR2) density, respectively. The objective of this study is to investigate the feasibility of quantification of simultaneous FDG and [68Ga]dotatate neuroendocrine tumor PET imaging using machine learning approach.

METHOD AND MATERIALS

Twenty-seven NET patients were recruited in the study. All patients had 45-min [68Ga]DOTATATE single-bed dynamic PET-CT scans, and eight of them have both FDG and [68Ga]DOTATATE and FDG dynamic PET-CT scans. Aorta TACs were used blood input function for kinetic modeling and computer simulation. An irreversible 2-tissue compartmental model with blood input function was used for simulation. The weighted average of simulated tracer activity curves is used to mimic simultaneous FDG and [68Ga]DOTATATE PET study. Random Forests Regression Models (RFM) was proposed to separate the mixed TACs in blood and tissue by computer simulation. In addition, tracer uptake rate constants Ki and initial distribution volume (Vid) are estimated from tissue-TACs by the RFM for parametric imaging.

RESULTS

For the aorta-TACs, the prediction errors of FDG and Ga68dotatate are 2.71% and 9.31%, respectively. And for the tissue-TACs, the prediction errors of FDG and Ga68dotatate are 7.69% and 11.41%, respectively. The parametric images generated by the Patlak plot from last 10 min are not reliable and too noise to be used in clinical, while the parametric images generated by the RFM from the last 10 min scan are comparable to the ones from last 35 min scan. In addition, the variance of estimates of Ki and Vid from RFM are almost constant at different noise level. But for the Patlak, the variance of Ki and Vid at high noise level are larger than the ones at low noise level.

CONCLUSION

It is feasible to reliably separate the mixed FDG and [68Ga]DOTATATE time activity using RFM algorithm. The parametric images of Ki and Vid by RFM is robust for clinical evaluation. The evaluation by human NET dynamic PET study with simultaneous FDG and [68Ga]DOTATATE injection will be investigated by the ongoing project.

CLINICAL RELEVANCE/APPLICATION

The simultaneous FDG and [68Ga]DOTATATE PET imaging on NET patient will reduce the time and cost of diagnosis, and improve the accuracy in NET detection, grading, staging, and monitoring the responses to treatments.

NR354-ED-WEB9

Staging of Sinonasal Cancer: What the Radiologist Needs to Know

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #9

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TEACHING POINTS

Cancers arising in the nasal cavity and paranasal sinuses are rare, consisting approximately 3% of head and neck malignancies. Each year approximately 2,000 people in the United States are diagnosed with these cancers. Most of these cancers occur in the nasal cavity and maxillary sinus. Two TNM staging systems have been developed for nasal cavity/ethmoid sinus tumors and maxillary sinus tumors. A staging system for frontal and sphenoid sinus tumors does not currently exist. In this education exhibit, we aim to do an imaging review of the eighth (2017) tumor, node, metastasis (TNM) staging systems developed by the American Joint Committee on Cancer (AJCC) and the Union for International Cancer Control (UICC). We will discuss important landmarks for each T stage and which additional findings may upstage the patient.

TABLE OF CONTENTS/OUTLINE

1. Overview of two different TNM staging systems for sinonasal cancers, for tumors arising in the nasal cavity and ethmoid sinus, and for those arising in the maxillary sinus. 2. Multiple cases with known histopathological diagnosis will be reviewed and each anatomical landmark for T-staging will be discussed. 3. A simplified checklist for the important anatomical structures will be made. Impact of each stage on prognosis will also be discussed.

NR355-ED-WEB10

Head and Neck Radiation Therapy: A Primer for Radiologists

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #10

Participants
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TEACHING POINTS

1. Intensity Modulated Radiation Therapy (IMRT) treatment delineates clinical target volume based on gross tumor and subclinical disease. 2. IMRT treatment planning delineates differential dose specifications based on the primary, stage, and surrounding organs at risk. 3. Imaging of radiation treatment effects: Recognize findings of acute radiation toxicity. 4. Imaging of radiation treatment effects: Recognize findings of early radiation changes. 5. Imaging of radiation treatment effects: Recognize findings of late complications.

TABLE OF CONTENTS/OUTLINE

1. Discuss the modes of radiotherapy frequently used in head and neck cancers, including IMRT and SBRT. 2. Discuss rationale for choice of radiation therapy and the principles behind radiation treatment planning, including target delineation, normal tissue contouring, and normal tissue dose constraints. 3. Review acute, subacute, and chronic post-radiation effects and their imaging correlates through case examples.

NR356-ED-WEB11

Advanced Imaging Techniques for the Assessment of Intracranial Vascular Pathology: 4D Flow and Beyond

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #11

Participants
Warren Chang, MD,MBA, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Charles Q. Li, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Aichi Chien, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

After review of this educational exhibit, the learner will be able to: 1) Understand the role of advanced imaging techniques such as 4D Flow MRA in the assessment of intracranial vascular pathology. 2) Explain how emerging technology such as machine learning and 3D Printing can be applied to evaluate intracranial vascular processes. 3) Understand the role of hemodynamics, including parameters such as wall shear stress (WSS), pressure, velocity, and flow in the pathophysiology of intracranial vascular abnormalities. 4) Explain the current prevailing theories regarding hemodynamics and intracranial stenoses, aneurysms, and arteriovenous malformations, and how they can guide risk stratification and treatment planning.

TABLE OF CONTENTS/OUTLINE

1) Introduction 2) 4D Flow MRA a) Physics and Background b) Advances and Improvements 3) Hemodynamics a) Wall Shear Stress b) Pressure c) Velocity/Flow 4) New Techniques a) Machine Learning b) 3D Printing 5) Pathologies a) Stenoses/Ischemic Stroke b) Aneurysms c) Arteriovenous Malformations 6) Summary

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NR385-SD-WEB1

Long-Term Rupture Risk in Patients with Unruptured Intracranial Aneurysms Treated with Endovascular Therapy: A Systematic Review and Meta-Analysis

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #1

Participants
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David F. Kallmes, MD, Rochester, MN (*Abstract Co-Author*) Research support, Terumo Corporation Research support, Medtronic plc Research support, Sequent Medical, Inc Research support, Benvenue Medical, Inc Research support, General Electric Company Consultant, General Electric Company Consultant, Medtronic plc Consultant, Johnson & Johnson

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PURPOSE

Surveillance imaging and routine retreatment of previously unruptured, coiled aneurysms remains routine, even though reports of rupture of these aneurysms are extremely rare. We performed a systematic review and meta-analysis of studies to examine the long-term risk of rupture over a follow up duration of >=6 months in patients with unruptured intracranial aneurysm (UIA) who underwent endovascular therapy.

METHOD AND MATERIALS

Multiple databases were searched for relevant publications between January 1995 and December 2018. Studies reporting outcome of long-term risk of rupture over a follow up duration of >=6 months in patients with UIA who underwent endovascular therapy were included. Random effects meta-analysis was used for pooling across studies and results were expressed as long-term (>=6 month) rupture rate per 100 Patient-Year (PY) with respective 95% confidence intervals (95% CIs). For documented ruptured aneurysms during follow-up, we collected data on size and completeness of initial treatment.

RESULTS

A total of 26 studies were identified (Figure). Among 5,309 patients with a mean follow-up duration of 3.0 years, a total of 12 patients (0.23%) experienced rupture of previous UIAs following endovascular treatment. Nine of these 12 patients harbored aneurysms that were either large, incompletely treated, or both. A total of 2 anterior circulations, small, completely coiled aneurysms subsequently ruptured. The long-term rupture rate per 100 PY for UIAs treated with endovascular therapy was 0.48 (95% CI: 0.45 to 0.51). Retreatment was carried out in 261 (4.9%) of these 5,309 patients.

CONCLUSION

Post-coil embolization spontaneous rupture of previously unruptured, small- and medium-sized, well treated aneurysms, is exceedingly rare. This finding suggests that frequent, prolonged surveillance imaging may not be warranted in specific clinical situations.

CLINICAL RELEVANCE/APPLICATION

The current study findings suggest that frequent, prolonged surveillance imaging may not be warranted in specific clinical situations of previously unruptured, small- and medium-sized, well treated aneurysms.

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NR386-SD-WEB2

Radiogenomic Analysis of Glioblastoma on Pre-Treatment Gd-T1w MRI Reveals Gender-Specific Imaging Features and Signaling Pathways

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #2

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

Recent epidemiological studies suggest that gender differences in Glioblastoma (GBM) influence the prognostic outcome of patients, and thus should be considered for targeted treatment. We hypothesize that (1) radiomic features from GBM sub-compartments (peri-tumoral edema, enhancing tumor, non-enhancing and necrotic core) on pre-treatment Gadolinium(Gd)-T1w MRI will have distinct imaging attributes that are prognostic of gender-specific survival, and (2) corresponding transcriptomic data can reveal signaling pathways that drive gender-specific tumor biology and treatment response.

METHOD AND MATERIALS

203 pre-operative Gd-T1w MRI(1.5T/3T scans, multi-center) of GBM (78 females[f] & 125 males[m]) from TCIA(n=130), Ivy-GAP(n=32) and participating institution(n=41), along with transcriptomic data were considered. For each study, tumor sub-compartments on MRI were segmented and verified by board-certified neuro-radiologists. 936 3D-radiomic features (Gabor, Haralick, and Laws energy) were extracted. 2 radiomic risk scores (RRS): [1] Female (f=31) consisting of 3 features, and [2] male (m=83) RRS with 7 features were developed and validated on 2 independent test cohorts (f=31, m=42) using multivariate cox regression. Pathway analysis was investigated on mRNA(Affymetrix) of training cohort using Gene Ontology.

RESULTS

Female RRS (p=0.02, Hazard Ratio [HR]=4.63) was associated with laws energy features (detects edges) within enhancing region of tumor. Similarly, male RRS (p=0.03, HR=0.4611) was associated with gradient based gabor wavelets from edematous region. Signaling pathways implicated in angiogenesis, p53 and EGFR were common between gender groups. Apoptosis, cell cycle, notch and JAK/STAT signaling pathways were more enriched within male cohort.

CONCLUSION

Gender-specific radiomic models can potentially serve as imaging biomarkers that are prognostic of survival in GBM and help evaluate treatment response. Association of certain malignant biological processes with RRS can contribute to relatively poor prognosis in male population.

CLINICAL RELEVANCE/APPLICATION

Females are known to have better response to standard treatment. We found distinct male specific radiomic MRI features that correlate with inhibition of apoptosis, cell cycle arrest and up-regulation of notch signaling pathways, which potentially leads to treatment resistance and poor prognosis. Gender is an important factor to consider for treatment personalization in GBM.

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NR387-SD-WEB3

Quantitative Radiological Features Affecting 2HG Detection with MEGA-PRESS Sequence

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #3

Participants
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PURPOSE

2-hydroxyglutarate (2HG) is a diagnostic and prognostic biomarker of IDH-mutated gliomas that can be detected noninvasively in vivo by MEGA-PRESS, an edited magnetic resonance spectroscopy (MRS) sequence. To standardize and optimize the clinical application of this technique, we assessed the imaging parameters that affect 2HG MEGA-PRESS measurements.

METHOD AND MATERIALS

We prospectively studied 70 IDH-mutant (26 treated, 46 non-surgically nor medically treated) grade II/III diffuse glioma patients using a Siemens Verio 3T MRI. Protocol included single-voxel MEGA-PRESS, 3D FLAIR, 3D T1-weighted and DTI. Tumor volume and its cystic parts were obtained using ITK-SNAP. IDH status was determined by immunohistochemical analysis of surgically obtained tissues. 2HG was quantified using LCModel and a simulated basis set, using CRLB cut-off of 50%. 2HG concentrations estimated with MRS were compared with gas chromatography-mass spectrometry (GC-MS) tissue samples levels. Statistical analysis was performed using R.

RESULTS

MEGA-PRESS revealed a sensitivity of 95% for 2HG detection in non-treated patients, and of 69% in treated patient. Positive predictive value was 100% in both groups. Measurements estimated by MRS correlated with levels obtained from GC-MS analysis ($r=0.68$, $p=0.0009$). 2HG positively correlated with choline ($r=0.58$ $P<0.0001$) while it negatively correlated with myo-inositol ($r=-0.29$ $P=0.03$) and minimal diffusivity measured inside the spectroscopic voxel ($r=-0.40$ $P=0.01$). 2HG was more easily detectable in the absence of cystic lesions ($P=0.04$) and when tumor volume was above 26.9 cm3 ($P=0.02$) or the percentage of tumor inside the spectroscopic voxel was above 72% ($P=0.04$). Finally, 2HG was lower in recurrent pretreated tumors compared to de novo tumors.

CONCLUSION

2HG detection strongly depends on tumor cellular density, which is reflected by lower water diffusivity and higher choline concentration. Treatments decrease IDH-mutant cells density, and therefore 2HG concentration. Our results confirm that MEGA-PRESS is a promising, reliable technique and lay the foundations for achieving valid and consistent 2HG measurements in clinical setting.

CLINICAL RELEVANCE/APPLICATION

IDH gene is mutated in 40% of diffuse gliomas, resulting in 2-hydroxyglutarate (2HG) accumulation. Non-invasive detection of 2HG through spectroscopy is technically challenging but feasible, although a rigorous validation of this imaging biomarker is needed.

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NR435-SD-WEB4

Automated Classification of Arteriolar Sclerosis Pathology and Prediction of Cognitive Decline Based on MRI Images

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #4

Participants
Nazanin Makkinejad, Chicago, IL (*Presenter*) Nothing to Disclose
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PURPOSE

Arteriolar sclerosis is one of the main pathologies of small vessel disease. In this work, an MRI-based classifier of arteriolar sclerosis based on ex-vivo MRI and pathology was developed.

METHOD AND MATERIALS

Cerebral hemispheres were obtained from 132 deceased participants of the Rush Memory and Aging Project (MAP), and the Religious Orders Study (ROS), two longitudinal cohort studies of aging. All hemispheres were imaged ex-vivo on a 3T clinical MRI scanner, while immersed in 4% formaldehyde solution. Following ex-vivo MRI, all hemispheres underwent neuropathologic examination by a board-certified neuropathologist. Regional white matter hyperintensities (WMH) volumes, and regional fractional anisotropy (FA) values were extracted from the ex-vivo MRI data and along with demographics information were used as features for training a linear support vector machine. Linear mixed-effects models were used to establish the relationship between the in-vivo and ex-vivo values. In-vivo 3T MRI and clinical data were obtained on 439 MAP and ROS participants. For each participant, regional WMH and FA values were extracted from the in-vivo MRI data, converted to ex-vivo values, and obtained a classification confidence score. The performance of the classifier in-vivo was assessed by testing the association of the classification confidence score with change in global cognition two years after baseline MRI, using Pearson's correlation. The same analysis was repeated for 5 cognitive domains: semantic memory, episodic memory, working memory, perceptual speed, and visuospatial abilities.

RESULTS

The average area under the receiver operating characteristic curve (AUC) for ex-vivo classification of arteriolar sclerosis was 0.74 for the classifier based on WMH, FA, and demographics, which was higher than that of a classifier based exclusively on WMH (0.69) ($p<0.05$). After translating the classifier in-vivo, the classification confidence score was associated with two-year decline in perceptual speed ($p=0.0004$), visuospatial abilities ($p=0.02$), and global cognition ($p=0.003$).

CONCLUSION

A novel MRI-based classifier was developed for arteriolar sclerosis, a neuropathology that can only be diagnosed at autopsy.

CLINICAL RELEVANCE/APPLICATION

A classifier of arteriolar sclerosis could help in designing clinical trials and prevention techniques.

NR436-SD-WEB5

Intravoxel Incoherent Motion (IVIM) Alterations in Glioblastoma during Chemoradiation Therapy?

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #5

Participants
Fateme Salehi, MD, Markham, ON (*Presenter*) Nothing to Disclose
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Arjun Sahgal, Toronto, ON (*Abstract Co-Author*) Speaker, Medtronic plc Speaker, Elekta AB Medical Advisory Board, Varian Medical Systems, Inc Speaker, Accuray Incorporated Research Grant, Elekta AB
Pejman Jabehdar Maralani, MD, FRCPC, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Response to chemoradiation therapy (CMT) for glioblastoma (GBM) remains poorly understood, and based on a comparison of structural changes from the baseline MRI to that taken 6 weeks after CMT is complete. The aim of this study was to characterize functional tumor information based on intravoxel incoherent motion (IVIM) diffusion-weighted imaging (DWI) parameters taken at the time of planning pre-CMT (DAY0), and then during the 6 week course of CMT at DAY10, DAY 20 and DAY 30 and the predictive capacity for response.

METHOD AND MATERIALS

This study included 9 patients with GBM who underwent standard 60 Gy in 30 fractions of conformal radiation with concurrent Temozolomide therapy who completed the imaging DAY0, DAY10, DAY 20 and DAY 30 protocol. MRI sequences included volumetric T1 with and without contrast, IVIM acquisition with 6 b-values and a volumteric FLAIR. On each scan volumes of interest (VOI) around the contrast enhancing margin and the FLAIR hyperintense regions were manually drawn. The VOIs were then overlaid on ADC, D and f maps derived from the IVIM dataset. IVIM data and first order features included the mean intensity, skewness and kurtosis, and these were compared at different treatment time points.

RESULTS

Statistically significant trends were exhibited in IVIM map alterations during treatment, including decreased ADC, f and decreased D mean intensity, which can serve as measures of perfusion. Additionally, f map coefficient of kurtosis significantly decreased ($p = 0.043$).

CONCLUSION

To our knowledge, this is the first study to investigate the utility of IVIM analysis in GBM patients at multiple time points during CMT. We have characterized changes during CMT and will correlate these changes to tumor response and 6 months progression free survival and overall survival data. Changes in IVIM may serve as a biomarker of tumor pathophysiology during treatment which can be explained in relation to patient outcome.

CLINICAL RELEVANCE/APPLICATION

IVIM can demonstrate alterations in diffusion and perfusion during chemoradiation therapy, and may provide clinicians with tools to undertake adaptive therapy and adjustment of radiation dose.

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NR437-SD-WEB6

Diagnostic Accuracy of Routine Non-Contrast MRI Sequences for Dural Venous Sinus Thrombosis

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #6

Participants
Minako Azuma, Miyazaki, Japan (*Presenter*) Nothing to Disclose
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Yoshihito Kadota, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To determine what routine non-contrast MR imaging (MRI) sequence or combination of MRI sequences is most useful for the diagnosis of dural venous sinus thrombosis (DVST).

METHOD AND MATERIALS

This multicenter study included 81 DVST patients (39 men, 42 women; age range 20-91 years; mean age 50 years) who underwent routine non-contrast 1.5- or 3T MRI within 14 days of digital subtraction angiography (DSA), contrast-enhanced MR venography, and/or CT venography. The controls were 243 age- and sex-matched individuals without DVST. They also underwent routine 1.5-or 3T MRI before- or within one month after DSA. The DVSTs were located in the transverse-, sigmoid-, and/or superior sagittal sinus. Three independent, blinded observers separately evaluated T1-, T2-, diffusion-, T2*-, and susceptibility-weighed images (T1WI, T2WI, DWI, T2*WI, and SWI) and FLAIR images for the presence or absence of DVST. The area under the receiver operating characteristics curve (AUC) was calculated for each MRI sequence. Fleiss κ statistics were applied to assess interobserver agreement. Univariate and multivariate analyses were performed to evaluate the predictive value of the sequences.

RESULTS

The overall accuracy for the diagnosis of DVST was 0.592 for T1WI, 0.914 for T2WI, 0.874 for FLAIR, 0.871 for DWI, 0.792 for T2*WI, and 0.673 for SWI. T2WI and DWI were most predictive of DVST [odds ratio (OR): 41.0; 95% confidence interval (CI) 7.8 - 216.3 and OR 75.1; 95% CI 15.6 - 361.6, respectively]. The combined use of T2WI and DWI yielded significantly better diagnostic performance than each sequence alone ($p<0.05$); the AUC was 0.802 (95% CI, 0.749 - 0.856). Interobserver agreement was good for T1WI (κ=0.681), T2WI (κ= 0.795), FLAIR (κ=0.719), and T2*WI (κ=0.745). It was moderate for DWI (κ= 0.600) and fair for SWI (κ= 0.351).

CONCLUSION

Among the examined routine non-contrast brain MRI sequences, the combined use of T2WI and DWI was the most predictive of DVST.

CLINICAL RELEVANCE/APPLICATION

Routine non-contrast brain MRI sequences, especially T2WI and DWI, were useful for evaluating DVST.

NR438-SD-WEB7

Efficacy of tc-MRgFUS Thalamotomy in The Treatment of Essential Tremor (ET) and Parkinson Disease (PD) Tremor: Experience From 39 Patients in A Single Centre with Long Term Follow-Up

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #7

Participants
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PURPOSE

To report the mid and long term follow-up clinical and MR imaging results in the treatment of ET and PD tremor using tcMRgFUS thalamotomy

METHOD AND MATERIALS

In the period February 2018-March 2018, we enrolled 39 patients (22 males, 17 females, mean age 64.6 years) with disabling and refractory tremor (18 ET, 21 PD tremor, mean duration of symptomatology 10.4 years) who were subjected to unilateral Vim ablation using MRgFUS. Clinical evaluation was performed using the Fahn-Tolosa-Marin scale (FTM) for tremor and the QUEST score for quality of life, assessed before treatment, immediately after treatment and with follow-up at 1 month, 6 months and 1 year. Instrumental MRI follow-up was performed immediately after treatment and at 1-month, 3-months and 6-months follow-up. Sonication parameters were recorded in all procedures.

RESULTS

Treatment was effective (substantial and immediate reduction of tremor) in 37 out of 39 patients (94.8%). In ET patients FTM scores decreased significantly from mean values of 36.2 before treatment to 13.8 immediately after treatment. The improvement was stable at the following follow up evaluations (14.6 at 1 month, 14.3 at 6 months, 14.5 in the patients evaluated after 1 year). In PD patients FTM scores decreased from mean values of 27.5 before treatment to 11.6 immediately after treatment. At the 6-months follow up mean FTM score was 15.5, due to mild recurrence of tremor in 4 patients, that remained stable at 1 year. Quality of life evaluation showed substantial improvement in both groups (73.2% reduction of the QUEST scores in ET patients, 68% in PD). Temporary side effects and complications (dysarthria, perioral paresthesias, limb weakness) occurred in 7 patients after treatment, with resolution at the 6-months follow-up in 4 patients. Instrumental imaging follow-up showed a progressive reduction of thalamotomy lesion size and perilesional edema in both groups without significant difference between ET and PD patients

CONCLUSION

MRgFUS thalamotomy is a safe and effective treatment option for tremor in patients with ET and PD

CLINICAL RELEVANCE/APPLICATION

Our long term follow up in a consistent number of PD patients confirmed lesser stability of treatment effects in comparison with ET patients, with however significant improvement in quality of life for both patient groups

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NR439-SD-WEB8

Automated Contrast Uptake Measurements at CT Angiography for Thrombectomy Triage in Extended Time Windows

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NR Community, Learning Center Station #8

Participants
Paul Reidler, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
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Franziska Dorn, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
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Wolfgang G. Kunz, MD, Munich, Germany (*Abstract Co-Author*) Grant, Medtronic plc

PURPOSE

To determine the clinical value of software-based automated cerebral attenuation measurements at CT angiography (CTA) to classify eligibility for late time window thrombectomy as established by DEFUSE 3 criteria using CT perfusion (CTP) imaging.

METHOD AND MATERIALS

We selected prospectively enrolled stroke patients with large vessel occlusion and complete imaging datasets including noncontrast CT, CTA and CTP. X-ray attenuation in Hounsfield Units (HU) was measured at noncontrast CT and CTA data in all Alberta Stroke Program Early CT Score (ASPECTS) regions using automated software. Contrast uptake (CU) was defined per ASPECTS region as absolute difference of attenuation on CTA minus noncontrast CT. All regional values were merged into a composite CTA-CU score using a linear regression model. Extent of ischemic core and target mismatch were determined at CTP. Association of hemispheric contrast uptake with ischemic core volume was tested using linear regression analysis. Receiver operating characteristics analysis was performed to calculate area under the curve (AUC) values for classification of DEFUSE 3 criteria (core <70mL, target mismatch >1.8).

RESULTS

We included 79 patients with large vessel occlusions with median noncontrast ASPECTS of 8 (interquartile range [IQR]: 8 - 10) and median ischemic core size of 17 mL (IQR: 9 - 46 mL). Automatic CU measurements were technically successful in all patients. CU values over all ASPECTS regions were significantly lower in the ischemic compared to the non-ischemic hemisphere with a median of 4.2 HU (IQR: 2.7 - 5.8 HU, $p<0.001$) and highly assoiciated with ischemic core volume (beta=-0.45, $p<0.001$). The composite CTA-CU score enabled significant classification of DEFUSE 3 thrombectomy criteria (AUC: 0.85, $p<0.001$, sensitivity: 91%, specificity: 67%) while outperforming visual ASPECTS (AUC: 0.74, $p=0.001$, sensitivity: 54%, specificity: 92%) .

CONCLUSION

As an observer-independent and quantifiable imaging biomarker, the composite CTA-CU score was able to classify CTP imaging criteria for late time window thrombectomy criteria.

CLINICAL RELEVANCE/APPLICATION

Automated CU measurements may serve as surrogate for CTP-based eligibility criteria. With further validation, this technique may have the potential to simplify imaging triage in late-presenting stroke.

OB002-EB-WEB

FIGO Classification System of Leiomyomas in MRI

Wednesday, Dec. 4 12:45PM - 1:15PM Room: OB Community, Learning Center Hardcopy Backboard

FDA Discussions may include off-label uses.

Participants
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Yeni Fernandez de Lara Barrera, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Laura M. Sanchez, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Hugo Alberto Cervantes Flores, Cdmx , Mexico (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

- To disseminate the FIGO classification in the radiology environment for better communication with the clinicians. - To understand the importance of the classification in management decisions. - To provide the features of leiomyomas in MRI.

TABLE OF CONTENTS/OUTLINE

- Introduction - Epidemiology - FIGO classification system - Types of leiomyomas - Management - Conclusion

OB185-ED-WEB1

Imaging Findings that Mimic Endometriosis: Tips and Tricks

Wednesday, Dec. 4 12:45PM - 1:15PM Room: OB Community, Learning Center Station #1

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TEACHING POINTS

To show findings that mimic endometriosis on cross-sectional imaging methods. To discuss tips for recognize these trick imaging findings. To highlight the importance of recognizing imaging findings that can simulate endometriosis.

TABLE OF CONTENTS/OUTLINE

Brief review of the main finding of endometriosis on transvaginal US and pelvic MRI. Lesions that simulate endometriosis will be demonstrate with illustrations and cases, as: leiomyomas; urachal remnant; small bowel and appendix neuroendocrine tumors; phleboliths; abdominal or pelvic wall masses (abdominal hematoma; desmoid tumor; suture granuloma; abscess; metastatic implants); rectouterine pouch hematoma; uterosacral ligament thickening due to deviated uterus; inflammatory pelvic disease; surgical fibrosis; sigmoid diverticula; sigmoid and rectal carcinoma; lymph nodes; hemorrhagic cysts after collected oocytes to in fertilization. Tips of this main differential diagnosis of endometriosis will be highlighted. A systematic approach for evaluate these lesions will be proposed.

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PD182-ED-WEB6

A Panorama of Panorexes: A Guide for Identifying Important Pathology on Pediatric Panorex

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PD Community, Learning Center Station #6

Awards
Identified for RadioGraphics

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TEACHING POINTS

1. Learn the appearance of a normal pediatric panorex study. 2. Become familiar with how the panorex image is acquired and how different types of artifact and distortion may result from this acquisition. 3. Appreciate the changes associated with important pathologies that can be identified on panorex in the pediatric population. 4. Identify instances in which further imaging may be required.

TABLE OF CONTENTS/OUTLINE

1. Review of normal anatomy on pediatric panorex. 2. Review of potential pathologies that can be identified on panorex, including sample cases demonstrating infectious, traumatic, congenital, and neoplastic pathology. 3. Red flag findings that should prompt further imaging, especially in the pediatric population. 4. Future directions and summary.

Printed on: 10/29/20

PD183-ED-WEB7

Fetal MRI: 20 Years of Experience in Urinary System Anomalies with Pathologic Correlation and/or Postnatal Follow-Up

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PD Community, Learning Center Station #7

Participants
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TEACHING POINTS

Urinary tract anomalies are the most common fetal abnormalities during the antenatal period and at birth. Since 1999, we have studied 1148 pregnant women with MRI. Of these, 220 had urinary tract anomalies. We aim to show representative and uncommon MRI cases, underlining the strengths and weaknesses of this technique, with pathologic correlation and/or postnatal follow-up by other imaging modalities in order to help in understanding these anomalies.

TABLE OF CONTENTS/OUTLINE

1. Urinary tract anomalies overview 2. Fetal MRI in evaluation of urinary tract anomalies 3. Normal appearance of the urinary tract on MRI 4. Urinary tract dilatation 4.1 Uretero-pelvic junction stenosis 4.2. Congenital midureteral obstruction 4.3. Vesico-ureteral union anomalies 4.4. Vesico-ureteral junction stenosis and megaureter 4.5. Urinary tract duplications 4.6. Posterior urethral valves 5. Malformative kidney disorders 5.1. Renal agenesis 5.2. Renal ectopia 5.2.1. Renal ectopia without renal fusion 5.2.2. Crossed fused renal ectopia 5.2.3 Horseshoe kidney 5.3. Multicystic kidney disease 5.3.1. Obstructive cystic dysplasia 5.3.2. Autosomal recessive polycystic kidney disease (ARPKD) 5.3.3. Multicystic dysplastic kidney 5.4. Rare syndromes 6. Conclusion

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PD221-SD-WEB1

Performance of Computer-Aided Detection (CAD) of Pulmonary Nodules in Pediatric Ultra-Low-Dose Chest CT

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PD Community, Learning Center Station #1

Participants
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PURPOSE

To evaluate the dose-dependency of a computer-aided detection (CAD) system for identification of pulmonary nodules in pediatric ultra-low-dose chest CT with tin filtration (ULDCT).

METHOD AND MATERIALS

Two scan protocols for 100 kV ULDCT with tin filtration differing in the reference mAs (ref. mAs) setup for the automatic tube current modulation were compared. 146 consecutive scans of pediatric patients who underwent ULDCT in clinical routine were included and 2 study groups were built based on the on the scan protocol applied: 48 patients (f=23; m=25; mean age 11.1 ± 5.5 years) underwent ULDCT with 30 ref. mAs while 98 patients (f=34, m=64; 13.5 ± 5.5 years) were scanned using 96 ref. mAs. Patients with inflammatory consolidations potentially hiding pulmonary nodules were excluded. Each scan was examined for pulmonary nodules by two radiologists in consensus reading and each finding was categorized by size (2-3 mm vs. >= 3 mm). Their findings were compared to the CAD results of the respective scans and consensus decision was made regarding correctness of each CAD marking. False negative and false positive CAD results were added resulting in total CAD errors. The radiation dose was estimated using conversion factors for the computed tomography dose index in order to calculate the size-specific dose estimates (SSDE) as recommended by report 202 of the AAPM Task Group.

RESULTS

The radiation dose in the 30 ref. mAs group was significantly lower (0.16 ± 0.09 mGy) than in the 96 ref. mAs group (0.56 ± 0.22 mGy, $p<0.001$). There was no significant difference between the 2 groups regarding CAD sensitivity (0.43 vs. 0.45 in nodule size (NS) >= 2 mm; 0.65 vs. 0.74 in NS >= 3 mm) and total CAD errors (mean per scan 1.44 ± 3.5 vs. 1.37 ± 2.24 for NS >= 2 mm and 0.85 ± 2.24 vs. 0.71 ± 1.59 for NS >= 3 mm). There was no significant correlation between SSDE and CAD errors for NS >= 2 mm ($r = -0.054$) and NS >= 3 mm ($r = -0.067$).

CONCLUSION

Lowering the parameters for automatic tube current modulation in pediatric ULDCT results in significant dose reduction without compromising the evaluated CAD system. However, its overall accuracy in this oncology-dominant study group (n = 108 with treated malignant tumors) was not satisfying in both scan protocols assessed. Thus, CAD analysis should be used with caution in tin-filtered ULDCT.

CLINICAL RELEVANCE/APPLICATION

Computer-aided detection (CAD) systems can assist in the detection of pulmonary nodules even in tin-filtered ULDCT with low tube current setup.

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PD223-SD-WEB3

Diffusion and Perfusion Quantified by IntraVoxel Incoherent Motion Imaging in the Study of Normal Pulmonary and Renal Maturation During Prenatal Life: A Fetal MR Study

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PD Community, Learning Center Station #3

Participants
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PURPOSE

To investigate the use of IntraVoxel Incoerent Motion (IVIM) model in the study of physiological microstructural tissue changes in terms of perfusion and diffusion qualities, occurring during gestation in renal and lung parenchyma.

METHOD AND MATERIALS

27 normal pregnancies without fetal or maternal pathologies were enrolled. Fetal body MR examinations were performed using a 1.5 T magnet, with standard fetal body MR protocol including a Diffusion-Weighted Echo-Planar Imaging sequence with 10 different b values (0, 10, 30, 50, 75, 100, 150, 400, 700, 1000 s/mm2). For each fetus, two bilateral ROIs were manually placed by an expert fetal radiologist in lung and renal parenchyma. Mean values of fraction of perfusion fp, Pseudo-Diffusion Coefficient D* and Diffusion Coefficient D were obtained and differences between ROIs f, D, D* mean values and IVIM parameters correlation with gestational age (GA) were investigated.

RESULTS

Results are in general agreement with literature. IVIM parameters changes with gestational ageing in lung and renal parenchymas may highlight perfusional and diffusional differences through ageing depicting physiological microtissutal changes occuring in renal and lung parenchymas during prenatal life. In particular, in lung and renal ROIs the fraction of perfusion fp and the Diffusion Coefficient D showed statistical significant higher and lower values respectively. The perfusion and the diffusion in this tissue changes.

CONCLUSION

IVIM model is able to detect microstructural physiological tissue changes occurring in fetal lung and kidneys during prenatal life. In both lung and renal ROIs there is an increasing fp and a decreasing D with gestational ageing, depicting the physiological increase of perfusion occurring in those tissue in fetal life.

CLINICAL RELEVANCE/APPLICATION

Our results highlight that DW imaging with IVIM model is useful as an additional prenatal diagnostic tool to study the correct and proper lung and renal maturation during prenatal life. These normal values may have clinical relevance as normal comparison base measurements to compare ADC values of restricted lungs and kidneys maturation, especially in fetal growth restriction and oligohydramnios.

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PD251-SD-WEB5

Automated Bone Age Assessment with Joint Ossification Center Detection from Hand Radiograph

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PD Community, Learning Center Station #5

FDA Discussions may include off-label uses.

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PURPOSE

To improve the accuracy of convolutional neural network (CNN) based bone age assessment methods by jointly training the networks to detect ossification centers of multiple phalangeal, metacarpal and carpal bones, where local appearances are normally examined by pediatric radiologists for skeletal maturity assessment in clinical practice.

METHOD AND MATERIALS

Our proposed method was evaluated on the public dataset from the RSNA Pediatric Bone Age Machine Learning Challenge. The dataset contains hand radiographs scanned from 12,585 (6,820 males) subjects with bone age ranging from 1 to 228 months. We first segmented the hand region of interest from the radiograph, and then employed the resulting mask to remove the background and normalize the pose and intensity of the hand. All images were resized to 512 x 512 pixels and input to the proposed network, for simultaneous bone age estimation and ossification center detection. The overall network architecture consists of the backbone network (U-Net) and three task-specific subnetworks for the bone age regression, the ossification center presence classification, and the ossification center localization, respectively.

RESULTS

We evaluated the proposed multi-task learning network on 1,259 randomly selected testing data, and compared the same network with and without joint learning of ossification center detection. The proposed method achieved 5.22±4.41 month mean absolute error of bone age, and showed 0.37 month error reduction on the average by joint training the network these two tasks.

CONCLUSION

The joint learning of ossification center detection can help the bone age estimation network extract truly meaningful features from the regions which are most relevant to the skeletal maturity such as phalanges, carpal bones, radial or ulnar epiphyses, this improve the accuracy of the latter.

CLINICAL RELEVANCE/APPLICATION

The proposed method can be used to automatically estimate the bone age with improved accuracy, and help pediatric radiologists understand better the assessment results of the convolutional neural network.

PH136-ED-WEB8

Triple-Rule-Out CT Angiography on 16cm Wide-Detector CT with Dual-Energy Spectral Mode: How to Obtain More (Information) with Less (Dose)

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PH Community, Learning Center Station #8

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TEACHING POINTS

To illustrate limitations of conventional triple-rule-out CT Angiography (TRO-CTA);To illustrate advantages of 16cm wide-detector CT with dual-energy spectral imaging in TRO-CTA;To demonstrate strategies of applying dual-energy spectral imaging in TRO-CTA to obtain more information; with less contrast and radiation doses

TABLE OF CONTENTS/OUTLINE

Limitations of conventional TRO-CTA:1)High radiation and contrast doses2)Only anatomic information and often at suboptimal phases3)Often limited by high or unstable heart ratesAdvantages of wide-detector CT with dual-energy: 1)Various energy levels for balancing contrast and image noise2)Iodine maps for detecting lung perfusion defects3)High-pitch helical with 8cm detector for fast lung and 16cm axial for one heartbeat coronary imaging4)2nd-generation iterative reconstruction algorithm for noise control Optimization Strategies:1)High-pitch spectral CT for lungs in 1sec to include COPD patients at low radiation dose2)Proper low keV to improve enhancement at low contrast dose3)Iodine maps to detect perfusion defects for more accurate Pulmonary Embolism diagnosis4)Prospective-trigging axial scan for one heartbeat, low dose coronary imaging for all heart rate patients 5)Low kVp for aorta to reduce contrast dose requirement6)Iterative reconstructions to reduce image noise at low dose

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PH211-SD-WEB1

Organ Dose Evaluations for Individual Patients in Chest-Abdomen-Pelvis CT Examinations Using Deep Learning-Based Automatic Segmentation

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PH Community, Learning Center Station #1

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PURPOSE

Organ dose evaluations with dose distribution images obtained as Monte Carlo (MC) simulation results for individual patients undergoing CT examinations require region of interests (ROIs) delineating each imaged organ. However, it takes more time and effort to manually draw the ROIs. The aims of this study are to perform automatic organ segmentation with deep learning methods and to validate organ doses determined with the automatically segmented images for individual patients in routine chest-abdomen-pelvis (CAP) CT examinations.

METHOD AND MATERIALS

Automatic segmentation of lung, liver, and bladder was performed with U-net convolutional neural network which was trained with CT images of 50 patients (2,633 images for lung, 1,475 images for liver, and 484 images for bladder) and was tested on CT images of 5 patients. Performance of the automatic segmentation was evaluated on Dice coefficient overlap with the manual segmentation. Dose simulations were performed by inputting the voxelized models created from data set of the 5 patients, detailed descriptions of an Aquilion ONE CT scanner (Canon Medical Systems), and CT scan parameters into MC simulation software ImpactMC (Advanced Breast CT). Organ doses for lung, liver, and bladder were evaluated by setting each organ ROI from automatic and manual segmentation on the dose distribution images obtained as the simulation results. The organ doses determined with the automatically segmented images were also compared with those with the manually segmented images.

RESULTS

Trained U-Net had average dice coefficients of 0.82 for lung, 0.63 for liver, and 0.53 for bladder on the test set. Organ doses for these organs determined with the automatically segmented images agreed with those with the manually segmented images to within approximately 4% for lung, 7% for liver, and 6% for bladder.

CONCLUSION

Organ doses determined with the automatically segmented images obtained using trained U-net showed good agreement with those with the manually segmented images.

CLINICAL RELEVANCE/APPLICATION

Automatic organ segmentation with deep learning methods will be useful for real-time and accurate organ dose evaluations for individual patients in CAP CT examinations.

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PH217-SD-WEB2

Quantitative Analysis of Hepatic Fibrosis and Adiposity Using Intravoxel Incoherent Motion and Magnetic Resonance Spectroscopy

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PH Community, Learning Center Station #2

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PURPOSE

To investigate diffusion parameters in intravoxel incoherent motion (IVIM) analysis and determine relationships with proton magnetic resonance spectroscopy (1H-MRS) and hepatic fibrosis serum biomarkers.

METHOD AND MATERIALS

Thirty-seven subjects, 8 with a liver fat fraction (FF) > 5% and 29 normal (N) subjects, were studied retrospectively. A 3 T abdominal MRI examination, with an intravoxel incoherent motion (IVIM) sequence (multi-band factor=3, and SPAIR; 8 b-values: 0, 10, 20, 60, 150, 250, 500, and 800 s/mm2) and 1H-MRS (volume=(20 mm)3, TR=2000 ms, TE=20-35 ms, TM=10 ms) to quantify hepatic steatosis. Fasted serum was collected and blood tests included a complete blood count, metabolic, lipid, and liver panels. The fraction of fast-diffusion (f), fast-diffusion (Df), and slow-diffusion (Ds) were calculated from the IVIM images using nonlinear least-squares fitting. T2 corrected FF were fitted using AMARES in jMRUI. Two-sided t-tests were used to compare MRI data. Spearman correlation was applied to evaluate associations.

RESULTS

The f values were significantly higher in subjects with fatty liver compared to normals (0.25±0.08 vs 0.19±0.07, p=0.02). Neither Df or Ds were found to be significantly different between groups. The FF was significantly correlated with alanine aminotransferase (ALT,ρ=0.42,p=0.01), aspartate aminotransferase (AST,ρ=0.39,p=0.02), and low-density lipoprotein (LDL) cholesterol levels (ρ=0.36,p=0.03). ALT levels and Ds were significantly correlated (ρ=-0.39,p=0.03). A significant negative correlation was found between albumin levels and the f (r=-0.46, p=0.007). A multivariate linear model for the f with weight, alkaline phosphatase, and albumin levels as factors was cross-validated 3-fold with a residual sum-of-squares of 0.004, adjusted R2=0.352, and p=0.002.

CONCLUSION

Significant correlations with serum measures suggest the viability of a role for diffusion weighted imaging to assess structural changes in liver parenchyma. Future studies will continue to investigate the predictive power of these imaging biomarkers in relation to steatosis and fibrosis.

CLINICAL RELEVANCE/APPLICATION

As the incidence of fatty liver continues to rise, so too does the importance of accurate assessment of reversible fibrosis. Biopsy, an invasive method prone to sampling bias, remains the gold standard for diagnosis. This data illustrates the potential for IVIM imaging and MRS to non-invasively assess steatosis and fibrosis.

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PH218-SD-WEB4

A Data-Driven Approach to Setting Radiation Dose Notification Values for CT That Can Be Used in Dose Management Software Applications

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PH Community, Learning Center Station #4

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PURPOSE

The purpose of this research is to propose a new data-driven method for setting radiation dose notification values that accounts for patient size

METHOD AND MATERIALS

Data were collected from CT exams of the chest, abdomen, and pelvis with contrast enhancement, which was performed from March 1, 2018 to February 28, 2019. Aquilion ONE and Aquilion ONE / ViSION (Both Canon Medical Systems, Tochigi) CT scanners were used. The CT-RDSR file (CTDIvol, DLP) of each cases were transferred to Workstation (Vitrea) and analyzed using a radiation dose management solution (Vitality XT, Canon Medical Systems). Based on single regression analysis data in the dose indices (CTDIvol, DLP) for body weight, the predicted upper limit (95%) for each body weight (20 to 120 kg, 1 kg interval) was calculated and a regression analysis was performed.

RESULTS

A total of 7,354 cases were collected with 3,323 and 4031 cases collected from the ONE and ONE/ViSION, respectively. For ONE scanner, the relationship between body weight and dose indices is described by the linear equation (CTDIvol: y=0.386x-4.628, DLP: y=34.15x-610.93), and a strong correlation (CTDIvol: γ=0.889, DLP: γ=0.924) was observed. Further, the regression equation of the upper limit predicted value (95%) to the weight was y=0.391x-0.312 for CTDIvol and y=34.52x-303.06 for DLP. Among the exams investigated, 111 (3.3% of total) and 122 (3.7% of total) cases exceeded the upper limits for CTDIvol and DLP, respectively. The relationship between body weight and dose indices was similarly linear in the ViSION, and a strong correlation (CTDIvol: γ=0.884, DLP: γ=0.918) was observed. In addition, the regression equation of the upper limit of prediction for body weight (95%) was y=0.476x-6.262 for CTDIvol and y = 40.68x-732.31 for DLP. Among the exams investigated for ViSION, 124 (3.1% of total) and 122 (3.0% of total) cases exceeded the upper limits for CTDIvol and DLP, respectively.

CONCLUSION

Based on regression analysis of patient weight and dose indices, we proposed a new method to set the upper limit for each weight for both CTDIvol and DLP. In this method, the notification value function is activated only when it is statistically significant (5%) from the past cases in each institution.

CLINICAL RELEVANCE/APPLICATION

Setting a notification value tailored to each patient's size allows sites to identify cases where the dose is clearly higher than usual while taking into account the patient size.

PH219-SD-WEB3

Dosimetric Validation of 3D Printed Quality Assurance Phantoms and Gynecologic Applicators for High Dose Rate Brachytherapy

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PH Community, Learning Center Station #3

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CONCLUSION

3D printing applicators for patient specfic use is a viable way to deliver HDR brachytherapy. It is recommended that the material used in the 3D printer be validated dosimetrically prior to use as applicator material.

Background

High dose rate (HDR) brachytherapy is used for patients where a high dose to the tumor is desired but it is essential to spare dose to normal tissue. Due to variabilities in patient anatomy, often the available applicator does not match the ideal one. 3D printing could solve this problem; however, for these applicators to be used for treatments, a rigorous dosimetric analysis is required for both the material being used and the applicators themselves.

Evaluation

Three calibration cubes with different densities were designed and 3D printed with the catheter insert placed such that dose could be measured at a 5mm, 10mm, 15mm and 20mm distance from the source. Five cylinders with the same radii as those from Elekta Brachytherapy were printed with a channel in the center for the catheter. Oncentra Brachy software was used to create simple dose distribution plans for the 3D phantoms and cylinders and also for the Elekta cylinders. Gafchromic EBT3 film and Landauer NanoDots (OSLDs) were placed on the surfaces of the cube phantoms and cylinders and the plans were delivered. The NanoDots were read with a non-linear calibration on a Landauer Microstarii dosimeter and the film was analyzed in Matlab using a calibration curve made for the film batch with the brachytherapy source used.

Discussion

The measured values for the QA phantoms were consistent regardless of the amount of material used to fill the cubes. This is shown in figure 1 - a graph of nanodot measured versus expected dose readings for the three different cubes. This means that to save on material costs and printing time, a lattice technique can be used to print patient applicators. Further, the dose through the 3D printed cylinder applicators was more consistent with the expected measurements than the dose through the Elekta applicators. This is shown in figure 2 - a graph of film and OSLD measurements through the printed and Elekta cylinders. The film dose should be higher due to 0.5mm buildup in the nanodots.

PH263-SD-WEB6

Assessment of Intraductal Carcinoma in Situ with Grating-Based Phase-Contrast Computed Tomography

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PH Community, Learning Center Station #6

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PURPOSE

To investigate the potential of grating-based phase-contrast computed tomography (GBPC-CT) using clinical X-ray sources for tomographic margin assessment of intraductal carcinoma in situ (DCIS) samples.

METHOD AND MATERIALS

X-ray grating-based phase-contrast computed tomography is an emerging X-ray imaging method, which is based on X-ray refraction in contrast to conventional attenuation-based CT. Originating from large synchrotron research facilities, the technique has been successfully translated to clinical settings. GBPC-CT uses a three-grating interferometer in combination with a clinical X-ray source and detector. In addition to the conventional attenuation image, GBPC-CT provides an X-ray phase-contrast image related to the electron density and thus allowing for much higher soft-tissue contrast compared to the corresponding attenuation image. In this ex-vivo study, we used the high soft-tissue contrast property of GBPC-CT (40 kV, 60 mA) to investigate the extent of intraductal carcinoma in situ, which is commonly underestimated due to discontinuous growth and lack of microcalcifications. Specimen radiography has been established to reduce the rate of re-excision. However, the predictive value for margin assessment with conventional specimen radiography for DCIS is low. The ex-vivo study presented here included four samples containing DCIS and invasive carcinoma of non-specific type. The samples were of maximum 3 cm in diameter, excised of tumor-bearing areas, and fixed with 4% formaldehyde solution. Histopathologic workup was performed using standard protocols. Relevant tomographic phase-contrast and attenuation slices were matched with histology being the standard of reference.

RESULTS

The CT data was successfully matched with histology. The GBPC-CT data provided improved soft tissue contrast in comparison to attenuation-based images and more histological details are revealed in the same phase-contrast slices. Non-calcifying DCIS exceeding the invasive tumor could be correlated with areas of dilated bright ducts around the tumor.

CONCLUSION

The GBPC-CT results allowed for an improved depiction quality in contrast to corresponding attenuation-based images, the identification of diagnostically relevant tissue details, and a full three-dimensional sample margin assessment.

CLINICAL RELEVANCE/APPLICATION

Grating-based phase-contrast CT realized in a clinical setting will improve DCIS diagnosis.

PH264-SD-WEB7

Cumulative Radiation Risk for Multiple CT Examinations: A One-Year Survey For a Large Multi-Specialist Hospital

Wednesday, Dec. 4 12:45PM - 1:15PM Room: PH Community, Learning Center Station #7

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CONCLUSION

Dose tracking systems allow to quickly identify frequency of recurrent CT examinations among patients with high cumulative dose and to drive optimization actions to reduce the radiation risk.

Background

To investigate the highest cumulative radiation risks consequent to multiple CT examinations performed in a large multi-specialist hospital over the course of one year.

Evaluation

During the whole year 2018, a total of 61743 CT studies were executed on 11 different CT equipments. All the radiation dose structured reports (RDSR) were collected by a radiation dose monitoring system (Physico, EMME ESSE). For each scan, organ and effective doses were estimated by the software Virtual CT. A focused investigation of the diagnostic paths associated to high cumulative doses was performed for all the patients with cumulative DLP above 10000 mGy cm and effective doses above 100 mSv. For the same sample, radiation risks were calculated by means of the PCXMC software using the integrated tool based on the BEIR VII approach.

Discussion

33536 patients received more than one MDCT study, 4748 more than 5 studies and 634 more than 10. Cumulative DLP values above 10000 mGy cm (maximum 30750 mGy cm, corresponding to 27 examinations) were observed for 76 patients, whereas effective doses above 100 mSv (maximum 377 mSv) were associated to repeated examinations of 101 patients. Most of these were patients scanned for cancer or trauma. Estimated risks of exposure-induced cancer death (REID) were in the range 0.3 -1.4%. Since a large number of examinations are repeated head CT, high cumulative DLP values and/or high number of CT acquisitions are not always correlated to high risk values.

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QI002-EB-WEB

Common Data Element (CDE) Implementation for CT Paranasal Sinusitis: Improved Disease-Specific Evidence-Based Clinical Reporting, Moving Towards a Community Standard, and Building a Foundation for Research in Artificial Intelligence/Machine Learning

Wednesday, Dec. 4 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

The ASNR-ACR-RSNA has created dictation macros which include Common Datat Elements (CDE) for evidence-based disease-specific reporting, including CT paranasal sinus inflammatory evaluation. We planned to use these macros to improve our reporting towards a community standard for paranasal sinusitis CT exams as a project for quality improvement, study pre-existing current state of reporting, implement the CDE macro, study the macro post-implementation utilization and reporting, and then re-evaluate our current practice to understand how we can further optimize our reporting to be both clinically relevant and useful for artificial intelligence/machine learning research.

METHODS

All CT sinus exam reports from 3/1/2018-5/1/2018 (before promotion of CDE macros) as well as 12-7-2018-1/31/2019 (after institutional implementation of CDE macros) were reviewed. Exams were excluded if not specifically for paranasal sinus inflammatory disease. Following CDE macro implementation on 12/7/2018, each of the 19 Common Data Elements for the CT paranasal sinus inflammatory macro were marked as either present or absent from each report, as well as the percentage of all 19 CDE's in each report. We also analyzed the adoption rate of the CDE macro.

RESULTS

Before CDE macro implementation, 66 reports met inclusion criteria, and 35 met exclusion criteria. Pre-intervention most commonly reported CDE include: maxillary sinus (97%), frontal sinus (91%), and ethmoid sinus (91%) (FIGURE 1). Pre-intervention least commonly reported CDE include: uncinate process lateralization (2%), nasopharynx (11%), and temporomandibular joint (11%). Completeness of reports for inclusion of all 19 CDE fields was 11-79%. After CDE macro implementation, 59 reports met inclusion criteria, and 30 met exclusion criteria. The CDE macro was adopted for 56% of reports. For those adopting the CDE macro, reporting improved for uncinate process lateralization (79%), nasopharynx (79%), and for temporomandibular joint (73%). Those not adopintg the CDE macro, reporting remained similar to pre-intervention frequency for uncinate process lateralization (4%), nsopharynx (0%), and temoporomandibular joint (8%). Completeness of reports for inclusion of all 19 CDE fields was 84% for those adopting the CDE macro, and 44% for those not adopting the CDE macro.

CONCLUSION

Implementation of the ASNR-ACR-RSNA CDE macro for CT paranasal sinus inflammatory consistently improved disease-secific reporting when adopted by the radiologist. We hope incorporation of the CDE macros will bring our group towards a community standard of evidence-based clinically useful reporting. These CDE macros will hopefully facilitate research into natural language processing, machine learning, and deep learning as the field of artificial intelligence advances imaging. As part of this Plan-Do-Study-Act project for quality improvement, further improvement of CDE adoption is planned via education as to the clinical importance of diseaes-specific reporting, demonstrating shortcuts in dictation software to improve turnaround times, and incorporating these macros into trainee education.

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QI021-EB-WEB

Improving 'Door to CT' Time in Acute Stroke Patients and 'Door in-Door out' Time in those appropriate for Endovascular Thrombectomy (performed in external tertiary Neuroradiology centre) as part of an Irish National QI Stroke Programme

Wednesday, Dec. 4 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

A National Endovascular Thrombectomy (EVT) referral service was commenced in Ireland in 2018. We noted avoidable delays in the clinical and imaging pathway of patients presenting to our institution with signs and symptoms of acute stroke. This resulted in delayed administration of IV thrombolysis and delayed or missed opportunities for referral for EVT. We noted delays in referral to radiology for CT, delays in patient transfer to CT, scan delays within the CT department and delays in transfer of patients out of our hospital for EVT.

METHODS

We formed a FAST committee with members including the Attending Stroke physician departmental lead, Stroke specialist nurse, Radiology resident and Emergency Department nursing manager to address the problem. We adopted the 'Plan, Do, Study, Act' methodology and created a process map of the existing process. A multidisciplinary meeting was arranged with representatives of all medical and allied health professionals a patient encounters from the onset of acute stroke, including paramedics, emergency department staff, clerical staff, medical physicians,radiographers, radiologists and portering staff. 'Red flags' or areas of possible improvement were identified in every step of the process and we created driver diagrams to redesign our acute clinical and imaging stroke protocol. Sub-specialty education sessions were performed at the time of protocol implementation. To improve our specific 'Door to CT' and 'Door in Door out' times we implemented a new 'Pre-alert' referral to radiology from ED department staff for incoming stroke patients. A new CT ordering proforma was developed to include relevant clinical information to aid in faster imaging interpretation and to identify patients who met referral criteria for EVT. Provision of a timely verbal report on the non- contrast CT brain to the stroke physicians in the CT department prior to CTA was commenced to allow administration of bolus dose thrombolysis in appropriate patients. Clear criteria for EVT referral and appropriate direct line neuroradiology contact numbers were provided for referring physicians. A new CT/CTA reporting proforma was implemented to facilitate audit.

RESULTS

A retrospective review of stroke patient presentation times from clinical records and corresponding CT times from PACS before implementing protocol were analysed. These were compared with new clinical stroke patient documentation and new stroke proforma CT reports. Data and times collected were collected monthly and presented on graphs. A 43% reduction in 'Door to CT' time was observed following protocol implementation. Number of EVT referrals tripled following protocol implementation.

CONCLUSION

Marked improvement in 'Door to CT' and 'Door in-Door out' times. Increase in appropriate referrals for EVT at Neuroradiology centre. Improved patient morbidity and outcomes. Continuous FAST committee meetings, audit and individual case analysis. Appropriate changes to protocol and process map based on case analysis in order to sustain ongoing improvement. Continued education to rotating medical staff.

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QI026-EB-WEB

Automation of the ACR MRI Low-Contrast Resolution Test Using Machine Learning

Wednesday, Dec. 4 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

Magnetic Resonance Imaging (MRI) is a powerful, widespread and indispensable medical imaging modality. The American College of Radiology (ACR) recommends weekly acquisition of phantom images to assess the quality of scanner. Usually, these images must be analyzed by experienced technicians. Automatic analysis of these images would reduce costs and improve repeatability. Some automated methods have been proposed, but the automation of two of the ACR image quality tests remains an open problem. Reports on the high- and low-contrast resolution tests are scarce and so far none of the proposed methods produce results robust enough to allow replacing human work.

METHODS

We use Machine Learning to emulate, with high accuracy, the detection of 120 low-contrast structures of ACR phantom by an experienced professional. We used a database with 620 sets of ACR phantom images that were acquired on scanners of different vendors, fields and coils, totaling 74,400 low-contrast structures. Technicians with more than 10 years of experience labeled each structure as 'detectable' or 'undetectable'. Machine learning algorithms were fed with image features extracted from the structures and their surroundings. Among the five methods we tested, Logistic Regression yielded the largest area under the ROC curve (0.878) and the highest Krippendorff's alpha (0.995). They are also better than the classifications made by junior technicians (with less than 5 years of experience). This indicate that the ACR MRI low-contrast resolution test may be automated using Machine Learning.We have in our database 620 ACR phantom acquisitions in the last 12 months, obtained in 13 scanners of different vendors (Siemens, GE and Philips), magnetic fields (1.5T and 3.0T) and head coils (8, 12 and 32 channels). That means, we have 74,400 low-contrast structures imaged in a great range of conditions to train our classification algorithms. All image processing was carried out using in-house algorithms programmed in Matlab and R language.

RESULTS

The method with the largest AUC was LR (logistic regression) with area of 0.878±0.056, where 0.878 is the mean of the areas obtained by 10-fold cross-validation and 0.056 is the standard deviation. LR also yielded the the highest Krippendorff's alpha (0.995). It is noteworthy that there is no guarantee that AUC and Krippendorff's alpha will agree that a specific algorithm is the best. We tried to solve this problem without using machine learning and did not get good results. Thresholding the signal-to-noise ratio did not work well. We also tried to include the area of the hole into the formula without success. To assess the quality of our method, we compared the answers of junior technicians (with less than 5 years of experience) with our algorithm, considering the answers of senior technicians (with more than 10 years of experience) as "gold standard". The results indicate that junior technicians classified correctly 82% of all holes; and classified correctly only 34% of undetectable holes and 84% of detectable holes. To measure the performance of our algorithm, we thresholded the output of LR model (that yielded the best results) using criterium "ROC01", that minimizes the distance between ROC plot and point (0,1). The results indicates that LR model classified correctly 84% of all holes, 68% of undetectable holes and 87% of detectable holes. In conclusion, our algorithm is better than junior technicians in classifying the holes as detectable/undetectable.

CONCLUSION

We fed five learning algorithms with features extracted from the ACR phantom images, and with labels (detectable/undetectable) assigned by senior technicians with more than 10 years of experience. Among the five methods we tested, Logistic Regression yielded the largest area under the ROC curve (0.878) and the highest Krippendorff's alpha (0.995). The results achieved in this study are substantially better than those previously reported in the literature. Also, the results are better than those obtained when junior technicians (with less than five years of experience) labels the image structures manually. This indicates that it may be possible to replace human operator in ACR low-resolution test.

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QI125-ED-WEB1

Beyond Error Detection and Efficiency Enhancement: Point-of-Care Photography as a QI Tool in Radiography

Wednesday, Dec. 4 12:45PM - 1:15PM Room: QR Community, Learning Center Station #1

FDA Discussions may include off-label uses.

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PURPOSE

Radiologists are rarely in the physical presence of their patients. This creates potential image quality and interpretation challenges, from images saved under incorrect patient identifiers, uncertainty about what procedures have taken place, to a lack of appreciation of the technical factors impacting the quality of images obtained. This project describes a process to address such challenges by acquiring point-of-care patient photos with radiographs.

METHODS

A system to automatically acquire patient photos with portable radiography was deployed at a large academic hospital. The system consists of: 1) WiFi-enabled smart cameras installed on portable radiography units (Fig. 1), and 2) an integration server responsible for retrieving acquired photos, matching photos to radiographs, then processing and sending photos to the hospital's picture archiving and communication system (PACS). Photo acquisition is automatically triggered without disrupting technologists' workflow. Photos are added to radiographs as a new series in PACS (Fig. 2). They are thus stored in a HIPAA-compliant environment and available only to individuals with appropriate access, i.e., radiologists, technologists, physicians, and nurses. Interruption of interpretation workflow is minimized by displaying the photo(s) after the series of radiographs. In addition, technologists have access to these photos prior to marking studies as complete.

RESULTS

Within the first year of deployment this quality improvement (QI) project resulted in the detection and reconciliation of misidentified radiographs, led to a perception of improved technologist and hospital workflow, and generated preliminary evidence of increase in radiologist accuracy and confidence. Misidentifications: Multiple misidentified studies were detected and reconciled with the assistance of patient photos. For those detected by the technologists, reconciliation could be carried out by the technologists themselves, saving radiologists time and effort. In all cases, reconciliation was made easier by the photos. In at least one instance, the patient photo allowed the technologists to not only detect the error but to further identify the correct patient to whom the initially erroneously assigned radiograph belonged. Workflow improvements: Due to the sensitive nature of patient photos, several opportunities for improvements to the patient experience were identified and carried out. Because the photos are sometimes obtained when patients are vulnerable, such as intubated in the ICU, staff training regarding maintaining patient dignity by appropriately draping patients during radiography, decreasing automatic logout time for hospital workstations, and implementing privacy screens for hospital workstations were implemented. Radiologists' confidence: To understand the effect of patient photos on radiologist interpretation, a preliminary study was conducted to assess radiologist accuracy and confidence in assessing lines and tubes on radiographs. This study suggested that patient photos increase both accuracy and confidence in radiologists' interpretation for these studies.

CONCLUSION

Several follow-up actions are being implemented in this ongoing QI project. For instances when it may not be possible to adequately cover the patient, e.g., during emergency imaging, a physical 'stop' button is being developed for the camera that technologists can use to prevent automatic photo acquisition for a predetermined time period. In sensitive instances, this will allow radiographs to be acquired without photos. In addition, a blank leader image will be added to each photo series with embedded text indicating that patient photos follow. This will prevent photos from being displayed unintentionally on hospital workstations and alert the viewer to these photos. Lastly, radiologist reading logs will be analyzed to assess the effect on reading time and confidence. An intriguing emergent benefit of this project is the availability of accurate timestamps corresponding to radiograph acquisition. Accurate timing information is crucial for numerous patient care QI metrics. The clocks of the portable radiography units were found to drift at a machine-specific rate of +/- 1-2 seconds per day, resulting in variations of multiple minutes between machines. Conversely, each camera clock is synchronized with the integration server clock, which in turn is synchronized using multiple network time protocol servers. Therefore, when photo acquisition is triggered automatically upon radiograph acquisition, a globally correct timestamp is generated and used as the acquisition time for each photo. By implementing this QI project, patient care improved by increasing the detection and reconciliation of misidentified studies, identifying improvements to patient care and privacy, and potentially increasing radiologist confidence and accuracy in interpreting portable radiographs. The further quantification of these improvements is an ongoing topic of research.

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QI126-ED-WEB2

Improving MRI Safety in Pediatric Patients Undergoing Sedation: Impact of In-situ Bi-monthly Multidisciplinary Simulation Training

Wednesday, Dec. 4 12:45PM - 1:15PM Room: QR Community, Learning Center Station #2

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PURPOSE

Primary objective was to identify gaps in practice management and increase personnel comfort in proper management of an unstable sedated patient while undergoing magnetic resonance imaging (MRI).

METHODS

In 2018, an in-situ bi-monthly MRI simulation program was implemented on appropriate management of an unstable pediatric patient receiving sedation during an MRI (a high-acuity, low-frequency event). Multidisciplinary team members included pediatric sedation physicians (intensivists), nursing from both sedation team and diagnostic imaging, child-life specialists, MRI technologists and technologist aide, Radiology Quality and Safety leaders, and Simulation Lab instructors. Scenarios simulated moving unstable patient out of Zone 4, role clarification, identification of emergency equipment location, and code activation. Identification of potential safety threats and team debriefing occurred in real time. A 10-question survey assessed the impact of simulation training after one year. Quality improvement tools in this project included flow charts, failure mode and effects analysis during post-simulation debriefing to aid in recognizing potential failures, latent safety threats and barriers to following prescribed workflow.

RESULTS

Nineteen, at least partially completed, survey responses were received (9 PICU physicians, 3 radiology quality and safety team members, 2 MRI technologists, 1 MRI technologist aide, and 4 sedation team nurses). Sixty-three percent (10/16) of participants reported that the simulations identified a gap in practice that could have potentially harm patients. Ninety-four percent (16/17) of participants agreed that the simulation addressed potential barriers to safely moving a sedated patient out of MRI Zone 4. Eighty-eight percent (14/16) of participants agreed or strongly agreed that the simulations helped clearly define roles in an emergency and improved awareness of resuscitation equipment location in MRI. An improvement in comfort on the proper workflow in managing an unstable sedated patient in MRI was seen in 70% (12/17) of respondents, with most (53%, 9/17) changing from comfortable to very comfortable after simulation training.

CONCLUSION

A high percentage of participants acknowledged that the simulation program helped identify a practice gap that could have harmed a patient and address potential barriers to safe evacuation of a patient from MRI Zone 4. Successful in-situ simulation programs require a multidisciplinary team approach to meet the needs of each team member. Simulations help practice high acuity, low frequency events that carry high risk of potential patient harm. Collaboration between team members has allowed for clearer role definitions, workflow familiarity, and identification of latent safety threats. Practice gaps and patient safety threats identified and corrected included malfunctioning intercom system preventing communication between MRI and nursing prep hold, deficiencies in oxygen supply during patient transfer, and confusion on who should call a code and location of resuscitation equipment in MRI.

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QI127-ED-WEB3

Standardized Progress Note Template in the Electronic Medical Record Improves Documentation of Contrast Extravasation Events

Wednesday, Dec. 4 12:45PM - 1:15PM Room: QR Community, Learning Center Station #3

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PURPOSE

CT contrast extravasation events are common, occurring in 1/100 to 1/1000 patients. Although most CT extravasations are self-limited, both initial physician evaluation and clinical follow-up are recommended to assess for signs and symptoms or more serious complications, such as compartment syndrome or skin ulceration. The ACR further recommends that all CT contrast extravasations and any related treatment should be documented in the medical record, particularly the radiology report, and the ordering physician should be notified. Conversely, MRI contrast extravasations are less common and rarely require physician evaluation or clinical follow-up; gadolinium based contrast media is less toxic to the skin and subcutaneous soft tissues than iodinated contrast. The purpose of this quality improvement project was to measure how the creation of a standardized progress note template in the electronic medical record (EMR) impacted the presence and consistency of radiologist documentation of initial physical evaluation and of patient as well as provider communication.

METHODS

All extravasation events at our 738-bed tertiary care urban teaching hospital are filed through an online safety event management reporting and tracking system. All 81 extravasations over a 6-month baseline period (March to September 2017) were reviewed to determine the presence of any EMR documentation on initial radiologist evaluation and treatment. Our intervention was the creation of two standardized 'SmartText' contrast extravasation progress note templates in our EMR with embedded pick lists for most mandatory fields; separate templates were designed for inpatients and outpatients. Mandatory fields included the volume and site of extravasated contrast, pertinent physical exam findings, treatment; additional fields included discharge instruction review for outpatients and direct communication of extravasation to clinical housestaff for inpatients. Trainees, staff and technologists were all educated regarding the new templates and documentation workflow. All 34 extravasations during the first two months of the standardized template roll-out (February and March 2019) were reviewed in the EMR for documentation of radiologist evaluation and treatment.

RESULTS

Radiologist documentation of contrast extravasation in the EMR increased from 76% (45/59) in CT during baseline to 88% (23/26) following the intervention and from 0% (0/22) in MRI to 25% (2/8). Documented CT extravasations during baseline mainly included a hand-filled form scanned into the patient's EMR (43/45; 96%), with a few free-text progress notes (2/45; 4%). Following the intervention, all CT extravasations were documented using the standardized progress note template (23/23) with consistent reporting of physical exam findings, discharge instructions for outpatients, and communication with clinical house staff for inpatients. A single emergent hand surgery consult was required during baseline.

CONCLUSION

Creation of standardized contrast extravasation progress note templates in the EMR with embedded pick lists improved consistent documentation of physical examination findings as well as patient and provider communication in the EMR.

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RO212-SD-WEB1

Bi-parametric MRI Prior to Primary Radiotherapy for Prostate Cancer in a Resource Limited Setting: Implications for Risk Group Stratification and Treatment

Wednesday, Dec. 4 12:45PM - 1:15PM Room: RO Community, Learning Center Station #1

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PURPOSE

Bi-parametric prostate MRI (bpMRI) was introduced in a predominantly non-Caucasian population where resources are limited and the age standardized mortality from prostate cancer is amongst the highest in the world. We assessed prostate risk group migration and subsequent management change following bpMRI, for men being offered radical radiotherapy (EBRT).

METHOD AND MATERIALS

This retrospective study assessed the bpMRI findings in 67 consecutive men who presented for EBRT over a 12-month period. Men known to be metastatic were excluded. PSA level, DRE findings, Gleason score and any prior CT results were used to stratify patients into low, intermediate and high risk, according to NCCN risk groups. Any androgen deprivation therapy (ADT) prior to MRI was recorded. The pre and post MRI T stage was recorded along with any risk group migration.

RESULTS

The men ranged in age from 53 to 85 years. Risk group stratification before MRI separated these men into low risk (4/67; 6%), intermediate (35/67; 55.2%), high risk (24/67; 35.8%) and nodal involvement (4/67; 6.0%). Following MRI, all men in low risk groups were upgraded, with final categories of intermediate risk (15/67; 22.4%), high risk (43/67; 64.2%), nodal involvement (5/67; 7.5%) and metastatic disease (4/67, 6.0%). Overall there were 41.8% (28/67) risk group upward shifts, no downward shifts and 58.2% (39/67) of men remaining in the same group. Of the upward shifts, most were men moving from the intermediate to high risk group (20/28; 71.4%). No correlation was found between initial histology or prior ADT and risk group shifts ($p>0.05$). PSA levels however correlated with risk group shifts ($p=0.02$), with men at intermediate risk PSA (10-20ng/ml) more likely to show risk group migration (13/21; 61.9%) compared with high risk:PSA>20 (7/30; 23.3%) or low risk:PSA<10 (8/16; 50%).

CONCLUSION

Current management options for prostate cancer uses the NCCN risk stratification system to optimize biochemical control and prostate cancer specific mortality. Utilization of bpMRI in this high risk population resulted in risk group migration for just over 40% of patients, with subsequent changes in EBRT planning and ADT prescription, which otherwise would have been suboptimal.

CLINICAL RELEVANCE/APPLICATION

In the limited resource high risk setting, bpMRI should be considered prior to primary RT for prostate cancer. Larger scale studies and patient outcome follow up is necessary and being conducted.

RO213-SD-WEB2

Ultrashort Echo-Time Dynamic Contrast Enhancement MRI of Vascular Perfusion and Permeability Changes in Multiple Organs in a Preclinical Model of Irradiation

Wednesday, Dec. 4 12:45PM - 1:15PM Room: RO Community, Learning Center Station #2

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PURPOSE

Lung and kidney injuries after exposure to high-dose radiation during cancer treatment have been well described. The injury of blood vessels is believed to be a determinant of the resultant effects of radiation in a variety of organs. Our goal in this study is to identify minimally invasive MRI biomarkers that characterize changes in vascular permeability and perfusion for predicting radiation-induced lung injury before symptoms develop in a rat model of radiation.

METHOD AND MATERIALS

Wistar rats (11-12 week females, weight ~155g, n = 10) were exposed to a single dose of 13 Gy X-rays with one hind leg shielded. The irradiated rats were randomized into two groups: treated (using ACE inhibitor Lisinopril) and untreated. Non-irradiated age-matched controls were also evaluated (n=5). Anesthetized rats were imaged at 6-weeks post irradiation on a 9.4T Bruker MRI scanner using ultrashort echo-time dynamic contrast enhancement (DCE) sequence. After baseline imaging, 0.05 ml Gadovist was injected in the tail vein, followed by 0.6ml saline flush. The images were processed to remove respiratory induced motion, followed by ROI analysis in the lung, kidney, and aorta using multi-compartment pharmacokinetic modeling to measure bio-distribution kinetics, uptake, and washout rates.

RESULTS

Lung contrast retention was elevated in radiated rats up to 10 weeks post-radiation, indicating increased vascular permeability. Contrast bio-distribution, uptake, and release rates were sensitive quantitative indices of change in organ perfusion and permeability. Lisinopril treated radiated rats indicated reduced uptake and retention of contrast in kidneys as expected because of the efferent vessel dilation effect of Lisinopril. Lung contrast uptake and clearance were not affected by Lisinopril treatment. Increased permeability in our model may be pathophysiologically related to apoptosis of endothelial cells, as has been previously reported.

CONCLUSION

We presented a non-invasive MRI-based DCE imaging method showing the potential for in vivo quantification of irradiation-induced vascular perfusion and permeability changes in multiple organs in the same rat.

CLINICAL RELEVANCE/APPLICATION

Advanced MRI provides crucial knowledge for accurately evaluating efficacy of radioprotectors, mitigators and therapeutic agents, as well as in monitoring individuals with survivable radiation injury.

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RO219-SD-WEB3

Hafnium Oxide Nanoparticles Activated by Radiotherapy Induce an Anti-Tumor Immune Response

Wednesday, Dec. 4 12:45PM - 1:15PM Room: RO Community, Learning Center Station #3

Participants
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PURPOSE

First in class hafnium oxide nanoparticles (NBTXR3) activated by radiotherapy (RT) increase radiation dose deposit within cancer cells compared to RT alone. Given that RT can prime an anti-tumor immune response we hypothesized that this response could be enhanced by NBTXR3+RT in both animals and humans.

METHOD AND MATERIALS

Different abscopal assays in mice were conducted. Immunocompetent mice were injected in both flanks with murine tumor cells. Intratumoral injection of NBTXR3 (or vehicle) was performed in right flank tumors, followed by RT of right flank tumors only. Tumor growth was followed and immune cell infiltrates were analyzed by immunohistochemistry (IHC). Some mice received anti-PD-1 injections and tumor growth was monitored. Pts with locally advanced soft tissue sarcoma (STS) [NCT02379845] received either NBTXR3+RT or RT alone. Pts pre- and post-treatment tumor tissues were analyzed by IHC and Digital Pathology for immune biomarkers.

RESULTS

Animal studies demonstrated that NBTXR3+RT induces an immune response which was not observed with RT alone. IHC showed significantly more CD8+ cells present in NBTXR3+RT treated and untreated tumors. Furthermore, NBTXR3+RT improved the effect of anti-PD-1. Similarly, increased CD8+ T cell infiltration pre- vs post-treatment was observed in tumor tissues from STS pts treated with NBTXR3+RT. An increase in biomarkers, including CD8, following NBTXR3+RT was also observed by IHC in tumor samples from STS pts compared to RT alone.

CONCLUSION

These results demonstrate that NBTXR3+RT induces a specific adaptive immune profile in both mice and STS pts. NBTXR3+RT also improved response to anti-PD-1 in mice, opening the potential for combination with immunotherapeutic agents in humans. We have therefore sought to investigate the safety and systemic effect of NBTXR3 activated by stereotactic ablative radiotherapy (SABR) in combination with anti-PD-1 in pts with locoregionally recurrent or metastatic (lung or liver) head and neck squamous cell carcinoma, as well as in metastatic non-small cell lung cancer and liver metastasis pts [NCT03589339].

CLINICAL RELEVANCE/APPLICATION

The results of this study highlight the potential of NBTXR3 to be used in combination with immune checkpoint inhibitors in order to improve patient outcomes.

UR190-ED-WEB7

VIRADS: Not Just Another "RAD's" - Why the Radiologist Should Know and Use It

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #7

Awards
Certificate of Merit

Participants
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TEACHING POINTS

•Bladder cancer (BC) is the most common urinary tract neoplasm, and one of the most expensive to manage. The correct staging is directly associated with prognosis and treatment planning. •Magnetic resonance imaging (MRI) has an important role on staging BC, due to its high spatial resolution and soft tissue contrast, differentiating tumor from normal muscle layer.•VI-RADS (Vesical Imaging Reporting and Data System) was developed using multiparametric resonance imaging (mpMRI), creating a systematic approach to define the risk of muscle invasion. MpMRI also allows differentiation between benign pathologies and post-treatment changes from BC.•Using the conventional T2 sequence and functional sequences such as diffusion and dynamic contrast enhanced images, VIRADS proposes a score using the appearance of BC in each sequence to define the probability of invasive disease, helping the radiologist to increase accuracy on staging.

TABLE OF CONTENTS/OUTLINE

• Basic concepts of BC and impact of adequate staging.• Limitations of conventional MRI and computed tomography alone on tumor staging.• Presentation of VIRADS.• Illustration of several cases highlighting the importance of functional sequences on staging, and in differentiate tumor from benign pathologies/changes after treatment.

UR191-ED-WEB8

Don't Get Fooled: Read Like a Musculoskeletal Radiologist - Key Benign Lesions for Abdominal Imagers

Wednesday, Dec. 4 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #8

Participants
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Ryan Ward, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD, Westlake, OH (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

By viewing this exhibit, the participant will: Realize that there are variety of incidental bone and soft tissue findings that can be detected on abdominal and pelvic MRI studies. Understand benign musculoskeletal entities that can be detected on abdominal/pelvic MRI studies that may be confused for aggressive pathology. Comprehend the differences between musculoskeletal MRI protocols and abdominal/pelvic MRI protocols to better navigate incidental musculoskeletal findings. Review example cases with emphasis on key imaging findings for each entity.

TABLE OF CONTENTS/OUTLINE

Incidence of bone and soft tissue findings on abdominal and pelvic MRI. Commonly encountered benign MSK pathology, classified in a meaningful way Compare and contrast abdominal/pelvic MRI and MSK MRI protocols Example cases within each category with key imaging findings Conclusion; how this knowledge positively impacts patient management.

Printed on: 10/29/20

VI141-ED-WEB9

Percutaneous Omental Biopsies: A Safe and Non-Surgical Method in Evaluation of Abdominal Disease

Wednesday, Dec. 4 12:45PM - 1:15PM Room: VI Community, Learning Center Station #9

Participants
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TEACHING POINTS

1.Evaluation of etiology of omental thickening in ascites of unknown origin. 2.Demonstrate histopathological findings in a series of patients.

TABLE OF CONTENTS/OUTLINE

Materials and methods A retrospective search of all patients who underwent omental biopsies was done from Feb 2011 to January 2019.A total of 153 patients were reviewed, out of which, three patients were lost to follow up,therefore were excluded from the study.150 patients were finally enrolled into the study.110/150 patients were biopsied using CT and USG guidance combined, while 40/150 patients underwent biopsy using USG guidance .Biopsies were done using 18 G needle .The number of new malignancies diagnosed by omental / peritoneal biopsies were also recorded. Data analysis:Sensitivity, specificity, positive and negative predictive values were calculated .Biopsy result was positive for disease in 144 / 150 (96. %) patients. Four patients were negative on biopsy. 3/150 patients with negative biopsy result were found to hematomas, which resolved on subsequent scans.Thus, in the entire group,the sensitivity was 97.29 % (144/158); Conclusion USG-guided biopsy of the omentum is a safe and effective procedure. A thickened omentum can serve as an easily accessible site for biopsy, especially in patients who have ascites of unknown etiology and in those with a history of previous malignancy.

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VI215-SD-WEB1

The Future Liver Remnant in Associating Liver Partition with Portal Vein Ligation or Embolization

Wednesday, Dec. 4 12:45PM - 1:15PM Room: VI Community, Learning Center Station #1

Participants
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PURPOSE

To compare increasing rate of future liver remnant (FLR) in modified associating liver partition with portal vein ligation or embolization (ALP combination) group and trans-ileocecal portal vein embolization (TIPE) group for staged hepatectomy.

METHOD AND MATERIALS

Recently, a new technique for hepatic resection that is performed in two stages called associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) has been described. In our hospital, modified ALPPS or associating liver partition and TIPE (ALP-TIPE) have been adopted. From 2012 to 2018, 4 patients underwent modified ALPPS, 3 patients underwent ALP-TIPE [ALP combination group (n=7)], and 14 patients underwent TIPE [TIPE group (n=14)] for right or extended right hepatectomy. The indication for ALP combination was small %FLR: less than 30% [%FLR = FLR ml/[total liver volume; TLV (ml) - tumor volume (ml)] × 100] or large tumor (<7cm) with future liver remnant plasma clearance rate of indocyanine green (ICGK-F) <0.07. TIPE was performed using absolute ethanol. Computed tomography volumetry was performed before and 1 week (ALP combination group) or 3 weeks (TIPE group) after the procedure. The FLR ml ratio (post FLR ml/pre FLR ml) was calculated. We compared the FLR ml ratio of the ALP combination group with that of the TIPE group.

RESULTS

All procedures succeeded. No procedure-related complications were recorded. The median FLR ml ratio of the ALP combination group was 1.48 (mean ± SD 1.49 ± 0.24), that of the TIPE group was 1.24 (mean ± SD 1.26 ± 0.13). There was a significant difference (Mann-Whitney *U* Test: *P* =0.03).

CONCLUSION

Combination of associating liver partition could increase the FLR more than only TIPE.

CLINICAL RELEVANCE/APPLICATION

Combination of associating liver partition could increase the future liver remnant (FLR) more than only trans-ileocecal portal vein embolization (TIPE).

VI216-SD-WEB2

Can Computational Fluid Dynamics Predict the Progression of Visceral Artery Aneurysms?

Wednesday, Dec. 4 12:45PM - 1:15PM Room: VI Community, Learning Center Station #2

Participants
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Keigo Chosa, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Progressive visceral aneurysms should be coil-embolized because their rupture is fatal. As aneurysmal blood flow dynamics may be related with progression, its prediction by hemodynamics study may make early intervention possible, save lives, and decrease the complication rate and cost.We investigated whether computational fluid dynamics (CFD) can predict the progression of splenic artery aneurysms, the most frequently-occurring visceral aneurysms.

METHOD AND MATERIALS

This retrospective study included 4 males and 6 females (age range 42 - 74 years) who underwent contrast-enhanced computed tomography (CECT) studies between January 2017 and December 2018. They confirmed splenic artery aneurysms. The patients were divided into a progression- and a non-progression group and followed up for a median of 26 months. For CFD analysis we extracted a 3D vessel model of the aneurysm with proximal and distal vessels in the arterial phase. Blood density was set at 1056 kg/m2, viscosity at 0.0035Pa·s, and the flow volume at 0.0036 kg/s. The blood flow velocity was acquired by Doppler ultrasound; the peak flow was 35 cm/s.The time-arranged wall shear stress (TAWSS) and the oscillatory shear index (OSI) of each aneurysm were calculated with the CFD model and differences between the progression- and the non-progression group were analyzed with the Mann-Whitney U-test.

RESULTS

The median TAWSS was 166 (range1.38-434) Pa/cycle in patients with- and 1720 (967-5930) Pa/cycle in patients without progression ($p = 0.008$). The OSI was not different ($p = 0.421$).

CONCLUSION

As lower TAWSS may be indicative of an arteriosclerotic process, it may be related with the progression of splenic artery aneurysms; vessel-wall destruction by inflammatory cells may also be related. Additional studies on larger populations are necessary to confirm the validity of CFD analysis to predict the progression of visceral artery aneurysms.

CLINICAL RELEVANCE/APPLICATION

Lower TAWSS, calculated by CFD analysis, may relate to the progression of splenic artery aneurysms. The prediction of progression based on hemodynamics studies may guide the timing of intervention.

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VI217-SD-WEB3

The Impact of Tissue Characteristics on Outcome of High-Intensity Focused Ultrasound Treatment of Uterine Leiomyomas

Wednesday, Dec. 4 12:45PM - 1:15PM Room: VI Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To comparatively evaluate therapeutic efficacy of high-intensity focused ultrasound (HIFU) ablation of uterine leiomyomas based on T1-perfusion and T2 signal intensity (SI)-based classifications.

METHOD AND MATERIALS

A total of 74 women with symptomatic leiomyomas (age, 39.1 ± 5.9 years) who underwent HIFU treatment were classified according to (i) T2 SI-based classification as type I (n = 10, if SI of lesion was lower than or equal to that of skeletal muscle), type II (n = 40, if SI of lesion was lower than that of the myometrium but higher than that of skeletal muscles) and type III (n = 17, if SI of lesion was higher than that of the myometrium), and (ii) T1 perfusion-based classification as group A (n = 44, if the time-SI curve of lesion was lower than that of myometrium) and group B (n = 23, if the time-SI curve of lesion was higher than that of myometrium). The non-perfused volume (NPV) ratios immediately after treatment and volume reduction ratios and transformed symptom severity scores (tSSS) at the 6-month follow-up were retrospectively assessed.

RESULTS

The mean fibroid volume in type I, II, III, and groups A and B was 155.4ml, 207.7ml, 156.5ml ($p > 0.05$), and 206.1ml, 150.0ml ($p > 0.05$), respectively. The mean NPV ratio was significantly higher in group A than in group B (95.6%, 51.9%, respectively; $p<0.05$). However, no statistically significant difference was observed in the immediate NPV ratio among patients with type I, II and III (80.6%, 79.5%, 83.2%, respectively; $p>0.05$). The 6-month fibroid volume reduction ratio in group A was significantly greater compared to that in group B (52.7% and 3.6%, respectively; $p<0.05$), whereas no statistically significant difference was observed among type I, II and III (44.3%, 32.8%, 38.2%, respectively; $p>0.05$). The corresponding symptom improvement ratio was 70.3%, 53.7%, 55.3% in type I, II and III and 80.9% and 10.1% in group A and group B, respectively.

CONCLUSION

This study suggests that tissue vascularity based on T1-perfusion based classification could play an important role in not only classifying and stratifying the uterine leiomyomas but also predicting the treatment outcome of HIFU ablation.

CLINICAL RELEVANCE/APPLICATION

In addition to tissue cellularity, vascularity also should be considered in the screening phase to improve the prediction of treatment response.

VI268-SD-WEB6

Time-Driven Activity-Based Costing in Interventional Oncology: Calculating the Longitudinal Costs of Care for Multidisciplinary HCC Care

Wednesday, Dec. 4 12:45PM - 1:15PM Room: VI Community, Learning Center Station #6

Awards
Trainee Research Prize - Medical Student

Participants
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PURPOSE

Only 36% of Medicare patients with hepatocellular carcinoma (HCC) undergo cancer therapy. Transarterial chemoembolization (TACE) is utilized 10 times more frequently than ablation for Medicare patients. Multidisciplinary care improves quality and utilization of cancer therapy; however, the true costs of such care are poorly understood. Therefore, the purpose of this study was to use time-drive activity-based costing (TDABC) to determine the costs of multidisciplinary liver clinic, TACE, yttrium-90 radioembolization (Y90) and ablation during HCC therapy.

METHOD AND MATERIALS

In this HIPAA-compliant, IRB-approved study, three observers prospectively recorded the utilization time for staff members, consumables, and equipment used to treat ten HCC patients during multidisciplinary liver clinic, TACE, Y-90, and ablation procedures. Process maps captured patient flow from admission to discharge, and the total duration of each phase of care was determined with prospective measurements. Capacity cost rates (cost per minute) were calculated for all staff members and fixed equipment. These rates were multiplied by the average utilization duration per resource to determine the average cost of that resource for each procedure.

RESULTS

The total costs of ablation were $3,826, which was 75% of the $5,088 cost for TACE, and 18% of the $20,747 cost of Y-90. The cost for an ablation increased from $3,288 to $4,245 to $4,461 for one vs. two vs. three lesions treated. The cost for a TACE increased from $5,051 to $5,296 for non-selective (lobar) vs. selective TACE. Consumables were the greatest cost contributor across all three procedures and accounted for 63% of ablation, 58% of TACE, and 91% of Y-90 costs. A single consumable accounted for a substantial portion of the overall procedure cost, namely ethiodized oil for TACE (30%), Y-90 resin microspheres for Y-90 (81%), and the probe for ablation (41%). Multidisciplinary tumor clinic cost was $334 per patient, driven entirely by personnel.

CONCLUSION

Using a bottom-up costing approach, ablation costs are significantly less than those of TACE and Y-90 despite the increased utilization of non-curative therapies in the Medicare population.

CLINICAL RELEVANCE/APPLICATION

A HCC bundled payment model may improve treatment utilization and use of potentially curative treatments. However, true costs of care need to be evaluated to accurately determine financial risk.

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VI270-SD-WEB8

Radiomics Analysis to Predict Progression-Free Survival for Patients of RFA by Using Deep Learning in Contrast-Enhanced Ultrasound

Wednesday, Dec. 4 12:45PM - 1:15PM Room: VI Community, Learning Center Station #8

Participants
Fei Liu JR, MD,MD, Beijing, China (*Presenter*) Nothing to Disclose
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PURPOSE

To develop and validate an deep learning (DL) based radiomics method for predicting progression-free survival (PFS) of radiofrequency ablation (RFA) accurately based on contrast-enhanced ultrasound (CEUS).

METHOD AND MATERIALS

Two hundred and fourteen patients were enrolled respectively (training cohorts: 149, validation cohorts: 65), who received CEUS within one week before RFA. DL-based radiomics model was developed and validated to predict the probability of PFS. Harrell's concordance index (C-index) was used to quantify the prediction performance. Kaplan-Meier survival curve was applied to show the stratification of PFS. An individualized prediction model incorporating the radiomics signature and clinical variables was proposed for the prediction of PFS, accompanied with calibration and decision curve analysis.

RESULTS

The C-index of the proposed model was 0.754 and 0.725 in training and validation cohorts, respectively. The radiomics signature was significantly associated with PFS ($P<0.05$ for two cohorts). The individualized model, which incorporated the age, PLT and radiomics signature, showed good discrimination as well, with good calibration result ($P>0.05$). Decision curve analysis confirmed the radiomics model's clinical utility.

CONCLUSION

Using CEUS cines data, our developed DL-based radiomics model showed excellent prediction performance for PFS of RFA. This non-invasive radiomics model may be used to identify patients who are more likely to benefit from RFA before treatment and optimize the clinical strategy.

CLINICAL RELEVANCE/APPLICATION

DL-based radiomics analysis can predict PFS of RFA with CEUS cines and distinguish who could benefit more from RFA to optimize the clinical decision making.

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VI271-SD-WEB5

Digital Variance Angiography as a Risk Reduction Measure in Peripheral Endovascular Interventions

Wednesday, Dec. 4 12:45PM - 1:15PM Room: VI Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Digital Variance Angiography (DVA) - that is based on the kinetic imaging technology - is a novel, patented X-ray image processing method visualizing contrast motion by calculating the variance of each pixel intensity in a recorded series of images. The image processing algorithm is built in a software that is able to generate DVA images from raw X-ray image series. Our aim was to determine the potential benefits of DVA in peripheral endovascular interventions.

METHOD AND MATERIALS

Two observational studies enrolled 66 patients undergoing lower limb X-ray angiography due to symptomatic peripheral arterial disease. A subgroup of 24 patients received carbon-dioxide (CO2) as contrast agent. We compared the signal-to-noise ratios (SNRs) of Digital Subtraction Angiography (DSA) and DVA image pairs. Visual quality comparisons were also performed by vascular specialists using an online questionnaire. Interrater agreement was characterized by percent agreement and Fleiss' kappa.

RESULTS

A total of 6814 regions of interest were selected on image pairs to calculate and compare SNRs. The ratio of SNR(DVA)/SNR(DSA) was calculated. DVA provided 3.3 times (median) higher SNR than DSA on angiograms obtained using iodinated contrast medium (ICM). The ratio was 3.0 times (median) higher in the images of the CO2 subgroup. In 69% of the ICM group comparisons it was judged that DVA provided higher quality images than DSA. Fleiss's kappa was 0.17 ($p<0.001$). DVA was preferred over DSA in 85% of paired image comparisons in the CO2 subgroup. Fleiss's kappa was 0.27 ($p<0.001$).

CONCLUSION

In conclusion, DVA provides significantly higher image quality than DSA while performing catheter angiography with ICM or CO2. The higher image quality makes CO2 angiography more feasible for patients with renal insufficiency and iodine allergy. The significant SNR difference suggests a remarkable reduction of radiation and ICM exposure, thus ongoing studies are investigating the optimal protocols for low-dose DVA acquisition.

CLINICAL RELEVANCE/APPLICATION

Digital Variance Angiography (DVA) significantly improves the image quality of X-ray angiograms compared to DSA. The quality reserve of DVA allows a substantial amount of iodinated contrast agent and radiation dose reduction but further studies are needed for the precise refinement of image acquisition protocols. The new technique helps the widespread use of CO2 as a safer contrast agent.

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VI272-SD-WEB4

The Guiding Value of 3D-BRAVO and 3D TOF MRA for Microvascular Decompressing

Wednesday, Dec. 4 12:45PM - 1:15PM Room: VI Community, Learning Center Station #4

Participants
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PURPOSE

To explore the guiding value of preoperative trigeminal nerve/facial nerve three dimensional brainvolume (3D-BRAVO) and three-dimensional time-of-flight (3D-TOF) MRA scanning for microvascular decompression.

METHOD AND MATERIALS

113 patients treated with microvascular decompression from February 2016 to February 2018 in First Affiliated Hospital of Dalian Medical University were retrospectively analyzed. All patients received 3D-BRAVO combined with 3D-TOF MRA sequence reconstruction before operation(Fig.1). Magnetic resonance scanning sequence includes 3D-BRAVO sequence,3D-TOF sequence and 3D-FIESTA sequence. The anatomical relationship of neurovascular was analyzed and compared with the results of intraoperative exploration. The data were analyzed by SPSS 22.0. $P < 0.05$ was considered statistically significant.

RESULTS

After reconstruction of 3D-BRAVO combined with 3D-TOF sequence,3D-FIESTA combined with 3D-TOF sequence, all patient images can visually observe trigeminal nerve, facial nerve and three-dimensional images of peripheral blood vessels from different angles. The relationship between the blood vessels and nerves were assessed. Responsible blood vessels are obtained by intraoperative exploration as the gold standard. The results of MVD showed that the number of positive cases is 108 (95.6%) on the involved side. 3D-BRAVO combined with 3D-TOF sequence reconstruction showed positive 106 cases (93.8%) with 98.1% positive coincidence rate and 5.3% false positive rate. 3D-FIESTA combined with 3D-TOF sequence reconstruction showed positive 98 cases (86.7%) with 90.7% positive coincidence rate.

CONCLUSION

3D-BRAVO combined with 3D-TOF sequence reconstruction before microvascular decompression can fully evaluate the morphology, location and anatomical relationship of the lesions, and improve the clarity and recognition of neurovascular tissue,which is of guiding value for clinical diagnosis and treatment.

CLINICAL RELEVANCE/APPLICATION

3d-BRAVO combined with 3D-TOF MRA sequence reconstruction technology improves the definition and identification of neurovascular tissue, carefully understands the size range, morphology, location and anatomical relationship of the lesion, and assists neurosurgeons to make surgical plans, increasing the probability of finding the responsible vessel and successful MVD surgery.

AI010-EC-THA

ePAD-AI: A Platform for Standards-Based Collaborative AI Application Development in Medical Imaging

Thursday, Dec. 5 12:15PM - 12:45PM Room: AI Community, Learning Center Custom Application Computer Demonstration

Participants
Daniel L. Rubin, MD, Stanford, CA (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd
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CONCLUSION

The enhancements to the ePAD platform are expected to catalyze image annotation data collection efforts, accelerate collaborations in such projects, and ultimately help lead to machine learning and AI applications to improve radiology.

Background

There is exploding interest in building AI models for many radiology applications, but this requires amassing many annotated images. While there are many tools for image annotation, annotations are not saved in a standard format that thwarts interoperability across tools or AI algorithms, and current tools focus only on data collection, not data discoverability. We extended our freely available ePAD platform (http://epad.stanford.edu) to meet the needs of collaborative collection and discoverability of image annotations in a standards-based format that will catalyze AI model development in the community.

Evaluation

ePAD is an open source, web-based tool enabling distributed, large scale collection of radiology image annotations. We enhanced ePAD to use keyboard shortcuts and graphical symbols for very rapid image and study level annotation (see Figure). Annotations are saved in the new DICOM-SR/AIM standard for interoperability across systems that support DICOM-SR. Users can now create custom templates to collect clinical labels for images (e.g., diagnoses, imaging observations, and anatomic locations). We also added collaboration features such as privileging of accessing/viewing of annotations and summaries of annotation efforts. We added ability of ePAD instances to poll other ePAD instances for discoverability of relevant data at other sites that will foster collaboration among sites in building AI models.

Discussion

ePAD is being used by many institutions, currently with 423 users who have created over 50,000 image annotations in 504 projects (on servers that are online, local instances are not included). The enhancements to the platform will foster multi-institutional collaborations for collecting image annotations in large scale for developing AI applications. The use of standards for image annotations will provide value to the community as other image viewing/annotation systems adopt DICOM-SR for annotations.

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AI239-SD-THA2

An Artificial Intelligence Solution for Detecting Significant Pneumothorax on Chest Radiographs: Experience on a Real-World Dataset and Potential Impact on Turnaround Time at an Academic Tertiary Medical Center

Thursday, Dec. 5 12:15PM - 12:45PM Room: AI Community, Learning Center Station #2

Participants
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PURPOSE

To evaluate the efficacy and potential impact of an artificial intelligence (AI) solution for detecting significant (moderate or large) pneumothoraces on chest radiography on turnaround time (TAT) on a 'real-world' dataset at a tertiary center.

METHOD AND MATERIALS

4,202 unique deidentifed frontal chest radiographs were used for model training, consisting of 677 (16%) significant pneumothoraces, and 3525 controls (84%) without pneumothoraces. Controls included images with support devices such as chest tubes, bullous disease and normal. 75 additional images were used for validation (50 controls and 25 with significant pneumothorax). All images were reviewed by two board certified radiologists. The algorithm consisted of an Inception V3 backbone using the Tensorflow framework. The best model on the validation set was deployed for assessment on new cases for a period of 10 days at an academic tertiary medical center. This consisted of an automated system that queried new unread chest radiographs from our PACS at 5-minute intervals, which were subsequently processed by the AI algorithm, and the results and timestamps were stored in a database. Unpaired t tests were used to assess for significant differences in TAT. $P < 0.05$ was considered statistically significant.

RESULTS

A total of 949 test radiographs were processed by the AI algorithm. Of these, there were 31 true positives, 11 false positives, 0 false negatives, and 907 true negatives, yielding a sensitivity of 100% (95%CI: 89-100%), specificity of 98.9% (95%CI: 97.9-99.4%), and positive predictive value of 73.8% (95%CI: 61.0-83.5%). The mean TAT for complete-to-AI read was 4.7min ± 2.7, and median TAT was 5.0min. The mean TAT for complete to earliest identification by the radiologist was 121.1 min ± 112.0, with a median TAT of 60.0min. There was a significant improvement in TAT for the AI solution ($P<0.0001$) compared to the radiologist.

CONCLUSION

An automated AI solution for detecting significant pneumothorax on chest radiography had significantly lower turnaround times for identification of such potentially critical results, with high sensitivity and specificity on a real-world dataset.

CLINICAL RELEVANCE/APPLICATION

AI solutions for detecting critical results has potential for radiology reading worklist prioritization or other clinical alert systems.

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AI262-SD-THA1

Determining Brain Age Using Machine Learning Combined with Automated Brain Segmentation and PET Imaging In Normal, Alzheimer's Disease and Mild Cognitive Impairment Subjects

Thursday, Dec. 5 12:15PM - 12:45PM Room: AI Community, Learning Center Station #1

Participants
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PURPOSE

Understanding brain aging may be critical to identify potential biomarkers in neurodegenerative diseases. Here we developed a machine learning based age-prediction model for metabolic and volumetric changes of normal brain structures and evaluated this model on imaging data from patients with Alzheimer's disease (AD) and mild cognitive impairment (MCI), as well as normal subjects.

METHOD AND MATERIALS

F18-FDG PET scans and paired T1 weighted MRI brain scans for normal subjects (59-96yo, 157m/169f), MCI (56-93yo, 263m/163f) and AD (56-91yo, 121m/80f) from the Alzheimer's Disease Neuroimaging Initiative (ADNI) imaging studies were used. All imaging data were processed by an automated brain PET activity analysis and MRI volumetric segmentation tool, PETQuant. The volumetric measurements, as well as the mean SUVR (Standardized uptake value (SUV) ratio) to the brain stem for all brain structures, were calculated. A subset of the normal test data (n=50) was reserved for testing. A brain aging model was created using a Random Forest machine learning algorithm with the normal subjects' data. MCI and AD data were evaluated using this normal brain aging model.

RESULTS

We found the best age prediction was achieved by combining both PET and MRI measurements. For normal subjects, this model showed a high accuracy with the mean difference of -0.23 ± 3.1 years between actual and predicted age by model. In comparison, the MCI group had a mean difference of -2.12 ± 5.13 years, while the AD group had a mean difference of -3.59 ± 5.76 years. The AD subjects younger than 75 years old had the largest disparity between the actual and predicted ages. The predicted age based on PET/MRI measurements was on average 9.35 ± 4.52 year older than the actual age, while AD patients 75 years and above only showed a mean difference of -0.3 ± 3.26 years.

CONCLUSION

Our brain aging model showed a significant predicted age difference between normal and younger (<75yo) AD subjects. This suggests that accelerated brain aging could serve as an early biomarker for Alzheimer's disease. This might help clinicians to identify younger subjects with AD and monitor their disease progression rates.

CLINICAL RELEVANCE/APPLICATION

Early diagnosis of Alzheimer's disease and monitoring disease progression to improve patient management.

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AI277-SD-THA3

Performance Evaluation of the ABC/2 Method and Deep Learning-Assisted Algorithm in Measuring the Volume of Intraparenchymal Hematoma

Thursday, Dec. 5 12:15PM - 12:45PM Room: AI Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate the performance of the ABC/2 method and deep learning based algorithm in measurement of intraparenchymal hematoma volume for patients with spontaneous cerebral hemorrhage using head CT images.

METHOD AND MATERIALS

200 patients with acute spontaneous cerebral hemorrhage from July 2017 to December 2018 were retrospectively collected in our hospital and 60 patients with intraparenchymal hematoma were finally included in this study (excluding intraventricular and subarachnoid hematoma). Two radiologists with more than 10 years' working experience used the Philips post-processing workstation software (Extended Brilliance Workstation) to delineate intraparenchymal hematoma region for area calculation. The volume of hematoma was calculated according to V=Σ hematoma area × layer thickness. The average of hematoma volume measured by two radiologists was used as the gold standard volume. The two radiologists analyzed and used ABC /2 method to measure hematoma volume. The largest slice of hematoma was selected, A is the maximum long diameter of the hematoma in CT images, B is the wide diameter perpendicular to A and C is the approximate number of bleeding layers multiplied by the thickness of the CT images. Finally, a deep learning-based artificial intelligence (AI) diagnostic system (InferRead CT Stroke Research, Infervision, Beijing) was used to measure the hematoma volume. The matched t-test was used to compare the volume and delineation time between the gold standard and deep learning algorithm.

RESULTS

The gold standard hematoma volume was (22.80±3.99) ml, ABC/2 method calculated volume was (24.28±4.17) ml and (22.42±4.05) ml for deep learning algorithm. There was no statistically significant difference in the volume of hematoma between deep learning algorithm and gold standard ($P>0.05$). The difference between ABC/2 method and gold standard was statistically significant ($P<0.05$).

CONCLUSION

Deep learning algorithm can measure the volume of intraparenchymal hematoma of patients with acute spontaneous cerebral hemorrhage in head CT images more accurately as compared with the commonly used ABC/2 method.

CLINICAL RELEVANCE/APPLICATION

It is recommended to use deep learning based algorithm to measure the volume of intraparenchymal hematoma of patients with acute spontaneous cerebral hemorrhage more accurately.

BR215-ED-THA6

Abbreviated and Ultrafast Breast Magnetic Resonance Imaging (MRI) in Clinical Practice: What the Radiologist Needs to Know

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center Station #6

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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TEACHING POINTS

Abbreviated and Ultrafast MRI are emerging techniques that reflect increasing understanding of breast cancer as a heterogenous group of diseases. These approaches aim to target more biologically aggressive cancers, while maximizing diagnostic accuracy. As these techniques enter clinical practice, it is essential that radiologists understand how and why interpretation in this setting may differ from conventional MRI. In this exhibit, we will describe current techniques; assess pros and cons of abbreviated approaches; discuss clinical applications and evolving guidelines; and explore diagnostic implications via a case-based review.

TABLE OF CONTENTS/OUTLINE

1. Define Abbreviated and Ultrafast MRI a. What are the differences? b. Pros and Cons 2. Understand important parameters a. Spatial vs. Temporal resolution 3. AB-MR a. Typical algorithms vs. conventional full protocol b. ? specificity, ? sensitivity c. No kinetics d. Review outcomes and literature 4. Ultrafast MRI a. Techniques and rationale b. ? specificity, maintain sensitivity and scan time c. Kinetic information d. Complements ABMR e. Review outcomes and literature 5. Clinical implementation a. ACR compliance b. Workflow, Reimbursement 6. Clinical implications/Case-illustration a. Lesion vs BPE b. Benign vs. Malignant (Utility of T2?) c. High risk screening - TP/FP/PPV

BR216-ED-THA7

Breast MR Imaging Response to Neoadjuvant Chemotherapy: Learning through Pathology Correlation

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center Station #7

Participants
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TEACHING POINTS

Neoadjuvant chemotherapy (NAC) is a vital tool in the treatment of locally advanced and increasingly, early stage breast cancer. NAC goals include downstaging disease and acheiving pathologic complete response (pCR). Downstaging enables lumpectomy in lieu of mastectomy, and acheiving pCR is associated with improved disease tree and overall survival. Future develpments surrounding NAC may enable avoidance of surgical intervention altogether. Breast MR more accuartely predicts residual tumor than mammography, US, and clinical exam. Assessing response to NAC on breast MR is challenging due to different subtypes, histologic grades, and tumor morphologies. It is paramount that interpreting radiologists be familiar with MR patterns of response to common subtypes, residual disease assessment, and imaging diagnosis of pCR. Using a series of cases from our institution, we will illustrate pre and post NAC breast MR findings and provide surgical pathology correlation.

TABLE OF CONTENTS/OUTLINE

Role of NAC. Factors affecting response to NAC: tumor subtype, ductal vs. lobular, ER/PR+/HER2-, HER2+, triple negative, histologic grade, treatment regimen, morphology on imaging. Case based review of reporting guidelines for pre and post NAC MR findings. Assessing pCR - invasive vs. in situ components and over and under estimation of disease with rad-path correlation.

BR217-ED-THA8

Collecting Pearls: An Interactive Review of Breast Cancer Staging

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center Station #8

Awards
Magna Cum Laude

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TEACHING POINTS

To use an interactive, learner-driven, case-based approach to: 1. Demonstrate impact of prognostic biomarkers on breast cancer staging according to American Joint Committee on Cancer (AJCC)'s 8th edition staging guideline 2. Review finer anatomic details pertinent to TNM staging

TABLE OF CONTENTS/OUTLINE

1. Overview of changes to new AJCC Breast Cancer Staging system 2. Case-based review of 8 main teaching points including: a) Intramammary = Axillary: intramammary lymph nodes and why they matter. b) Be positive: upstaging of disease based on ER/PR/HER2 profile. c) May I have your number: downstaging of disease based on Oncotype DX Breast Recurrence Score. d) Nicer than it looks: classification change for lobular carcinoma in situ. e) Not in the chest: pectoral muscles involvement does not count for T staging. f) Judging the cover: satellite skin changes and T staging. g) Counting stars: multifocal vs. multicentric disease. h) One, two, three: classification of axillary lymph nodes.

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BR245-SD-THA1

The Crowd-Within Effect in Expert Radiologists: Independent Ratings of the Same Case Lead to Better Performance in Mammography Diagnosis

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center Station #1

Participants
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PURPOSE

If you ask a person the same question twice and average the results, performance can be significantly better than any single response alone ("crowd-within" effect, Vul & Pashler, 2008). Is this true for assessments of mammograms by expert radiologists? We measured the crowd-within effect in the context of a study of radiologists' memory for images. If this is true, averaging a given person's rating of abnormality across multiple exposures to the same mammograms should result in better accuracy than looking at either rating alone.

METHOD AND MATERIALS

Stimuli were single-breast mammograms: 80 abnormal and 40 normal (non-cancerous) cases. Images were presented for three seconds each, followed by two questions. (1) Was the image normal or abnormal? (2) Have you seen this image before? Confidence was rated on a six-point scale. Each image was either new or a repeat of an image seen 3 or 30 items previously. Comparing combined responses to pairs of images to responses to individual images allows us to measure the crowd-within effect.

RESULTS

Radiologists (N=32) are better at remembering abnormal than normal at 30-back ($t(31) = 2.2$, $p < 0.05$), but not 3-back. Under these viewing conditions, experts could detect abnormality with $d' = 0.94$ (AUC=0.716). When information was combined over pairs of repeated images, performance increased ($d' = 0.97$; AUC=0.745, $p<0.001$).

CONCLUSION

Radiologists had better memory for abnormal compared to normal medical images at long delays. Furthermore, when presented with the same case twice, performance improved when averaged across those responses compared to either response alone. This suggests that there is some independent "noise" in each judgement. These noise effects can be reduced by averaging more than one response. It remains to be seen whether this benefit would occur if radiologists were offered unlimited time to process each image.

CLINICAL RELEVANCE/APPLICATION

There may be situations in which having a second look at an image or a case will prove to be valuable and future studies will determine the potential integration of this strategy to the clinic.

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BR246-SD-THA2

Low-Dose Imaging Technique (LITE) MRI: Introduction of a Reduced-Dosage Dynamic Contrast-Enhanced MRI Technique in Breast Imaging

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center Station #2

Participants
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PURPOSE

To evaluate the diagnostic equivalency of a reduced-dosage dynamic contrast enhanced (DCE) breast MRI technique to standard-dosage utilizing a novel dual-dose injection protocol.

METHOD AND MATERIALS

Between October 2017 and April 2018, six patients (age range: 18-60) with a total of eight lesions (lesion size range: 0.5-2.0 cm as measured on ultrasound) with imaging features suggestive of a fibroadenoma were imaged. All lesions were ultimately either biopsy-proven or clinically-confirmed to be benign. Each patient underwent an IRB-approved dynamic contrast-enhanced MRI scan utilizing a novel dual-dose injection protocol. Pre-contrast scans including T2-weighted scans and high temporal resolutions scans were obtained. Next, 15% of the contrast was administered with post-contrast imaging including: standard T1 weighted scans and high temporal resolution scans. Approximately 10 minutes later, 85% of the contrast was administered with repeat post-contrast imaging similar to prior. Two radiologists reviewed the low-dose MR images and high-dose MR images to evaluate for: lesion conspicuity, imaging characteristics and enhancement kinetics.

RESULTS

In all 8 out of 8 lesions, there was concordance between the low-dose MR images and high-dose MR images in terms of lesion conspicuity and imaging characteristics. While the ratio of the contrast doses administered was roughly 0.18, this was not reflected in the ratios of kinetic parameters. The uptake rate ratio (low-to-high dose) was 1.30 ± 0.39, upper limit of enhancement had a 0.31 ± 0.06 ratio, and 0.35 ± 0.06 for initial area under the uptake curve. Rates of initial uptake measured with low-dose MRI were uniformly and significantly greater than rates measured by the high-dose MRI. Lesion time-to-enhancement was similar for both doses, with a ratio of 0.91 ± 0.06. Lesion conspicuity was measured as the ratio of the signal increase in the lesion to the signal increase in the surrounding parenchyma. The average lesion conspicuity over the first minute of enhancement had a low-to-high dose ratio of 1.87 ± 0.99.

CONCLUSION

This preliminary study demonstrates that LITE MRI has the potential to be diagnostically equivalent to standard DCE MRI in breast imaging.

CLINICAL RELEVANCE/APPLICATION

Low-dose imaging technique (LITE) MRI can be a promising alternative to standard-dose breast MRI, particularly with recent concerns related to gadolinium deposition.

Printed on: 10/29/20

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BR247-SD-THA3

A Machine Learning Approach to Radiogenomics of Breast Cancer to Predict Prognostic Biomarkers Using Low-Dose Perfusion Breast CT

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center Station #3

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To investigate the diagnostic value of a machine learning approach to radiogenomics using low-dose perfusion breast computed tomography (CT) for predicting the prognostic biomarkers of invasive breast cancer.

METHOD AND MATERIALS

This prospective study enrolled a total of 771 cases in 257 patients with invasive breast cancer. Low-dose perfusion CT was performed in the prone position using a spectral CT (iQon, Philips Heathcare) after contrast injection (Xenetix350, Guerbet). The 18 CT perfusion parameters of cancers analyzed using six machine learning models to predict lymph nodes status, tumor grade, tumor size, estrogen receptor (ER), progesterone receptor (PR), HER2, Ki67, and molecular subtype of cancer. Accuracy and the AUC (area under the ROC curve) were calculated for the machine learning models, and importance of CT parameters were evaluated in prediction of biomarkers.

RESULTS

The random forest is the best model for predicting prognostic biomarkers in terms of accuracy and the AUC. The accuracy of the random forest was higher than that of logistic regression by 11% on average: 78% vs. 65% for lymph node status, 81% vs. 66% for tumor grade, 80% vs. 71% for tumor size, 83% vs. 76% for ER status, 81% vs. 70% for PR status, 83% vs. 78% for HER2 status, 72% vs. 63% for Ki67, and 67% vs. 48% for the molecular subtype of breast cancer. The better performance of the random forest over logistic regression was more apparent in AUC with a 0.16 margin on average: 0.84 vs. 0.66 for lymph node status, 0.90 vs. 0.72 for tumor grade, 0.86 vs. 0.74 for tumor size, 0.89 vs. 0.77 for ER status, 0.87 vs. 0.71 for PR status, 0.89 vs. 0.68 for HER2 status, 0.80 vs. 0.67 for Ki67, and 0.83 vs. 0.69 for the molecular subtype of breast cancer. According to CT variable importance from the random forest, perfusion (mL/min/100/g), permeability (mL/min/100/g), blood volume permeability (mL/100/g), peak enhancement intensity (HU), time to peak (sec) were important predictors.

CONCLUSION

A machine learning approach to radiogenomics using low-dose perfusion breast CT is a useful noninvasive tool for predicting the prognostic biomarkers of invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

A machine learning approach to radiogenomics using low-dose perfusion breast CT is a noninvasive recommendation tool for predicting the prognostic biomarkers of invasive breast cancer.

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BR261-SD-THA4

Trends in Use of Percutaneous versus Open Surgical Breast Biopsy: An Update

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center Station #4

Participants
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PURPOSE

To compare trends in the use of percutaneous and open surgical breast biopsies and to determine the relative roles of radiologists and surgeons in performing them.

METHOD AND MATERIALS

The nationwide Medicare Part B Physician/Supplier Procedure Summary Master Files for 2004 to 2016 were reviewed. CPT codes pertaining to breast biopsies were selected and analyzed. Trends were studied in total volume of breast biopsies performed in the Medicare fee-for-service population, as well as in the volumes of imaging-guided percutaneous biopsies (IGPBs) and open surgical biopsies. Using Medicare's physician specialty codes we determined the number of procedures performed by radiologists, surgeons, OB/GYNs, and all other physicians as a group. Because the Medicare Part B databases are complete population counts, sample statistics are not required.

RESULTS

Between 2004 and 2016, the total volume of breast biopsies steadily increased in the Medicare fee-for-service population from 144,697 in 2004 to 193,736 in 2016 (+34%). Utilization of IGPBs increased from 124,423 to 187,914 (+51%). The use of open surgical breast biopsies declined from to 6605 to 2373 (-64%). IGPBs performed by radiologists increased from 89,493 to 160,485 (+79%). IGPBs by surgeons declined from 30,264 to 24,703 (-18%). By 2016, 97% of all breast biopsies were performed using imaging-guided percutaneous techniques. Radiologists performed 85% of these IGPB procedures, while surgeons performed 13%, OB/GYNs performed 0.1%, and other physicians performed 1%.

CONCLUSION

There is a steady upward trend in the utilization of breast biopsies, largely due to increased use of imaging-guided percutaneous techniques. By 2016, the overwhelming majority of breast biopsies (97%) used this approach and radiologists strongly predominate. In contrast, the use of open surgical biopsies has steadily declined, as has performance of any type of breast biopsies by surgeons and other nonradiologist physicians.

CLINICAL RELEVANCE/APPLICATION

Imaging-guided percutaneous needle breast biopsies are replacing open surgical breast biopsies, and a large majority of these procedures are done by radiologists.

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BR262-SD-THA5

A Radiomics Approach to Classification of Fibroepithelial Lesions on Breast Ultrasonography

Thursday, Dec. 5 12:15PM - 12:45PM Room: BR Community, Learning Center Station #5

Participants
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PURPOSE

To develop and evaluate a radiomics-based classifier to distinguish between phyllodes tumors and fibroadenomas on breast ultrasonography.

METHOD AND MATERIALS

A total of 190 patients with fibroepithelial lesions diagnosed by core needle biopsy between August 2003 and December 2017 were included. These lesions were finally confirmed as fibroadenomas (n=82) or phyllodes tumors (n=108) by surgical resection within 3 months. The tumors were semi-automatically segmented using publicly available software MIPAV (Medical Image Processing, Analysis, and Visualization). Pixel spacing and grayscale histograms of the ultrasound images were normalized using open-source library Simple ITK. A total of 737 radiomic features were extracted from the preprocessed images. By comparing the radiomic profiles of 40 tumor masks drawn by two radiologists, radiomic features with an intraclass correlation coefficient of less than 0.75 were excluded. The high-throughput radiomic features were selected by a least absolute shrinkage selection operator (LASSO) through 5-fold cross validation using a training set (133 of 190 images, 70%). An area under the receiver operating characteristic curve and accuracy of the radiomic classifier were estimated using a validation set (57 of 190 images, 30%).

RESULTS

The radiomic signatures based on the 10 selected features were higher in phyllodes tumors than in fibroadenomas when applied to the validation set (0.29 [95% CI: 0.27, 0.31] vs. 0.21 [95% CI: 0.18, 0.25], p=.001). The radiomic classifier achieved an area under the receiver operating characteristic curve of 0.745 (p=.002, 95% CI: 0.613, 0.877) with an accuracy of 0.719 (sensitivity 0.781, specificity 0.640) when the threshold value was optimized to 0.247.

CONCLUSION

Our radiomics-based classifier to differentiate phyllodes tumor from fibroadenoma on ultrasonography yielded an area under the receiver operating characteristic curve of 0.745 and an accuracy of 0.719.

CLINICAL RELEVANCE/APPLICATION

An optimized classifier with radiomics approach may help prevent unnecessary excision of fibroadenomas and undertreatment of phyllodes tumors.

CA170-ED-THA6

Late Iodine Enhancement and Myocardial Extracellular Volume Quantification by Using Cardiac CT: Emerging Trends in Clinical Practice

Thursday, Dec. 5 12:15PM - 12:45PM Room: CA Community, Learning Center Station #6

Participants
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Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

TEACHING POINTS

1. Late iodine enhancement (LIE) and myocardial extracellular volume (ECV) quantification by cardiac CT has become clinically available. 2. These techniques can provide additive diagnostic information to the routine cardia CT or body CT. 3. Myocardial LIE assessment and ECV quantification by cardiac CT can be comparable to that obtained by cardiac MRI, and offer an alternative to cardiac MRI for noninvasive assessment of patients with myocardial disease. 4. In comparison to cardiac MRI, LIE and ECV analysis by cardiac CT is practical because of its accessibility, fast acquisition times, and suitability for use in patients with mechanical devices or receiving dialysis.

TABLE OF CONTENTS/OUTLINE

1. Myocardial tissue characterization: basic knowledge - Myocardial fibrosis - Late gadolinium enhancement by cardiac MRI - Myocardial T1 mapping 2. LIE by using cardiac CT - What is LIE - LIE imaging techniques using single-energy CT - LIE imaging techniques using dual-energy CT 3. ECV quantification by using cardiac CT - What is ECV - ECV analysis methods 4. Clinical applications - Coronary artery disease - Acute chest pain - Cardiomyopathy - Systemic diseases: sarcoidosis and amyloidosis - Aortic stenosis (addition to TAVR planning CT) 5. Limitations and future directions

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CA224-SD-THA1

Myocardial Deformation Assessment in Patients with Isolated Left Ventricular Non-Compaction Using Deformable Registration of Cine MRI: Comparison with Feature Tracking

Thursday, Dec. 5 12:15PM - 12:45PM Room: CA Community, Learning Center Station #1

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PURPOSE

To evaluate cardiovascular magnetic resonance based on a deformable registration algorithm(DRA) and feature tracking(FT) in quantitation of LV myocardium deformation in patients with isolated left ventricular non-compaction(iLVNC) and the accuracy of diagnosis.

METHOD AND MATERIALS

We recruited 30 patients with iLVNC and 50 healthy volunteers to undergo cardiovascular magnetic resonance on a 1.5T MR scanner.Cardiac cine images of short-axis, long-axis (2- 3- and 4-chamber) were acquired. A prototype post-processing software(TrufiStrain) based on DRA was used for the myocardial strain analysis. The same datasets were analyzed by FT method using the commercially available software.Global and segmental strain of radial, circumferential and longitudinal directions were semi-automatically calculated.All three available long-axis orientations were used to quantify global and segmental longitudinal strain.The global longitudinal strain was calculated based on the average of the peak systolic global longitudinal strain from the three long-axis orientations.Short-axis views were used to analyze radial or circumferential strain, including LV basal, mid-ventricular, and apical levels.

RESULTS

The absolute values of global longitudinal strain (GLS), radial strain (GRS), and circumferential strain (GCS) derived from DRA were lower in the iLVNC group than those in the control group [GLS: (- 11.9±3.9)% vs. (- 14.5±1.4)%; GRS: (26.3±11.0)% vs. (37.6±7.2)%; GCS: (- 12.1±4.2)% vs. (- 16.4±1.6)%; $p<0.01$ for all]; The absolute values of GLS, GRS, and GCS derived by FT were lower in the iLVNC group than those in the control group [GLS: (- 17.8±6.4)% vs. (- 23.3±2.8)%; GRS: (33.2±23.5)% vs. (56.9±16.4)%; GCS: (- 15.5±6.6)% vs. (- 22.5±2.6)%; $p<0.01$ for all]; The global strain values measured by the two methods had notable correlation (GLS: $r=0.575$, GRS: $r=0.392$, GCS: $r=0.697$, $p<0.01$ for all)

CONCLUSION

Both DRA and FT can reveal the impaired myocardial strain of LV in patients with iLVNC.GRS derived from DRA and FT can both distinguish patients with iLVNC with a better diagnostic power than EF.The reproducibility of both global and segmental strain measured by DRA are better than those measured by FT.

CLINICAL RELEVANCE/APPLICATION

Myocardial deformation analysis based on CMR can detect early dysfunction of left ventricle in patients with isolated left ventricular non-compaction, and DRA has better reproducibility than FT.

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CA225-SD-THA2

Does Knowledge-Based Iterative Model Reconstruction Improve Diagnostic Performance in Dynamic Myocardial CT Perfusion Imaging with Low-Tube Voltage Scan?

Thursday, Dec. 5 12:15PM - 12:45PM Room: CA Community, Learning Center Station #2

Participants
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PURPOSE

A knowledge-based iterative model reconstruction (IMR) (Philips Healthcare, Cleveland, USA) is a fully iterative reconstruction (IR) algorithm. The purpose of this study was to evaluate the effects of IMR on diagnostic performance of dynamic myocardial computed tomography perfusion (CTP) for detecting obstructive coronary artery disease (CAD) assessed by invasive coronary angiography (ICA) and fractional flow reserve (FFR).

METHOD AND MATERIALS

The study group consisted of 31 patients who underwent stress dynamic myocardial CTP with 80-kV for assessment of CAD using a 256-slice CT and ICA with invasive FFR measurement. Obstructive CAD was defined as severe lesion >=70% stenosis or moderate lesions (50-69% stenosis) with FFR <=0.8. CTP images were reconstructed with filtered back projection (FBP), hybrid IR (iDose4), and IMR. myocardial blood flow derived from dynamic CTP (CT-MBF) were calculated by deconvolution analysis, and compared between normal and ischemic territory by Student t-test. Diagnostic performance of CT-MBF was assessed using the area under receiver operating characteristic curve (AUC), and compared among three reconstruction algorithms.

RESULTS

Of 93 vessels in 31 patients, 30 vessels were diagnosed as obstructive CAD. Mean values of CT-MBF in ischemic territory were significantly lower than that in remote territory for FBP (1.52 ± 0.29 vs. 1.27 ± 0.33 mL/g/min), hybrid IR (1.44 ± 0.27 vs. 1.15 ± 0.30 mL/g/min), and IMR (1.36 ± 0.21 vs. 0.94 ± 0.28 mL/g/min) ($p < 0.05$, in each), respectively. Sensitivity and specificity of CT-MBF to identify obstructive CAD were 63% [95% confidence interval (CI): 47-80)] and 84% (95%CI: 75-93) for FBP, 83% (95%CI: 70-97) and 71% (95%CI: 60-82) for hybrid IR, and 93% (95%CI: 83-100) and 78% (95%CI: 68-88) for IMR, respectively. The AUCs of the CT-MBF with FBP, hybrid IR, and IMR were 0.76 (95%CI: 0.63-0.86), 0.82 (95%CI: 0.70-0.90), and 0.91 (95%CI: 0.81-0.96). The AUC of the CT-MBF with IMR was significantly superior to that with the other reconstruction algorithms ($p < 0.05$, in each).

CONCLUSION

IMR significantly improved diagnostic performance of CT-MBF for detecting obstructive CAD in stress dynamic myocardial CTP imaging with low-tube voltage scan compared with FBP and hybrid IR.

CLINICAL RELEVANCE/APPLICATION

IMR can provide incremental diagnostic value for detecting obstructive CAD over conventional reconstruction algorithm.

CA242-SD-THA4

Combined Coronary CT-Angiography and TAVI-Planning: A Contrast-Neutral and Efficient Routine Approach to Exclude Significant Coronary Artery Disease

Thursday, Dec. 5 12:15PM - 12:45PM Room: CA Community, Learning Center Station #4

Participants
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PURPOSE

To analyze the ability of CT coronary angiography (cCTA) to exclude significant coronary artery disease (CAD) during pre-TAVI-evaluation.

METHOD AND MATERIALS

208 consecutive patients undergoing pre-TAVI-evaluation (108 female; mean-age 79.5±7.2 years) were retrospectively included. Patients after CABG had been excluded. All patients were examined with a standard protocol consisting of a retrospectively gated CT scan of the heart, immediately followed by a high-pitch scan of the vascular access route utilizing a single bolus of 70 ml iodinated contrast-medium. No betta-blockers or nitrates were applied. Heart-rate and heart-rate-variability during the scan were 74.5±19.3 and 22.7±33.1 beats-per-minute; attenuation at the ascending was 462.7±138.8 HU. Images were evaluated per segment (18-AHA) for significant CAD (stenosis >=50%); examinations where stenoses could not be excluded were read as positive. Routinely all patients received invasive coronary angiography (ICA) 76.4% (159/208), which was omitted if renal function was impaired significantly and no significant stenosis could be identified on cCTA. All stenoses visually identified on ICA were graded qualitatively (QCA) with the same cut-off.

RESULTS

cCTA was negative for significant CAD in 43.8% of patients (91/208). Sensitivity, specificity, PPV, NPV and accuracy were 96.5%, 49.0%, 51.4%, 96.2% and 66.0% per patient and 81.3%, 85.9%, 24.4%, 98.8% and 85.6% per segment, respectively. The significant stenoses additionally identified on ICA were most frequently located in side-branches (2/3) or the distal LAD.

CONCLUSION

cCTA and pre-TAVI evaluation can be performed jointly with no need for additional contrast medium or medication. cCTA is able to exclude significant CAD in a relatively high proportion of this high-risk collective.

CLINICAL RELEVANCE/APPLICATION

Severe aortic stenosis is a frequent disease in the elderly and often coincides with significant CAD. The latter is recommended to be excluded or treated before TAVI. Patients with severe aortic stenosis prior to TAVI-implantation are often frail and comorbid with a high incidence of nephropathy. cCTA can reduce the number of ICA and total amount of contrast-medium applied, thereby making pre-procedural-evaluation for TAVI-Planning safer for elderly patients with a high incidence of nephropathy.

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CA243-SD-THA5

Use of Salient Features to Optimize a Machine Learning Classifier of Coronary Artery Disease Severity

Thursday, Dec. 5 12:15PM - 12:45PM Room: CA Community, Learning Center Station #5

Participants
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Erin Angel, PhD, Tustin, CA (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
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PURPOSE

Machine learning-based methods have been proposed as an alternative to the current gold standard of determining the hemodynamic significance of coronary artery lesions, invasive Fractional Flow Reserve (FFR) measurements. In this work, we look to optimize the performance of a machine learning classifier that used coronary CT angiography image data to determine coronary artery disease severity.

METHOD AND MATERIALS

50 coronary CT angiographies (CTAs) were collected (Aquilion ONE, Canon Medical Systems) at 70% of the R-R cardiac cycle. Straightened curved planar reformations (SCPRs) of different artery branches were generated (Vitrea, Vital Images) using a slice thickness of 5.0 mm considering four rotational views around the vessel centerline per CTA for a total dataset size of 200. The dataset was split into a training cohort numbering 125 and a testing cohort numbering 75. FFR values were measured to create a labeled dataset. A convolutional neural network was developed to classify input SCPRs by the severity of the coronary lesion. The network synthesized class activation maps (CAMs) such that the most salient features (lesion and aorta) in the SCPRs were visualized. SCPR image data were modified such that the aorta was removed, rendering the lesion as the only salient feature present, and the network was re-trained using the optimized data. Network performance on both original and optimized test data was assessed using area under the receiver operating characteristics curve (AUC), classification accuracy, and a Student's T-Test.

RESULTS

Mean AUC was 0.727 (95% confidence interval, 0.675-0.773) and 0.799 (0.761-0.837) using the original and optimized SCPR data respectively. Mean classification accuracy was 68.1% (63.8%-72.4%) and 79.1% (76.1%-82.1%) using the original and optimized SCPR data respectively. There was a statistically significant advantage to using the optimized SCPR data for classification of coronary disease severity in terms of both AUC ($p = 0.001$) and classification accuracy ($p = 0.0001$).

CONCLUSION

This work indicates the potential utility of CAMs for debugging and optimizing a machine learning algorithm to aid in clinical decision making.

CLINICAL RELEVANCE/APPLICATION

Machine learning provides a valuable alternative to invasive FFR measurements for the determination of coronary artery disease severity.

CH236-ED-THA7

Potentially Critical Thoracic Complications in the Oncologic Patient: Spectrum of CT Findings and Imaging-Based Diagnostical Approach

Thursday, Dec. 5 12:15PM - 12:45PM Room: CH Community, Learning Center Station #7

Participants
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TEACHING POINTS

The purpose of this exhibit is: To review the variety of symptomatic thoracic complications which may occur in patients with oncological pathology To evaluate CT findings in these patients, emphasizing the signs that may lead us to a correct diagnosis To gain an awareness of the importance of the global context of the patient (type of neoplasm, clinical manifestations and underlying treatment) in the diagnostical approach

TABLE OF CONTENTS/OUTLINE

Clinical context: Symptoms Oncological background: primary neoplasia (visceral vs hematologic) Special considerations: neutropenia, hematopoietic stem cell transplantation Type of complications: *Infectious:* Bacterial Fungal Viral *Non-infectious:* Drug toxicity: chemotherapy, immunotherapy, immunosuppressive agents Radiation-induced pneumonitis Vascular: pulmonary embolism, alveolar hemorrhage Miscellaneous: tumoral progression-related, others Spectrum of CT findings: Consolidation Ground-glass opacities Mass Nodules Others

CH237-ED-THA8

Dual-Energy Imaging in Cardiothoracic Pathologies: A Primer for Radiologists and Clinicians

Thursday, Dec. 5 12:15PM - 12:45PM Room: CH Community, Learning Center Station #8

Awards
Identified for RadioGraphics

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TEACHING POINTS

Understand the basic physics behind dual energy subtraction radiography(DESR) and dual energy computed tomography (DECT). Discuss common dual energy images/ reconstructions available and their added value in clinical practice. Highlight the pitfalls associated with interpreting the dual energy data.

TABLE OF CONTENTS/OUTLINE

Basics Single energy versus dual energy Physics behind DESR and DECT DESR Single exposure versus dual exposure Clinical examples: Improved Pneumothorax detection, Lung/pleural lesions, Cardiac and coronary artery disease ,Osseous lesions and miscellaneous Pitfalls in interpretation: Increased noise, Misregistration from breathing and cardiac motion,False positive from incomplete bone/soft tissue suppression DECT Various approaches to DECT and clinically relevant reconstructions available with a sample work flow DECT benefits with clinical examples :Better diagnostic certainty, boost contrast enhancement, beam hardening artifact reduction, improved lesion detection and characterization, estimation of organ function, intravenous contrast and radiation dose reduction, emerging indications: Combined DECT and 3D printing; Quantification of lobar lung function Future directions:Combined PET/ DECT scanners; Photon counting detectors

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CH266-SD-THA1

Safety Impact of Patient Positioning on Pneumothorax Rates After Lung Biopsy at a Single Community Hospital

Thursday, Dec. 5 12:15PM - 12:45PM Room: CH Community, Learning Center Station #1

Participants
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PURPOSE

To assess the safety benefits and pneumothorax (PTX) rates when patients are placed in the lung lesion down position during CT-guided lung biopsy when performed in a community hospital.

METHOD AND MATERIALS

A retrospective cohort study was performed of all CT-guided percutaneous lung biopsies by radiology after IRB approval from January 2013 to March 2018. This includes several years of data with various patient positioning techniques used for biopsy. All patients underwent CT-guided core biopsies utilizing the coaxial technique with a 16 gauge outer Trocar needle and a 18 gauge core biopsy needle. 186 patients were placed in the lung lesion down position during and after the biopsy regardless of their co-morbidities and risk factors. This was compared to a control group which included all other patient positions- supine (S), prone (P), and lung lesion up (LLU) regardless of risk factors and co-morbidities. The primary endpoint of this review was to assess the safety profile in preventing intervention for PTX. Comparison of the two groups for PTX, PTX requiring intervention and the associated positions was performed. Specifically, PTX rates in the S, P and LLU positions. Statistical analysis to compare the two groups was performed by Chi Square analysis.

RESULTS

In a total of 349 patients, PTX occurred in 67 patients (19.2%): 50 patients (30.1%) in the control group (N=163), and 17 patients (9.1%) in the LLD group (N=186) which was a statistically significant difference (p=.0001). Eleven interventions (6.7%) were required in the control group (chest tubes), and three (1.6%) in the LLD group (chest tubes) which was statistically significant (p=.02). Therefore, for every 5 patients whose biopsies were performed in the LLD positions, 1 PTX was prevented that would have happened under the control group. For every 2 patients whose biopsies were performed in the LLD position,1 intervention was prevented that would have happned under the control group. Within all positions in the control, PTX occurred in 40 patients (31.7%) in the S group (N=186), 7 patients (28%) in the P group (N=25), and 3 patients (25%) in the LLU group (N=12).

CONCLUSION

The LLD position significantly reduces PTX and subsequent intervention in the technique of lung biopsy.

CLINICAL RELEVANCE/APPLICATION

Routinely placing patients in the LLD position during and after lung biopsy is associated with significant safety benefits to the patient at no additional cost.

CH268-SD-THA3

Determination of Active Tuberculosis and Inactive Fibronodular Opacity on Chest Radiographs Using Deep Learning Algorithm

Thursday, Dec. 5 12:15PM - 12:45PM Room: CH Community, Learning Center Station #3

Participants
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PURPOSE

Inactive fibronodular (FN) opacity on chest radiograph (CR) is often found in high tuberculosis (TB) incidence countries. Differentiation of fibrotic lesions from active TB lesions on CR is important to prevent unnecessary evaluation and medication. This study develops a deep learning based algorithm to discriminate inactive fibronodular lesions and active TB on chest radiograph.

METHOD AND MATERIALS

A total of 3824 active TB from 511 individuals and 2277 inactive FN CRs from 558 individuals were retrospectively collected. Active TB-CRs were collected from patients diagnosed with active TB by microbiological testing or PCR. Inactive FN-CRs were defined by typical findings of fibronodular opacities on both upper lung zone and with no change for more than 6 months. CR data were randomly assigned into three datasets: (1) training dataset: 3100 active TB-CRs and 1500 inactive FN-CRs, (2) tuning dataset: 624 active TB-CRs and 677 inactive FN-CRs, (3) internal validation dataset: 100 active TB-CRs and 100 inactive FN-CRs. A meta-trained convolutional neural network (based on ResNet50 model) was fine-tuned to classify active TB and inactive FN. Meta-training was done with 8,964 pneumonia and 8,525 normal cases from the NIH dataset released for the 2018 RSNA challenge. The model learns the following tasks during the meta-training phase: pneumonia vs normal, active TB vs normal, and pneumonia vs normal.

RESULTS

The proposed algorithm achieved high accuracy (0.925 in AUC) for the determination of active TB lesions and inactive fibronodular opacity. The use of meta-training with pneumonia (n=8,964) and normal (n=8,525) cases from NIH increased the accuracy to 0.970 in AUC.

CONCLUSION

Our deep learning-based algorithm showed good performance for the determination of active TB lesions and inactive fibronodular opacity on CR.

CLINICAL RELEVANCE/APPLICATION

Our deep learning-based algorithm can be used in active TB surveillence on chest radiograph in high TB incidence countries where the individuals with inactive fibronodular opacity are frequently observed.

CH278-SD-THA4

Texture Analysis Based on Apparent Diffusion Coefficient Maps: Potential Imaging Biomarkers in the Prediction of Epidermal Growth Factor Receptor Mutations for Advanced Non-Small Cell Lung Cancer

Thursday, Dec. 5 12:15PM - 12:45PM Room: CH Community, Learning Center Station #4

Participants
Shen Jie, Nanjing, China (*Presenter*) Nothing to Disclose

PURPOSE

To explore the potential association between texture analysis of apparent diffusion coefficient (ADC) maps with epidermal growth factor receptor (EGFR) status in advanced non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

Sixty-five patients underwent pre-operative MRI including diffusion weighted imaging with a 3.0 Tesla scanner. Conventional ADC variables (ADCmean, ADCmin, ADCmax), histogram parameters and high-dimensional texture features grey-level co-occurrence (GLCM), run length matrix (RLM) were extracted from tumor region of interest (ROI) and compared between EGFR wild and mutant type group in non-early stage NSCLC patients (stage IIIA-IV). Diagnostic performances of MR ADC TA parameters were evaluated using receiving operating characteristic (ROC) and multivariate logistics regression analysis.

RESULTS

The EGFR mutant group included 34 patients and the wild group included 31 patients. GLCM_entropy, kurtosis were significantly lower, and 10th ADC was significantly higher with EGFR mutant status compared to those of wild ones ($P<0.05$). GLCM_entropy [(6.84 ± 1.67) vs (9.35 ± 1.60), $p < 0.01$] and kurtosis [(0.57 ± 0.47) vs (1.00 ± 0.89), $p < 0.01$] were independently associated with EGFR mutant status for non-early stage NSCLC patients. ROC regression curve demonstrated GLCM_entropy had the highest AUC of 0.851.

CONCLUSION

Texture analysis parameters based on ADC maps have the potential to predict the EGFR status for non-early stage NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Texture analysis based on MRI ADC maps has a potential value in the differentiation of non-early stage NSCLC EGFR mutant status.

CH279-SD-THA5

Leveraging Interobserver Variability for Sensitive Pathology Detection in Chest X-Rays

Thursday, Dec. 5 12:15PM - 12:45PM Room: CH Community, Learning Center Station #5

Participants
Leonhard A. Steinmeister, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
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PURPOSE

For designing clinical decision support systems a sensitive pathology detection is essential, but limited by the availability of reliable annotations. In particular for open source datasets, ground truth is often obtained from individual radiologists or automated report analysis. The aim was to investigate the potential of multiple expert annotations of chest X-rays and how to employ them for Deep Convolutional Neural Networks (DCNN).

METHOD AND MATERIALS

Two radiologists annotated the Indiana University dataset, containing 3125 pairs of frontal and lateral chest X-rays, in a multi-label setup with eight representative classes (i.e. pleural effusion, infiltrate, congestion, atelectasis, pneumothorax, cardiomegaly, masses, foreign objects). Reading was performed on a diagnostic workstation, while the radiologists were required to actively indicate the presence of a pathology in a Webbased annotation tool. We rated mismatching labels pathological, assuming false positive annotations to be unlikely. Hence, the union of both annotations might facilitate the detection of pathologies. We fine-tuned a pre-trained ResNet-50 (i.e. pre-trained on the ChestXRay14 dataset) for each radiologist annotation and a union: ExpertNet-1, ExpertNet-2 and ExpertUnionNet. We evaluated our method by using ROC statistics and the average area under curve (AUC). For our evaluation, we used a 10 times re-sampling scheme. Within each split, we divided the data into 70% training and 30% testing.

RESULTS

The average AUC (without pneumothorax because of the very low number of cases) for ExpertNet-1, ExpertNet-2, and ExpertUnionNet were 0.874±0.077, 0.857±0.073, and 0.878±0.076, respectively. We observed the highest increase of AUC for 'foreign object' with 0.013.

CONCLUSION

We demonstrated how to leverage the differences in expert radiologists´ annotations for training a more accurately predicting DCNN (ExpertUnionNet) as compared to a DCNN trained on either of the annotations (ExpertNet-1, ExpertNet-2).

CLINICAL RELEVANCE/APPLICATION

Leveraging multiple expert annotations of medical image datasets increases sensitivity of DCNN-based pathology detection tools and avoids consensus labelling for ground truth formation.

CH280-SD-THA6

The Diagnostic Accuracy and Complication of Percutaneous Transthoracic Needle Lung Biopsy in Patients with Idiopathic Pulmonary Fibrosis

Thursday, Dec. 5 12:15PM - 12:45PM Room: CH Community, Learning Center Station #6

Participants
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PURPOSE

To determine the diagnostic accuracy for the diagnosis of malignancy and complication rate of percutaneous transthoracic needle lung biopsy (PTNB) in patients with idiopathic pulmonary fibrosis (IPF).

METHOD AND MATERIALS

Our institutional review board approved this retrospective study. Among 964 IPF patients diagnosed between April 2003 and December 2016, 80 IPF patients (mean age, 69 years; age range, 49-89 years; 74 men and six women) underwent 91 CT-guided PTNB for pulmonary lesions suspected for malignancy. The accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of PTNBs for diagnosis of malignancy were measured. The complication rate of PTNBs was also measured, and risk factors for the major complication were identified.

RESULTS

Of the 91 PTNBs, two biopsies could not be performed due to pneumothorax and categorized as a technical failure. Of the 89 technically successful PTNBs, the final diagnosis could not be determined in 4 biopsies due to follow-up loss. The accuracy, sensitivity, specificity, PPV, and NPV of PTNBs was 92% (78 of 85), 94% (62 of 66), 84% (16 of 19), 100% (62 of 62), and 94% (16 of 17), respectively. The overall complication rate was 53% (48 of 91). The minor complication occurred as follows: pneumothorax without requiring tube insertion (29%, 26 of 91) and transient hemoptysis (19%, 17 of 91). The major complication was as follows: pneumothorax requiring tube insertion (9%, 8 of 91) and acute exacerbation of IPF within one month after PTNB (2%, 2 of 91). The needle transversing honeycombing lesions (odds ratio, 20.3; P = 0.002) was a significant risk factor for the occurrence of a major complication. There was no air embolism or death due to PTNB.

CONCLUSION

The diagnostic accuracy of PTNB was over 90% of biopsies, but the complication rate was also high. The major complication occurred in about 10% of biopsies performed in IPF patients.

CLINICAL RELEVANCE/APPLICATION

The reported diagnostic accuracy and complication rate of PTNB in IPF patients may help patients, radiologists, and physicians make more informed choices about whether to perform a biopsy of a pulmonary nodule.

ER173-ED-THA5

Imaging Evaluation of Abdominopelvic Gunshot Trauma: What the Radiologist Needs to Know

Thursday, Dec. 5 12:15PM - 12:45PM Room: ER Community, Learning Center Station #5

Awards
Identified for RadioGraphics

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TEACHING POINTS

1. To review major types of the commonly used firearms in the urban setting 2. Most commonly used imaging modalities and protocols in the evaluation of gunshot wounds and their immediate complications 3. To discuss the range of imaging appearances in main abdominopelvic gunshot injuries, and the role of the radiologists in clinical management

TABLE OF CONTENTS/OUTLINE

1. Types of firearms: small arms (revolver and pistol); long guns (rifles, shotguns, machine, and submachine guns) 2. Radiological imaging and protocols: a. Ultrasound FAST b. CECT/CTA and modifications to the protocols and technique (artifact reduction techniques) c. Emergent and urgent fluoroscopic examinations 3. Direct abdominopelvic injury: a. visceral organs (renal, hepatic, adrenal, pancreatic, and splenic lacerations) b. hollow organs (bowel, urinary bladder, ureters, and gallbladder penetrating trauma) c. musculoskeletal systems (spinal/pelvic and muscle/ligamentous injuries) d. vascular systems (arteriovenous and lymphatic injury) 1. Indirect imaging findings and predictors related to bullet trajectory injury 2. Flow chart outlining emergent Management, and role of the radiologist

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ER221-SD-THA1

The Accuracy and Feasibility of Automatic Classification and Localization of Rib Fractures from Thorax CT Using Convolutional Neural Networks

Thursday, Dec. 5 12:15PM - 12:45PM Room: ER Community, Learning Center Station #1

FDA Discussions may include off-label uses.

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PURPOSE

Rib fractures are the most frequently observed injury in thoracic blunt trauma. However, it is time-consuming to detect rib fractures and the subtle buckled fracture was often missed. This study aims to analyze the accuracy and feasibility of automatic classification and localization of rib fractures on CT images using convolutional neural networks (CNNs), and test the robustness by three hospitals.

METHOD AND MATERIALS

Institutional review board approval was obtained with waiver of informed consent for this retrospective study. A total of 1087 rib CT images, 7,696 annotations, from our hospitals were divided into training (n = 978) and validation (n = 109) sets. CNN model was applied in current work. Images were labeled by 4 certified radiologists and one orthopedics specialist according to patient's clinical trauma history, radiologic characteristic and callus formation or fracture healing is in follow-up period. Four classifications (fresh complete fracture, fresh incomplete fracture, old fracture, and fracture healing period) combined with precise fracture location were detected automatically. We analyze the accuracy of different classification models and compared the detection time, diagnostic accuracy, omission diagnostic rate (ODR) with different seniorities of radiologists, and multi-task loss evolution and the AUC was calculated as an index for statistical analysis. Four hundred of images from two other different hospitals were used to verify the robustness of the model.

RESULTS

The time of diagnosis made by doctors was 6.7 minutes on average, compared with an average of 2.3 seconds in AI software. The accuracy of CNN model was greater compared with that of primary radiologist (AUC, 92.4% and 88.3%, $P < 0.05$) and had a similar accuracy with attending radiologist and above (AUC, 92.4% and 93.8%, $P > 0.05$). ODR of CNN model was less than all radiologists (mean ODR, 0.83% and 5.7%, $P = 0.0024$). Similar diagnostic performance was obtained from two other hospitals.

CONCLUSION

The classification and location of ribs fracture can be detected by CNNs with high accuracy and can reduce miss rate. The results would help emergency patients to obtain accurate CT findings quickly and reduce the eye strain and workload of radiologists.

CLINICAL RELEVANCE/APPLICATION

(dealing with ribs fractures) CNN can detect the classification and location of ribs fracture automatically with high accuracy and short time and is recommended in clinical rib diagnosis.

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ER222-SD-THA2

Segmental Bowel Wall Hypoenhancement on CT Predicts Devascularizing Mesenteric Injury After Blunt Trauma

Thursday, Dec. 5 12:15PM - 12:45PM Room: ER Community, Learning Center Station #2

Participants
Alexis R. Boscak, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
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Kathirkamanathan Shanmuganathan, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To demonstrate the utility of segmental bowel hypoenhancement on contrast-enhanced CT as a predictor of devasularizing mesenteric injury after blunt trauma to the abdomen.

METHOD AND MATERIALS

Informed consent was waived by the institutional review board for this HIPAA-compliant study. Retrospective record review identified 122 adult patients (age range 18 - 80 years; 80 male [65%] and 42 female [34%]) who had undergone contrast-enhanced CT of the abdomen and pelvis after blunt trauma, including 30 with surgically proven mesenteric injury resulting in devascularization of bowel. Two radiologists each performed blinded review of all 122 cases, evaluating bowel wall enhancement as well as other signs of injury including body wall disruption, mesenteric hematoma, active bleeding, hemoperitoneum, extraluminal gas, bowel wall edema and bowel wall discontinuity. Discordant interpretations underwent subsequent consensus review. Data analysis included calculation of diagnostic performance measures with confidence intervals, areas under the receiver operating characteristic curves, and interobserver agreement/variability.

RESULTS

In 30 cases of surgically proven mesenteric injury resulting in devascularization of bowel after blunt trauma, contrast enhanced CT demonstrated anatomically concordant segmental bowel hypoenhancement in 80.0% (24 of 30) patients, with 20.0% (6 of 30) false negative. This finding was 98.9% specific and 94.3% accurate, with a positive predictive value of 96.0% and a negative predictive value of 93.8%. False positive bowel hypoenhancement was identified in only 2.4% (1 of 92) casesconsidered negative for devascularizing bowel injury based on surgical exploration and/or clinical course.

CONCLUSION

Segmental hypoenhancement of bowel on contrast-ehanced CT is an accurate signifier of devascularizing mesenteric injury after blunt trauma, with moderate sensitivity and high specificity.

CLINICAL RELEVANCE/APPLICATION

Segmental bowel hypoenhancement predicts the presence of devasularizing mesenteric injury requiring emergent surgical intervention after blunt trauma, and should be carefully evaluated for on contrast-enhanced CT examinations performed in this clinical setting.

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ER232-SD-THA4

Virtual Monochromatic Reconstructions of Dual-Energy CT in Abdominal Trauma: Optimization of Energy Level Improves Pancreas Laceration Conspicuity and Diagnostic Confidence

Thursday, Dec. 5 12:15PM - 12:45PM Room: ER Community, Learning Center Station #4

Participants
Gavin M. Sugrue, MBBCh, Vancouver, BC (*Presenter*) Nothing to Disclose
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PURPOSE

Pancreatic injury is associated with significant morbidity and mortality. Pancreatic lacerations can be challenging to identify as the pancreas is not scanned at peak enhancement in most trauma CT protocols. This study qualitatively and quantitively assessed pancreatic lacerations with virtual monoenergetic dual-energy CT (DE CT) to establish an optimal energy level for visualization of pancreatic lacerations.

METHOD AND MATERIALS

Institutional review board approval was obtained. We retrospectively examined 17 contrast-enhanced CT studies in patients presenting with blunt trauma with MRCP, ERCP or intraoperatively proven pancreatic lacerations. All studies were performed in our Emergency Department from 2014-2019 with a 128 slice dual-source DE CT scanner. Evaluation was performed using the portal venous phase acquired simultaneously at low (80 or 100 kVp) and high (140 kVp with tin filtration) energy levels. Images were reconstructed at VMI energy levels from 40 to 100 keV in 10 keV increments and analysed quantitatively and qualitatively. Pancreatic laceration attenuation, background parenchymal attenuation and noise were measured for all VMI datasets and compared to conventional mixed polychromatic images (PCI) at 120 kVp. Subjective analysis was performed by two independent readers. Qualitative parameters included diagnostic acceptability, subjective noise, contrast resolution, diagnostic confidence and laceration conspicuity. Differences between the CNR of the VMI monoenergetic series and mixed images were assessed using a one-way ANOVA. Qualitative parameters were compared using a Paired T Test.

RESULTS

The optimal CNR for the assessment of pancreatic lacerations was observed at 40 keV ($p=0.0002$). Diagnostic acceptability and subjective noise were improved on conventional PCI ($p=0.0006$ and $p=0.001$ respectively), however both readers reported improved contrast resolution, diagnostic confidence and laceration conspicuity at VMI at 40 keV ($p=0.0156$, $p = 0.0002$ and $p=0.0012$ respectively).

CONCLUSION

Contrast-enhanced dual source dual energy CT with VMI reconstruction at 40 keV maximizes the CNR of a pancreatic laceration with increased contrast resolution, diagnostic confidence and laceration conspicuity.

CLINICAL RELEVANCE/APPLICATION

Virtual monoenergetic imaging at lower keVs improves diagnostic confidence and conspicuity of pancreatic lacerations and may allow for more accurate grading of pancreatic injuries.

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GI319-ED-THA8

From Incidental to Intentional: A Review of Appropriately Managing Imaging Incidentalomas

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #8

Participants
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TEACHING POINTS

1. Recognize common incidental findings on CT, MRI, ultrasound, and molecular imaging. 2. Understand guidance for management of incidental findings and comprehend important imaging characteristics that influence management. 3. Apply consensus-based guidance to imaging examples of incidental findings.

TABLE OF CONTENTS/OUTLINE

This case-based presentation evaluates incidental findings involving the following organs/structures: A. Renal B. Liver C. Adrenal D. Pancreatic cysts E. Adnexal F. Vascular G. Splenic and nodal H. Gallbladder and biliary

Printed on: 10/29/20

GI320-ED-THA9

Cholangiocarcinoma in 2019: Current Update in Pathology, Classification, and Imaging Findings

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #9

Awards
Certificate of Merit

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TEACHING POINTS

Discuss recent updates in classification & pathogenesis of cholangiocarcinoma Describe imaging findings of intra and extrahepatic cholangiocarcinomas & their precursors Review role of imaging with special emphasis on radiogenomics & prognostic markers

TABLE OF CONTENTS/OUTLINE

Introduction Classification: Anatomic (Intrahepatic (IHC) & extrahepatic (EHC)), Macroscopic growth pattern (Mass forming, periductal, intraductal & mixed growth), Microscopic features (EHC: adenocarcinoma; IHC: Small duct & large duct types) & Cell of origin (Stem cells in the canals of Hering & peribiliary glands) Risk Factors & precursor lesions (IPNB & MCN), Pathogenesis: IDH1/2, KRAS IHC: large duct type, small duct type, Mimics: Combined HCC/ICC, Intraductal metastases, epithelioid hemangioendothelioma & metastases ECC: perihilar & distal bile ductal Role of Imaging: US, CT, MRI & EUS Radiogenomics: IDH1/2: Intratumoral arteries & arterial/venous phase hyperenhancement Treatments and Prognosis Conclusion Summary: Cholangiocarcinoma is a heterogeneous disease with different subtypes that demonstrate varied clinical behaviors & imaging findings. Precursor lesions & select risk factors demonstrate characteristic imaging findings that can help in early diagnosis. New imaging biomarkers have been identified that assist in treatment & prognostication.

GI321-ED-THA10

Associating Liver Partition and Portal Vein Ligation for Staged Hepatectomy in Hepatocellular Carcinoma Treatment: What Radiologists Need to Know

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #10

Awards
Cum Laude

Participants
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Chang Li, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zi-Ping Li, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) is a noval surgical approach aimed to induce rapid liver growth. ALPPS is suitable for the treatment of hepatocellular carcinoma (HCC) whose remaining liver volume is unenough to accept a wide range liver resection. Radiologists play an important role in the preoperative and intraoperative assessment. The purpose of this exhibit is : 1. To introduce the procedure of ALPPS and postoperative liver regeneration mechanism in details 2. To discuss the merit, demerits and progress of ALPPS 3. To recommend appropriate imaging to preoperative assessment and during surgery. 4. To recognize complications of ALPPS and corresponding solutions.

TABLE OF CONTENTS/OUTLINE

1.Procedures of ALPPS and its mechanism of liver regeneration. 2.Pros of ALPPS 3.Cons: Unsatisfied liver regeneration, Adhesion, Tumor progress.4. Appropriate imaging for preoperative assessment - CT - MR(emphasize Gd-EOB-DTPA enhanced MRI).5. Appropriate imaging for liver growth assessment before the second stage hepatectomy .6.Complications of ALPPS : Unsatisfied liver growth (AVF, severe liver cirrhosis), Liver failure, Bile leakage, Liver necrosis and infection. 7. The solutions of complications. 8.Summary

GI322-ED-THA11

Texture Analysis in Abdominal Imaging: From Basic Concepts to Applications

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #11

Participants
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Joao V. Horvat, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

-Understand the definition and general concepts of textural analysis (TA) -Understand the definition and general concepts of radiomics, radiogenomics and precision medicine. -Comprehend the workflow process in performing TA, radiomics and radiogenomics -Recognize the most common difficulties and how to overcome them during the workflow process -Know the most relevant applications of TA on CT and MRI in abdominal imaging including both gastrointestinal and genitourinary imaging -Be familiar with the limitations and challenges to be overcome before its implementation into clinical routine.

TABLE OF CONTENTS/OUTLINE

INTRODUCTION: - General concepts of TA, radiomics and radiogenomics WORKFLOW PROCESS - A PRACTICAL GUIDE: - Image acquisition; Creation of a dataset; Image segmentation; Feature extraction and categories (morphological, first-order parameters, second-order parameters, and superior order features); Feature selection and prediction model; Validation GASTROINTESTINAL APPLICATIONS (LIVER, PANCREAS, STOMACH, SMALL BOWEL, RECTAL) GENITURINARY APPLICATIONS (KIDNEY, BLADDER, PROSTATE, UTERUS AND OVARIES) DATA INTERPRETATION: Systematic approach to evaluate the results published in the literature LIMITATIONS AND CHALLENGES: Limitations, pitfalls and challenges FUTURE DIRECTIONS: What's on the horizon

GI323-ED-THA12

Step by Step: A Guide to Barium Swallow for the Study of Anatomy and Function of the Gastroesophageal Junction

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #12

Awards
Certificate of Merit

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TEACHING POINTS

Barium swallow is a non-invasive dedicated radiological evaluation of the most upper gastrointestinal (GI) tract: from the pharynx to the gastric cavity, it has the ability to diagnose both structural changes and motility disorders in the gastroesophageal junction. Because of its dynamic nature it is sometimes modified depending on the patient symptoms and history, and it may be performed as a single or double contrast study. The knowledge of the anatomy of the upper GI tract and the correct barium swallow procedure is necessary for the accuracy in the diagnosis of different pathologies and adequate interpretation of image findings. The aims of this presentation: To review the most common indications for this study. To recognize the normal anatomy of the normal upper gastrointestinal tract, focusing on the GE junction. To describe a step by step procedure to achieve adequate diagnostic images. To present a systematic approach to appropriate interpretation of barium swallow. To describe and illustrate findings related to morphologic and functional GE junction abnormalities, such as hiatal hernias, postsurgical esophagus, gastroesophageal reflux and other motility disorders.

TABLE OF CONTENTS/OUTLINE

Introduction. Indications. Normal anatomy. Barium swallow step by step: projections and patient position. Illustrative imaging findings. Conclusion.

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GI324-ED-THA13

Defecography: Assessment of Different Imaging Methods a Review

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #13

FDA Discussions may include off-label uses.

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Yeni Fernandez de Lara Barrera, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Rocio Iniguez, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

• To show the defecography and evaluation of pelvic floor anatomy with different imaging methods • To know the myriad of pathologies assessed with defecography modalities • Recognize the best type of method in certain pathology group to correct characterization • Approach of the evacuation disorders with fluoroscopy and MRI

TABLE OF CONTENTS/OUTLINE

Introduction. Anatomy and physiology of pelvic floor. Normal and anomalous findings. Demographics. Defecography: Systematic approach of the Compartment Abnormalities.

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GI358-SD-THA1

Deep Learning Assisted MRI Prediction of Tumor Response to Chemotherapy for Patients with Colorectal Liver Metastases

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #1

Participants
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PURPOSE

To predict the response to preoperative chemotherapy in patients with colorectal liver metastases (CRLM) with a deep learning algorithm and the histological tumor regression grading (TRG) in a prospective study

METHOD AND MATERIALS

Between January 2013 and November 2016, consecutive CRLM patients (<= 5 lesions) scheduled to receive preoperative chemotherapy followed by liver resection were included. All patients received pre- and post-treatment MR examinations (including T2WI and DWI sequence) on a 1.5T device. Pathology tumor response grade (TRG) was obtained, and lesion by lesion radiologic-pathological correlation of all CRLMs was conducted. Deep learning models were constructed for discrimination between response (TRG1/2) and non-response (TRG3/4/5) on lesion-level, the result was compared with RECIST criteria. In addition, the performance of deep learning model on patient-level was tested using survival analysis.

RESULTS

155 patients (328 lesions) were included, chronologically 101 (264 lesions) for training and 54 (64 lesions) for testing. In testing cohort of 16 response lesions and 48 non-response lesions, DC3CNN model including both pre- and post-treatment MRI information (Model A) achieved an accuracy of 0.875 and an AUC of 0.849 for discrimination of response, which was much better than RECIST (accuracy: 0.578; AUC: 0.615) and the model only include the pre- T2WI and DWI alone (Model B) (accuracy: 0.797; AUC: 0.635), the model only include the post-T2WI and DWI alone (Model C) (accuracy: 0.859; AUC: 0.686). The DC3CNN model defined response and non-response group presented different survival outcomes (P=0.03 and 0.04 for DFS and OS), similarly as pathology discrimination did. However, RECIST criteria defined response group and non-response group didn't yielded significantly different survival outcomes (P= 0.12 and 0.99 for DFS and OS, respectively).

CONCLUSION

The MRI based DC3CNN model could provide surgeons accurate prediction of tumor response to preoperative chemotherapy in CRLM patients. The model may be helpful for providing surgeons individualized information of treatment response and risk for prognosis.

CLINICAL RELEVANCE/APPLICATION

The deep learning model using MRI dataset is capable for preoperative, noninvasive, individualized prediction of TRG in CRLM, which achieved a good diagnostic performance according to pathology (overall accuracy of 87.5%).

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GI359-SD-THA2

Value of MRI as A Screening Tool for Hepatocellular Carcinoma in a High-Risk Population

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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PURPOSE

The purpose of this study was to investigate the utilization of full MRI liver protocol as a screening tool for hepatocellular carcinoma (HCC) in high-risk patients.

METHOD AND MATERIALS

Patients in a HCC surveillance program, who were deemed unsuitable for ultrasound, underwent yearly screening with full MRI liver protocol from January 2010 to January 2019. These cases were evaluated to assess underlying liver disease (hepatitis, grade of cirrhosis) and detection rate of HCC. Patients with HCC were re-evaluated by 2 experienced radiologists for proper characterization conform LIRADS V 2018. Characteristics of HCC (early or advanced) and causes for possibly surveillance failure with advanced HCC on first detection were investigated.

RESULTS

A total of 240 patients were included (170 (71%) male; median age 57 years, IQR 50-64 years). The median number of MRI examinations received per patient was 4, IQR 3-7. Cirrhosis was present in 198 (83%) patients; most (91%) with Child-Pugh A (CP-A). Non-cirrhotic hepatitis was present in the remaining 42 patients. Forty-two (17.5%) patients developed HCC: 41 patients in underlying cirrhosis (81% CP-A) and one patient in non-cirrhotic hepatitis. A Total of 52 HCC lesions were detected: 33 (79%) patients had single lesion; 8 patients (19%) had multiple lesions and 1 patient (2%) had diffuse infiltrative HCC. HCC lesions were classified as LIRADS 4 (n=9); LIRADS 5 (n=43) and LIRADS 5 diffuse (n=1). Lesion size was median 21mm (IQR 6-29mm). Thirty-four (81%) patients had early HCC conform BCLC staging system. Patients with early HCC had a significant shorter time interval between MRI with first detected HCC and previous screening MRI (median 12 months) compared to patients with intermediate, advanced or terminal stage HCC (median 25 months).

CONCLUSION

MRI has a HCC detection rate of 17.5% in a surveillance program of high-risk patients. Most (81 %) patients had early HCC. Cases of advanced HCC can be regarded as surveillance failure with a significant longer time delay between MRI with first detected HCC and previous screening MRI when compared to patients with early HCC.

CLINICAL RELEVANCE/APPLICATION

Yearly full MRI liver protocol has a HCC yield in 17.5% of patients in a surveillance program and can be recommended whenever ultrasound is deemed inadequate.

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GI360-SD-THA3

Cirrhosis-Like HCC - A New Subtype of HCC? A Clinical, Pathologic, And Radiologic Correlation

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #3

Participants
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PURPOSE

To establish a new subtype of HCC and compare its histologic, clinical and radiologic characteristics to the scirrhous and conventional variants of HCC.

METHOD AND MATERIALS

In this HIPPA-compliant, IRB-approved, retrospective study, a board-certified pathologist identified 24 scirrhous (SC-HCC) and 29 cirrhosis-like (CL-HCC) lesions and randomly selected 30 conventional (CV-HCC) lesions from 290 cases. CL-HCC was defined as a subtype distinct from cirrhotomimetic HCC with multiple nodules encircled by fibrous septa in one mass lesion mimicking cirrhosis pathologically. Baseline clinical data at diagnosis were systematically collected. Liver function tests and AFP were assessed using a Mann-Whitney U and a X2-test, respectively. A board-certified radiologist examined the radiologic appearance of SC-HCC and CL-HCC on contrast-enhanced MRI based on major and ancillary LIRADS (Liver Imaging Reporting and Data System) features. Notable feature differences were further analyzed using Fisher's exact test. Correlation of imaging features with histologic findings was performed.

RESULTS

CL-HCC cases showed lower AST (p=0.006) and ALT (p=0.030) levels than CV-HCC. No differences in age, gender, etiology, AFP, or liver function tests were observed between SC-HCC and CL-HCC. Despite the notable overlap of histologic features, CL-HCC compared to SC-HCC presented with higher rates of washout (p=0.0001) and multiple hypointense nodules embedded into enhancing septations on the delayed phase (p<0.0001), a novel imaging feature that correlates with histology findings. Though not significant, SC-HCC was more likely to show rim-arterial enhancement (p=0.054), a previously identified imaging feature of SC-HCC, and satellite lesions (p=0.103).

CONCLUSION

Despite the notable overlap of histologic features, CL-HCC can be distinguished on MRI based on already existing and novel distinct imaging features.

CLINICAL RELEVANCE/APPLICATION

Though limited by sample size, this study establishes radiologic and pathologic characteristics that differentiate CL-HCC, a new subtype of HCC, from SC-HCC.

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GI384-SD-THA5

Differentiation of Pancreatic Mucinous Cystic Neoplasm from Macrocystic Serous Cystic Adenoma: Feasibility of Radiomic Analysis and Comparison of Diagnostic Performance between Radiomic Model and Radiologists

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #5

Participants
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PURPOSE

To investigate the feasibility of radiomic analysis in the differentiation of mucinous cystic neoplasms (MCNs) and oligo-cystic serous cystadenomas (O-SCAs) and compare the diagnostic performance of radiomic model with experience radiologists.

METHOD AND MATERIALS

49 Patients (MCN = 25, O-SCA = 24) with pre-surgery multidetector computed tomography (MDCT) scans were retrospectively included in this study. Demographic and radiological characteristics were compared in univariate analyses. Radiomic features extracted from portal venous phase images were calculated and radiomic models were built using the 0.623 + bootstrap method. Two radiologists evaluated multiple CT features and made radiological diagnosis for each patient. The diagnostic performance of the best radiomic model and radiologists were compared in terms of area under the receiver-operating characteristic curve (AUC), sensitivity, specificity and accuracy.

RESULTS

Clinical and most radiological characteristics had no significant significance between patients with MCN and O-SCA except the cyst wall (P = 0.005). A model combined by 7 texture features had the best predictive performance. The optimal feature set reached an AUC of 0.82, sensitivity of 72.0%, specificity of 73%, and accuracy of 72%. Diagnostic performance of radiologists reached an AUC of 0.55, sensitivity of 54.2%, specificity of 64%, and accuracy of 59.2%.

CONCLUSION

Radiomic analysis was feasible in the differentiation of MCN and O-SCA. Diagnostic performance of radiomic model was better than experienced radiologists.

CLINICAL RELEVANCE/APPLICATION

The differentiation of MCN and O-SCA was difficult based on demographic and radiological characteristics. Radiomic analysis was a feasible approach for pancreatic lesion categorization.

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GI385-SD-THA6

Diagnostic Performance of Quantitative Ultrasound Parameters for Detection and Classification of Hepatic Steatosis in Nonalcoholic Fatty Liver Disease

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #6

Participants
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PURPOSE

Nonalcoholic fatty liver disease (NAFLD) is a leading cause of chronic liver disease (CLD) worldwide. Early diagnosis and monitoring are critical for disease management and therapeutic interventions. Here, we assess the diagnostic performance of seven quantitative ultrasound (QUS) parameters for detecting and staging hepatic steatosis in patients with or suspected of NAFLD.

METHOD AND MATERIALS

24 patients with or suspected of NAFLD, without any history of other CLDs (12 men, 12 women) were prospectively recruited (average age: 53 ± 14.9, average body mass index: 30.2 ± 6.5) in this HIPAA-compliant IRB-approved study. Informed consent was obtained from all participants. In each patient, up to 12 ultrasound (US) liver acquisitions were obtained using a Philips EPIQ 7 US machine. The following QUS parameters were measured: acoustic attenuation coefficient (AC), hepatorenal index (HRI), spectral intercept (SI), Nakagami parameter, shear wave elasticity (SWE), shear wave viscosity (SWV), and shear wave dispersion (SWD) measures. Proton density fat fraction (PDFF) was calculated for all patients using 3T magnetic resonance imaging within 14 days, which served as the reference standard. Hepatic steatosis was categorized as S0, <5%; S1, 5-10%; S2, 10%-20% or S3 >20% based on PDFF. Diagnostic performance and correlation of QUS parameters to PDFF grading were assessed using receiver operating characteristic (ROC) curves and Pearson correlation coefficients (r), respectively.

RESULTS

Hepatic steatosis categories were near-evenly distributed across our patient population (25% S0, 13% S1, 29% S2 and 33% S3). The AC, HRI, and SI had highest correlations to PDFF (r = 0.82, 0.76, and 0.85 respectively). The Nakagami parameter had a moderate correlation with PDFF (r = 0.73). SWE, SWV and SWD parameters had poor correlations with PDFF (r = 0.46, 0.23, and 0.10 respectively). The area under the ROC curve (AUROC) for AC and HRI for identifying steatosis grades >=1, >=2, and 3 was found to be 0.96, 1.00, 0.87 and 0.95, 0.96, 0.87, respectively.

CONCLUSION

AC, HRI, and SI values are well correlated to PDFF, and can accurately detect and classify hepatic steatosis in patients with or suspected of NAFLD.

CLINICAL RELEVANCE/APPLICATION

QUS parameters such as AC, HRI, and SI are accurate and inexpensive alternatives to MRI-PDFF for detecting and staging hepatic steatosis in NAFLD, which is increasingly becoming a global health concern.

GI386-SD-THA7

The Evaluation of Low-Dose Contrast Media Protocol by Using New Saline Chaser Administered via Spiral Flow Injection Tube on a Single-Source Dual-Energy CT

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #7

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PURPOSE

This study aimed to assess the effectiveness of a saline chaser administered via spiral flow injection tube at a low-dose contrast media protocol in a single source dual energy CT (ssDECT).

METHOD AND MATERIALS

Eighty patients were divided into two groups (spiral flow injection tube/conventional injection tube). ssDECT was performed in each patient. The contrast medium (360 mgI/kg) was delivered over 30s; subsequently, 30mL saline solution was delivered at the same rate. The study included post-contrast aortic CT during the arterial and delayed phase. We measured the CT number with the same regions of interest (ROIs) at the same slice for aortic arch, abdominal aorta (celiac levels), and iliac artery. The differences (ΔCT) of CT numbers (HU) between two sets (spiral flow tube and conventional tube) were defined to quantitatively evaluate the effectiveness of a saline chaser administered via spiral flow injection tube.

RESULTS

The CT numbers (HU) for the aorta of arterial phase using different tubes were (aortic arch; conventional injection tube[C]:357.8±51.4, spiral flow injection tube[S]:385.7±58.5),(abdominal aorta; C:351.5±50.9, S:381.1±54.9),(iliac artery; C:331.2±47.8 , S:361.4±51.4). Delayed phase results were (aorta arch ; C:138.0±13.2, S:139.0±14.9), (abdominal aorta ; C:143.1±12.5, S:143.6±14.5), (iliac artery ; C:138.1±13.2, S:137.4±15.4), respectively. The ΔCT(HU) for the aorta of arterial phase using different tubes were (aortic arch; 27.9HU (7.8%)),(abdominal aorta; 29.6HU (8.4%)),(iliac artery; 30.2HU(9.1%)).Spiral flow injection tube improved CT numbers by 30 HU compared with use of a conventional injection tube in arterial phase ($p<0.05$).

CONCLUSION

A saline chaser with the use of a spiral flow injection tube showed significant improvement for aorta enhancement at the low-dose contrast injection protocol in a ssDE CT scan.

CLINICAL RELEVANCE/APPLICATION

This study is useful for reducing volume of contrast material by using spiral flow injection tube.

GI387-SD-THA4

Reduction of Motion Artifact and Improvement of Lesion Visibility of the Left Lobe in the Liver: Usefulness of Velocity-Compensated Diffusion-Weighted MRI

Thursday, Dec. 5 12:15PM - 12:45PM Room: GI Community, Learning Center Station #4

Participants
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PURPOSE

To investigate if the velocity-compensated diffusion-weighted MRI (vc-DWI) affects the degrees of motion artifact and lesion visibility in the left lobe of the liver as compared with conventional DWI (c-DWI).

METHOD AND MATERIALS

Eleven patients with hepatocellular carcinoma (n = 5) or liver metastasis (n = 6) in the left lobe were included in the study and underwent liver MRI. All examinations were performed on a clinical 3.0 T MR scanner (Achieva, Philips). Both c-DWI and vc-DWI were acquired using single-shot spin-echo echo planar imaging sequence with following parameters: TR/TE = 833/64 ms, thickness = 7 mm, slices = 7, b = 800 s/mm2, NSA = 3, scan time = approximately 210 s, fat suppression, respiratory and peripheral pulse unit triggering. A pair of monopolar gradients was used as motion probing gradients in c-DWI whereas dual bipolar gradient was used in vc-DWI. Two abdominal radiologists evaluated the severity of signal loss (signal loss score) of the left and right lobe of the liver in a consensus fashion as follows: 1 = negligible; 2 = mild; 3 = moderate; and 4 = severe. Further, signal intensity ratio of lesion to muscle (SIR) was measured in each patient to evaluate the visibility of the lesions. Comparison of signal loss score and SIR was performed between c-DWI and vc-DWI.

RESULTS

The mean tumor size was 2.21 ± 1.10 cm (0.9-4.5cm). The mean signal loss score of the left lobe in the vc-DWI was significantly lower than that in the c-DWI (1.82 ± 0.75 vs 3.00 ± 1.00, $p < 0.01$) whereas the mean signal loss score of the right lobe did not show significant difference. The mean SIR in the vc-DWI was significantly higher than that in the c-DWI (2.87 ± 1.59 vs 2.14 ± 1.56, $p < 0.05$).

CONCLUSION

Using dual bipolar diffusion gradients, all phase sensitivity to constant velocity motion during the diffusion weighting period was removed. Therefore, vc-DWI could reduce the artifact mostly due to the cardiac motion in the left lobe and then visibility of the lesion was improved as compared with c-DWI. Since the DWI is a valuable technique for the detection and characterization of liver lesions, vc-DWI might improve diagnostic quality of the lesion in the left lobe of the liver.

CLINICAL RELEVANCE/APPLICATION

(dealing with MR artifact reduction) The lesion detection or characterization in the left lobe of the liver can be improved by using of velocity-compensated diffusion-weighted imaging.

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GU224-SD-THA1

Cloverleaf-Sign: A New MRI Sign Predicting Significantly Longer Operation Time and Higher Bowel Resection Rate in Deep Infiltrating Endometriosis

Thursday, Dec. 5 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #1

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PURPOSE

We observed on MRI repeated a 'conglomerate' including deep infiltrating endometriosis with constricting adhesions between at least three different organs. We called it a 'Cloverleaf-Sign' and investigated the value of it.

METHOD AND MATERIALS

103 patients operated 2015-2017 with preoperative 1,5 T and 3 T MRI with or without vaginal and rectal gel opacification blinded to intraoperative findings were analyzed by a specialized gynecologic radiologist and then compared to intraoperative findings by looking at the operation report, postoperative diagnosis and intraoperative images and videos. A conglomerate was defined as a DIE with constricting adhesions to at least three organs. Statistical analysis was performed with SPSS (Vers 25.0) with ANOVA and crosstables for specify and sensitivity (DIE and gel filling) and with Excel (t-test, correlation coefficients).

RESULTS

103 patients were analyzed. Mean age was 33,2 years (18-46), mean BMI was 23.0 (16.1-36.8) and the women had a mean of 1,4 previous surgery. 11.5% had no endometriosis, 32.6% had and rASF °I and° II, 55.9% °III and °IV. 46 patients (45%) had received rectal and vaginal gel opacification before scanning, 57 (55%) did not. A conglomerate = 'Cloverleaf-Sign' on MRI was discovered in 34 patients (15 in gel filling and 19 in non-filling group). The mean operation time in the conglomerate group was 261 minutes (45-570 min.) compared to 150 minutes (30-300 min.) in the non-conglomerate group (p=0.000175). The highest correlation was yield between MR-graphic conglomerate (cloverleaf-sign) and operation times equal or more than 300 minutes (correlation coefficient 0.50), intraoperative blood loss being also significantly higher in the conglomerate group (179 ml vs. 96 ml, p=0.0002). 41% (14/34) of all bowel resections (22% of patients) of our study population were proceeded in the patients with Cloverleaf-Sign on MRI, on the contrary in 13% (9/69) in patients without the Clover-leaf Sign. The results of the gel opacification MRI protocol are reported in a separate study.

CONCLUSION

A 'Cloverleaf' MRI sign predicts significantly longer lasting and more extent operations, the bowel resection rate being also higher.

CLINICAL RELEVANCE/APPLICATION

For surgeons crucial in planning the operation and informing the patient: A 'Cloverleaf' MRI sign predicts a longer lasting, challenging operation and a higher risk to a bowel resection.

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GU226-SD-THA3

Geometrical Distortion on Diffusion-Weighted Imaging of Prostate: Comparison of Single-Shot Echo-Planar and Readout Segmentation of Long Variable Echo Train Techniques

Thursday, Dec. 5 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #3

Participants
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PURPOSE

This study aimed to compare the image quality in two acquisition techniques of prostate diffusion weighted imaging (DWI): single-shot Echo-Planar Imaging (ssEPI) and Readout Segmentation of Long Variable Echo trains (RESOLVE)

METHOD AND MATERIALS

This HIPAA-compliant, IRB-approved study assessed data of 68 consecutive patients who underwent 3 Tesla prostate mpMRI (3T mpMRI) from January to March 2019. Non-cooperative patients and patients with a history of prior pelvic surgery or radiation therapy were excluded. Two radiologists blinded to the clinical information evaluated each MRI in consensus for qualitative scoring. A five-point Likert scale was used to assess the geometrical distortion on ssEPI and RESOLVE DWI as followed: 1= no perceptible artifact, 2= minimal susceptibility artifact, which did not interfere with diagnosis 3= mild susceptibility artifact, obscuring <50% of the peripheral zone, 4= moderate susceptibility artifact, obscuring >50% of the peripheral zone, and 5= severe susceptibility artifact, affecting the peripheral and transitional zones. The degree of rectal gas was also scored based on the largest transverse diameter in dynamic contrast-enhanced images using a five-point scale as followed: 1: collapsed rectal wall, 2: minimal gas (<1cm), 3: mild gas (1-2 cm), 4: moderate gas (2-3 cm) and 5: severe gas (>3 cm). Chi-square test and ordinal logistic regression were used for statistical analysis by means of SPSSv.16.

RESULTS

Mean scores were 1.54 and 1.37 for image distortion in ssEPI and RESOLVE techniques, respectively. A significant mild-to-moderate correlation was observed between rectal gas grading and geometrical distortion on both ssEPI and RESOLVE DWI (Rs: 0.39 and 0.45, respectively, P<0.001). The geometrical distortion was significantly less observed in RESOLVE compared to ssEPI, regardless of the gas grading (P<0.01) and when stratified based on rectal gas scoring (P<0.05). Geometrical distortion scores of 3 and 4 were observed in six and two patients in ssEPI, respectively, with all eight patients having scores < 3 on RESOLVE.

CONCLUSION

RESOLVE performed significantly better in producing images with less geometrical distortion compared to ssEPI in prostate DWI.

CLINICAL RELEVANCE/APPLICATION

Using RESOLVE for DWI acquisition may augment or replace ssEPI on 3TmpMRI with higher image quality and less geometrical distortion.

GU240-SD-THA4

A Retrospective Evaluation of the Impact of Fetal MR Imaging on Prognosis and Referral Patterns for Intrauterine Fetal Anomalies

Thursday, Dec. 5 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #4

Participants
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Carolynn M. DeBenedectis, MD, Natick , MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study evaluates the impact of fetal MR imaging on patient referral patterns and prognosis in cases of prior ultrasound diagnoses of fetal anomalies. Prenatal evaluations after diagnosis by ultrasound are usually followed up with fetal MR and amniocentesis. Routine prenatal care also involves blood tests such as the triple screen. Thus, a case-by-case evaluation of the relative impact of each testing modality on fetal outcomes is valuable.

METHOD AND MATERIALS

This is a retrospective study of 43 pregnant women seen during a 4-year period. Electronic medical records were researched and results from ultrasound, fetal MR, blood tests and amniocentesis were collected. The percentage of patients who tested positive for fetal anomalies by fetal MR, amniocentesis and blood tests after an ultrasound diagnosis was calculated. Results of ultrasound and fetal MR were compared to find the impact of fetal MR in overall prognosis and to evaluate the findings from both imaging modalities for agreement.

RESULTS

The principal diagnoses made by fetal MR and ultrasound were in complete agreement in only 55% of cases. Overall, MR gave a better prognosis than ultrasound in 38% of the cases and in the remaining 62%, MR gave a similar prognosis as ultrasound. In 69% of cases, MR led to significant changes in pre and perinatal management thus highlighting the impact of fetal MR on patient care. None of the patients who got karyotyping (amniocentesis) and only 9.5% of patients who got pregnancy markers tested (from amniotic fluid and/or blood) had results positive for suspected fetal abnormalities. All UMass-internal patients and 79% of externally referred patients stayed at UMass until delivery, indicating that in most cases, UMass has served as a preferred site.

CONCLUSION

In this study, fetal MR imaging demonstrated positive outcomes in patient management, whereas karyotyping by amniocentesis and pregnancy marker tests did not contribute significant impact in prenatal diagnosis in most cases. The referral patterns and follow-up history showed that UMass was a patient-preferred site in managing pregnancies complicated by fetal anomalies.

CLINICAL RELEVANCE/APPLICATION

Fetal MR is a valuable resource for prenatal and perinatal management of congenital anomalies.

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GU241-SD-THA5

Predicting CD8+ T Cell infiltration in Renal Cell Carcinoma Using CT Radiomic Signatures

Thursday, Dec. 5 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #5

Participants
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PURPOSE

CD8+ T cell infiltration has been shown to predict treatment response with immune checkpoint inhibitors (ICIs). However, it is not tested routinely in clinical practice due to inherent issues with tissue-based markers including pathologic specimen requirement (biopsy), tumor heterogeneity and sampling variability. We investigate the association between computed tomography (CT) based radiomic metrics and CD8+ T cell infiltration in patients with clear-cell renal cell carcinoma (ccRCC).

METHOD AND MATERIALS

In this IRB approved, retrospective study, we evaluated 48 patients with pathologically confirmed localized ccRCC, and who had preoperative multiphase CT with available tumor tissue from June 2009-2018. Immunohistochemistry (IHC) of CD8 was performed. Of the 48 patients, 25 were CD8 positive (>80) and 23 negative (<80). Manually segmented whole lesions from the multiphase CT acquisitions were evaluated using a radiomics panel comprising of 1708 metrics derived from 9 texture methods. Radiomic signatures were created from voxel-wise data analysis and tumor segmentation in Synapse 3D. Least absolute shrinkage and selection operator (LASSO) was used to select radiomic features that predict infiltration. Area under the curve (AUC) based on predicted probability from 48 iterations of leave-one-out cross-validation (LOOCV) testing data was used to assess robust discrimination accuracy. SAS 9.4 was used for all data analysis.

RESULTS

The result from 48 iterations of LOOCV testing data showed an AUC of 0.9; 95% CI; 0.8-1 in discriminating patients with CD8-positive from CD8-negative infiltration. While we cannot rule out discovery by chance due to a small sample size, distribution of predicted probability using histogram showed almost complete separation between CD8-positive and CD8-negative around 0.5. Maximal correlation coefficient extracted from the grey-level difference map (GLDM) of the sagittal plane image of the precontrast phase and uniformity metric extracted from the GLDM of the 3D tumor volume in the nephrographic phase were the top ranking predictors in the variable of importance.

CONCLUSION

CT-based radiomic metrics of ccRCC could provide useful information regarding the density of CD8+ T cell infiltration.

CLINICAL RELEVANCE/APPLICATION

Predicting CD8+ T cell infiltration could allow us to accurately identify patients that would benefit from ICI therapy non-invasively.

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GU242-SD-THA6

Laser Lithotripsy for Ureteral Calculus: Can CT Three-Dimensional Texture Analysis Technique Help Predict the Therapeutic Effects? An Article Accorded with the STARD

Thursday, Dec. 5 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #6

Participants
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PURPOSE

To explore whether multi-parameter of three-dimensional texture analysis (3D-TA) in computed tomography (CT) can predict the therapeutic effects of laser lithotripsy(LL) for ureteral calculus before operation.

METHOD AND MATERIALS

Patients with ureteral calculus, diagnosed by Toshiba 640-slice CT and treated with LL from January 2016 to March 2019, were retrospectively and continuously collected in the third-level medical institution of national single-center. According to the intraoperative observations and postoperative reexamination results, the patients were divided into two different groups: crushed completely group and non-crushed completely group. The CT value of each target stone was measured, and 15 TA parameters was extracted by delineating the 3D regions of interest (ROI) in Mazda software. The receiver operating characteristic curve (ROC) was drawn to determine the optimal critical value of each parameter between the two groups based on Jordan index, and univariate and multivariate logistic regression analyses were used to determine the significant factors on the curative effects of LL.

RESULTS

156 suspected samples were analyzed, and 94 samples, with 102 stones, were finally identified as qualified subjects. On univariate analysis, the significant differences ($P< 0.05$) among 7 parameters were shown, including CT value, Volume, Variance3D, Skewness3D, Kurtosis3D, Z-RLNonUni, Z-GLevNonU. On multivariate analysis, perc.01 3D > 2062(P=0.03) and Z-Fraction> 0.45570(P=0.009) were significant independent predictors of LL success, and the odds ratios (OR) respectively were 24.204 and 60.329. In subgroup analysis based on the cutoff value of CT value (HU=960)of stones, the significance of Perc.01 3D(OR=44.154,95%CI(2.379,819.618),P=0.011)and Z-Fraction(OR=14.519,95%CI(2.088,100.953),P=0.007)were also stronger.

CONCLUSION

3D-CTTA and multi-parameter combination can be used as quantitative references to predict whether target stones could be completely crushed by LL for patients with ureteral calculus before operation.

CLINICAL RELEVANCE/APPLICATION

(dealing with ureteral calculus and laser lithotripsy)'3D-CTTA and multi-parameter combination can be recommended as quantitative references to predict whether target stones could be completely crushed by laser lithotripsy for patients with ureteral calculus before operation.'

HP128-ED-THA4

Self Help: Creating Research Opportunities in a Hybrid Training Setting

Thursday, Dec. 5 12:15PM - 12:45PM Room: HP Community, Learning Center Station #4

Participants
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TEACHING POINTS

Research is an integral part of physician training especially as the number of residents pursuant of fellowship training continues to increase. There is an inherent difference in the accessibility and quality of research performed in major academic institutions versus those available to hybrid or private practice based training programs. Occasionally individuals who are highly motivated to pursue academics end up matching into these hybrid practice groups where the individual's goals and the culture of the program may not necessarily align. We, the authors, are such individuals who matched into hybrid programs but have a strong desire to pursue academics and maintain a high level of scholarly activity throughout training. Having published a combined 14 papers and 71 presentations (oral, poster, eposter) during our clinically rigorous residencies, we would like to share our experiences and offer advice to trainees in similar positions.

TABLE OF CONTENTS/OUTLINE

Talking to the program director about career goals. Identifying possible projects. Reaching to outside institutions and entities. Balancing clinical duties and research. Engage the hospital adminstration. Take advantage of societal scholarships.

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HP224-SD-THA1

Impact of Live versus Recorded Radiology Lectures for a 4th-Year Medical Student Radiology Clerkship Rotation on Test Performance

Thursday, Dec. 5 12:15PM - 12:45PM Room: HP Community, Learning Center Station #1

Participants
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PURPOSE

We sought to determine if there is a difference in radiology test performance between medical students receiving live lectures compared to pre-recorded lectures.

METHOD AND MATERIALS

27 fourth-year medical students completed a required 4-week radiology clerkship with a curriculum following the AMSER guidelines with 12 unique lectures. For a subset of 4 of the 12 lectures, students received either live lectures or recorded version, while in the remaining 8, 7/8 of lectures were delivered live and 1/8 was provided recorded for all students. Students completed pre and post-lecture quizzes, mid-term and final exams. Change in the score performance between pre and post quizzes within and between groups were measured. A two-tailed t-test was performed for continuous variables. A p-value of less than 0.05 was considered significant.

RESULTS

In the subset of 4 lectures where the mode of delivery varied (live vs. recorded), 9 (33%) students received the live lecture format and 18 (67%) received the recorded lecture. Total pre-lecture quiz performance between live and recorded cohorts did not differ significantly (63% live vs 63% recorded, p=0.90). The post-lecture performance also demonstrated no significant difference (89% live vs 93% recorded, p=0.21) between live vs recorded, respectively. Both cohorts demonstrated a significant improvement between the pre- and post-lecture quiz within the group: 26% for live compared to 29% for recorded cohorts. The improvement was not significantly different between the recorded and live groups (p=0.51). In addition, the control lectures (either given live or recorded for all students) demonstrated no measurable difference between the pre- and post quiz within and between groups (p>0.05).

CONCLUSION

In subset of students whose lectures were varied (live vs pre-recorded), students performed comparably with radiology lecture-based quizzes/exams irrespective of mode of delivery (live versus recorded). Similar test performance was seen in the students' scores for the controlled lectures which were given live or pre-recorded for all students.

CLINICAL RELEVANCE/APPLICATION

An online (pre-recorded) curriculum may be as effective as a live lecture for student learning; medical schools with limited resources may benefit by expanding their online radiology curriculum.

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HP225-SD-THA2

Slowly Injected Unsplit-bolus Protocol for the Reduction of Contrast Medium (CM) and Mean Radiation Dose Exposition (SUPREME Protocol)

Thursday, Dec. 5 12:15PM - 12:45PM Room: HP Community, Learning Center Station #2

Participants
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PURPOSE

To validate SUPREME protocol in terms of vascular/parenchymal enhancement and diagnostic accuracy, in oncological patients.

METHOD AND MATERIALS

SUPREME Protocol was adopted for prospective examination of 40 consecutive patients with a previous standard protocol CT examination, performed in our institution. SUPREME protocol: patient weight: >70/<70 kg; Contrast Medium (CM) volume: 130/120; CM injection-rate: 2/1,8 mL/s; Saline solution volume: 60/50 mL; Saline solution injection-rate: 3 mL/s; Acquisition delay: 80s; body surface: thorax-abdomen.Two radiologists in consensus compared SUPREME Protocol examinations with both immediately previous and next follow-up CT examinations of the same patient performing: images qualitative (0/3=poor/excellent) and quantitative (Hounsfield Units sampling at aorta, great vessels and liver/spleen parenchyma) assessment; diagnostic accuracy (findings confirmation) assessment; CM volume and Radiation Dose (RD) administration comparison. Statistical analysis was performed with T- student test and Cohen's k coefficient.

RESULTS

The agreement between the two protocols for the images qualitative assessment was good (k-Cohen>0.6) for the two radiologists in consensus. No quantitative differences were observed between the two protocols with only a better enhancement of the inferior mesenteric artery in the standard protocol ($p<.05$). A global 15% of CM volume and 37.8% of dose exposition reduction of was observed in the SUPREME protocol with respect to standard protocol ($p<.05$).

CONCLUSION

SUPREME Protocol is a valid tool for CM and RD reduction in oncologic patients.

CLINICAL RELEVANCE/APPLICATION

A new CT protocol for oncologic patient's follow-up, reducing Contrast Medium and radiation exposure.

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HP226-SD-THA3

Shot, but Not Forgotten: Predicting Long-Term Consequences of Gun Shot Wound-Related Injuries

Thursday, Dec. 5 12:15PM - 12:45PM Room: HP Community, Learning Center Station #3

Participants
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PURPOSE

There continues to be profound lack of substantial information related to gun violence, particularly in predicting long term outcomes. As sites of initial evaluation and follow up, healthcare centers are in a unique position to study predictors of health in patients with a history of gunshot wound (GSW) who represent to the emergency room (ER). The goal of our study was to identify variables that may help predict readmission or reoperation in patients with a history of GSW.

METHOD AND MATERIALS

A retrospective analysis was performed by searching a database from a single institution for non-acute GSW-related imaging exams from January 2018 to April 2018. Their original GSW-related injury pattern on imaging was recorded (neurologic, vascular, visceral, musculoskeletal, multiple) and clinical information regarding prior hospital course (admitting unit) and subsequent encounters (readmission, surgical history) was collected. Demographics (age and gender) were also collected. Imaging studies were examined for bullet morphology (intact, deformed/shrapnel). A total of 174 imaging studies for 110 patients were queried.

RESULTS

The average patient age for our non-acute GSW patient population is 49.7 (SD 16.3) with men accounting for 91.8% (N=101) of non-acute GSW-related imaging. Partial correlation was used to explore the relationship between injury pattern on prior imaging and readmission whilst controlling for age. There was a moderate positive correlation between injury type, namely neurologic and visceral, and subsequent readmission, which were statistically significant $r(107) = .436$, $N=110$, $P<.001$. However, an inspection of the zero order correlation ($r = .514$) suggested that controlling for age had some effect on the strength of the relationship between the two variables. There was a moderate positive correlation between admitting unit (i.e. ICU) during initial GSW encounter and subsequent reoperation, which was statistically significant $r(107)=.494$, $N=110$, $P<.001$. An inspection of the zero order correlation ($r=.495$) suggested that controlling for age had very little effect on the strength of the relationship between these two variables. Logistic regression was performed to assess the impact of a number of factors on the likelihood that GSW patients would be readmitted. The model contained independent variables (age, injury type, region injured, and bullet morphology). The full model containing all predictors was statistically significant, $X^2 (5, N=110)=56.8$, $P<.001$. The strongest predictor of readmission was prior injury type, namely visceral injury, with an odds ratio of 6.44.

CONCLUSION

This retrospective study suggests an association between GSW injury type and readmission. Furthermore, patients who had a prior visceral GSW-related injury were more likely to be readmitted than other GSW-related injuries.

CLINICAL RELEVANCE/APPLICATION

Morbidity and outcomes from gun violence can only be assessed after a firm understanding of injury patterns on imaging. A location/injury severity scale based on imaging findings could be used to preduct long term consequences as well as extraplate costs, and quality of life years (QALYs) .

IN149-ED-THA4

How to Build a Reliable and Reproducible Radiomics Application

Thursday, Dec. 5 12:15PM - 12:45PM Room: IN Community, Learning Center Station #4

Awards
Certificate of Merit

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TEACHING POINTS

In this exhibit, we present an overview about the radiomics reproducibility and the workflow to build a reliable and reproducible radiomics application. 1. The radiomics reproducibility is affected by the scanning parameters in image acquisition and post-processing parameters in texture calculation. 2. Post-processing parameters is critical in calculation of reproducible textures including data resampling, filtering, segmentation, and discretization. 3. Different groups of textures may require different parameters to optimize the texture reproducibility. 4. Training a reliable radiomics model is affected by the feature selection and balanced samples in a machine-learning classifier such as Random Forest and SVM. 5. Standardized workflow of radiomics application can improve the reliability and reproducibility in building of radiomics applications

TABLE OF CONTENTS/OUTLINE

1. The statistical analysis method to determine texture reproducibility 2. Reproducible segmentation to reduce the inter- and intra-observer viability 3. Selection of optimal post-processing parameters in texture calculation 4. Selection of importance features for reliable radiomics models 5. Data balancing methods in training of reliable radiomics models 6. Hand-on demonstration on the workflow to build a reliable and reproducible radiomics application

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IN234-SD-THA3

Radiomics Could Improve Predictive Performance of Overall Survival in Patients with Hepatocellular Carcinoma (HCC)

Thursday, Dec. 5 12:15PM - 12:45PM Room: IN Community, Learning Center Station #3

Participants
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PURPOSE

To assess the role of Radiomics (texture analysis followed by machine learning) in improving overall survival (OS) predictive performance of current staging system (BCLC) for HCC patients.

METHOD AND MATERIALS

This retrospective and IRB approved study included 266 randomly selected HCC patients who had an MRI at presentation between 2005-2016. Baseline Demographics, laboratory, clinical, health status and imaging parameters were collected for all the patients. For radiomics data collection, an expert in the field of hepatobiliary imaging segmented the volume of interest on post contrast venous phase and diffusion weighted MRI sequences. Texture features were extracted, processed to have uniform gray-scale range and quantized. Statistical machine learning techniques were then used to identify the performance of the combined set of texture features in prediction of OS. Steps of feature extraction were illustrated in Figure1. Random survival forest(RSF) algorithm was used - logrank statistic was used for split criterion, optimal values for minimum leaf node size(10), number of variables tried at each split(40), and number of decision trees(500) were obtained after hyperparameter tuning. Predictor importance was estimated based on the out-of-bag(OOB) samples by permutation. The integrated brier score(IBS) was calculated over time as well as the concordance index (C-index) to assess the performance of the RSF based on the out of bag samples. Two models were assessed: BCLC only and BCLC with Radiomic features(95 in total).

RESULTS

In the RSF algorithm as the number of trees increased, the OOB error rate for survival prediction decreased (Figure 2). The top-5 most important radiomic features were ADC gray-level zone-length matrix zone size variance, Enhancement map global variance, ADC global skewness, ADC gray-level run-length matrix long run high gray-level emphasis, ADC gray-level zone-length matrix high gray-level zone emphasis Prediction performance of BCLC only model and BCLC + Radiomics features were estimated as 0.55 and 0.80, respectively (Figure 3).

CONCLUSION

In a large group of HCC patients radiomics significantly improved the prediction of OS prediction over and above BCLC by 25%.

CLINICAL RELEVANCE/APPLICATION

Incorporating Radiomics(texture analysis and machine learning statistical analysis) can potentially help clinicians to better stratify HCC patients based on survival risk and help define optimized treatment plans.

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IN254-SD-THA1

MRI Texture Analysis for Differentiating Solitary Fibrous Tumors/Hemangiopericytoma from Angiomatous Meningioma

Thursday, Dec. 5 12:15PM - 12:45PM Room: IN Community, Learning Center Station #1

FDA Discussions may include off-label uses.

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PURPOSE

To explore the clinical value of preoperative MRI image texture analysis in distinguishing solitary fibrous tumors/hemangiopericytoma (SFT/HPC) and angiomatous meningioma (AM).

METHOD AND MATERIALS

The clinical data and preoperative magnetic resonance imaging data (including T2WI, ADC, T1CE) of 24 patients with SFT/HPC and 20 patients with AM confirmed by surgery and pathology were retrospectively analyzed. The texture parameters,such as maximum value, minimum value, average value, median ,standard deviation, skewness, kurtosis, angular second moment, contrast, inverse different moment, entropy, correlation and so on were measured using histograms and grey-level co-occurrence matrix (GLCM) and compared between SFT/HPC and AM.The independent sample t test or the Mann-Whitney U test was used to compare the difference of the histogram and GLCM parameters of the MRI images between SFT/HPC and AM. ROC curves for statistically significant parameters were used to confirm their efficacy in predicting SFT/HPC and AM.

RESULTS

In histogram parameters, the maximum value , minimum value , mean value ,median of the T2WI, T1CE, and ADC sequences of SFT/HPC are smaller than AM. The T2WI and T1CE image kurtosis values and skewness values of SFT/HPC were all greater than AM, and the difference was statistically significant ($P<0.05$). In GLCM parameters, the SFT/HPC ADC sequence ASM energy value is smaller than AM; the SFT/HPC T2WI, T1CE sequence contrast value is smaller than AM; SFT/HPC ADC sequence entropy The value was greater than AM, and the difference was statistically significant. The T2WI, T1CE, ADC sequence inverse moment values and the T1CE sequence autocorrelation value were statistically different between the two groups. Significance ($P<0.05$); The ROC curve was drawn by the parameters of the AUC > 0.7. The AUC (sensitivity and specificity) of MinT1CE, MedT1CE and MeanT1CE were 0.970 (95.8%, 90.0%) ,0.964 (91.7%, 95.0%),0.960 (91.7%, 95.0%).

CONCLUSION

This study demonstrated that MRI texture analysis can provide more quantitative information, which has important clinical significance for distinguishing SFT/HPC and AM.

CLINICAL RELEVANCE/APPLICATION

Texture analysis extracts feature parameters from the image and can quantify tumor imaging heterogeneity. Instead of relying solely on the subjective diagnosis of a radiologist, it can provide objective information that is invisible to the human eye and has a very large potential clinical value.

IN259-SD-THA2

Therapeutic Pancreatic Cancer Tumor Analysis in CT Images Using Global Atlas, Multi-Resolution Convolutional Neural Network and Wavelet Volumetric Shape Extraction

Thursday, Dec. 5 12:15PM - 12:45PM Room: IN Community, Learning Center Station #2

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CONCLUSION

The proposed multi-step approach for volumetric extraction of pancreas and tumor shape rendered higher level of accuracy compared to previous work. The approach can be applied to a large volume of images and to other organs or other types of tumors.

Background

Computed tomography (CT) images have been used to assess the morphologic integrity as well as the volumetric measure of pancreases to facilitate the diagnosis and treatment of pancreatic cancer. Compared to organs with a more rigid form (e.g. liver, kidney), pancreases exist with uncertain shapes. In addition, finding the accurate spatial location and the shape of a pancreatic tumor is even more challenging due to the indistinguishable change of intensity on the edges of the tumor. We proposed an automated volumetric shape extraction method to segment, detect and classify pancreatic tumors.

Evaluation

The algorithm was developed and trained based on 45 CT scans with a total of 24885 images. First, a hierarchical atlas model was applied to find the estimated location of a pancreas. Then, a multi-resolution convolutional neural network was developed to label the patches of CT images with coarse to refine resolutions. An edge detection algorithm was developed based on structured map to find the accurate edges of pancreas and tumor using direct intensity information. Finally, the wavelet based multi-resolution rendering was used to extract the volumetric shape of the pancreas and tumor. Validation was performed based on 6-fold cross validation method. All the images used as the gold standard for both training and validation were labeled by radiologists. The performance of the algorithm was evaluated by Dice Similarity Coefficient (DSC), Jaccard index (JI), precision and recall.

Discussion

The subjects were 31-88 years of age with a mean and SD of 56±24.3 years. The proposed method yielded a DSC, JI, precision and recall of 85.8%, 83.5%, 87.8%, 92.4% for pancreas and 71.2%, 70.1%, 74.8%, 82.3% for tumor, respectively.

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MI213-SD-THA1

Basic Research on AQP9-MR Molecular Imaging of HCC: The Differential Expression of AQP9 in HCC Tumor Tissues

Thursday, Dec. 5 12:15PM - 12:45PM Room: MI Community, Learning Center Station #1

Participants
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PURPOSE

To investigate the expression differences of AQP9 between HCC tissues, tumor surrounding cells and liver normal cells, and to verify the feasibility of AQP9 as a molecular imaging target for HCC.

METHOD AND MATERIALS

30 patients with liver cancer who were hospitalized in our hospital from April 2009 to September 2015 were prospectively included, and their pathological specimens were collected after surgery. After the labeling of all samples, the specific antigen was detected and the target protein was extracted. The genetic sequence of the target protein was amplified and detected by fluorescence quantitative PCR, and the Ct value was determined. The initial copy number of AQP9 in each sample was obtained by using the standard curve. Statistical analysis was done by SPSS18.0 software to compare the differences of each value between groups and analyze correlation of relative factors of groups. $P<0.05$ was considered statistically significant.

RESULTS

There were 26 males and 4 females in the 30 cases, with an average age of 57.6 years. There were 26 cases of HCC, 3 cases of cholangiocarcinoma and 1 case of partial cholangiocarcinoma. There was no significant difference between the expression level of AQP9 in para-tumor tissues and that of normal hepatocytes (1.01 ±0.01 vs. 1.01±0.76, q= 0.04656,P=0.9984).The expression of AQP9 in tumor tissues was significantly lower than that in normal hepatocytes, with statistically significant differences (1.01 ±0.01 vs. 0.36± 0.36, q=4.122, P=0.0003).

CONCLUSION

AQP9 is differentially expressed in HCC tissues, para-tumor tissues and normal liver tissues, and the expression of AQP9 in HCC tissues is significantly lower than that in para-tumor tissues and normal liver tissues. AQP9 can be used as a target for MR molecular imaging of HCC.

CLINICAL RELEVANCE/APPLICATION

Hepatocellular carcinoma (HCC) is one of the most common malignant tumors. Aquaporins (AQPs) refer to the membrane intrinsic proteins that can selectively and efficiently transport water molecules. One scan of AQP MR imaging can obtain the information of tissue capillary blood perfusion, intercellular water molecule diffusion, and changes of AQP expression on the cell membrane. Specific liver AQP9-MR molecular imaging can be used for the diagnosis of HCC, the evaluation of therapeutic efficacy and the establishment of a database for high-throughput data analysis, so as to find a new breakthrough for the diagnosis and treatment of HCC.

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MI217-SD-THA2

Radiomics Features as a Predictor of Survival in Patients Affected by Pulmonary Metastatic Melanoma

Thursday, Dec. 5 12:15PM - 12:45PM Room: MI Community, Learning Center Station #2

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PURPOSE

Radiomics is an innovative field of radiology, allowing quantitative data extraction from radiological images which can be applied as a survival predictor especially in the oncological field. The aim of our study was to determine if radiomic features of lung metastases in patients affected by melanoma could predict the overall survival.

METHOD AND MATERIALS

Patients with stage IV melanoma affected by lung metastasis, who underwent a contrast enhanced CT scan prior the beginning of the immunotherapy with anti programming cell-death 1 (PD-1) were included. The patients were subdivided in two groups, according to the overall survival (i.e., dead at the time of the study, D+, alive at the time of the study, D-). Three radiologists expert in oncological imaging, performed a blinded and independent segmentation, drawing a region of interest (ROI) along the margins of the biggest metastatic lesion of the lung using a software. 505 radiomic features were extracted using IBEX software and analyzed with Matlab and R-software. The feature stability using intraclass correlation coefficient (ICC) for feature reduction retaining was evaluated. A Wilcoxon based method were obtained and then included in the COX proportional hazard ratio model. Finally a survival curve with Kaplan Meyer method was performed (log-rank, p-value<0.05).

RESULTS

Overall 25 patients with lung metastasis of melanoma, six dead at the time of the analysis, matched the inclusion criteria (9 females, mean age 62,22 ± 12,19 yrs). One hundred and forty-five out of the 505 investigated features showed stability;four of these (GLDZM, Zone Distance Variance; IVH, Area Under IVH Curve; GLDZM, Large Distance Emphasis; GLDZM, Large Distance High GLE Emphasis) demonstrated a statistically significant difference between survivors and not-survivors (p=0.01).

CONCLUSION

Radiomic features seem to be markers of survival in patients with lung metastasis of melanoma.

CLINICAL RELEVANCE/APPLICATION

Radiomic features could become predictor of survival in patients affected by metastatic lung melanoma before immunotherapy with a strong impact on the therapeutic approach.

MK338-ED-THA10

Gluteal Pathology in the Kardashian Era: An Imaging Review

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #10

Participants
Hugo F. Bueno, MD, Jersey City, NJ (*Presenter*) Nothing to Disclose
Iman Khodarahmi, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Cornelia B. Wenokor, MD, South Orange, NJ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

At the end of this exhibit the learner should be able to: Understand the anatomy of the gluteal musculature and its relationship to the pelvis and hips Be able to identify and accurately describe the CT and MR appearance of a diverse set of pathology in relation to the gluteal region (ranging from cosmetic procedures and their complications to other established pathologies including muscle and nerve pathology, depositional diseases, neoplastic and non-neoplastic lesions)

TABLE OF CONTENTS/OUTLINE

Normal gluteal anatomy: CT and MR appearance Imaging of cosmetic procedures such as silicone injections, placement of gluteal implants, and complications Infectious pathologies (e.g., decubitus ulcers, abscess) Non-neoplastic mass lesions (e.g., keratinaceous cyst, tumoral calcinosis, amyloidoma, Klippel-Trénaunay syndrome, fibrolipomatous hamartoma) Low-grade neoplasms (e.g., myxoma) High-grade neoplasms (e.g., osteosarcoma, chondrosarcoma, myxoid sarcoma, high-grade sarcoma) Metabolic-related conditions (e.g., muscle necrosis after Tylenol overdose, rhabdomyolysis) Other miscellaneous pathology involving the gluteal region (e.g., sciatic neuritis, polio, dermatomyositis)

Printed on: 10/29/20

MK339-ED-THA9

Beyond Muscles and Bones: Significant Vascular Findings on Routine Musculoskeletal Imaging

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #9

Participants
Tina Shiang, MD, Worcester, MA (*Presenter*) Nothing to Disclose
Christopher Sereni, MD, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The aim of this presentation is to highlight significant vascular findings on musculoskeletal studies, particularly on modalities for which the vessels are not optimally imaged or may be overlooked. 1. Understand normal appearance of vasculature on all imaging modalities. 2. Incorporate assessment of vasculature in routine search pattern to avoid inattentional blindness. 3. Recognize urgent and unexpected vascular findings and review next steps to clinical management.

TABLE OF CONTENTS/OUTLINE

1. Normal vascular appearance and anatomy on CT, MR, and XR. 2. Significant vascular findings on routine musculoskeletal studies. a. Thromboembolic - fat embolism in popliteal vein (CT), deep venous thrombosis in popliteal vein (MR) b. Aneurysmal - mycotic aneurysm of the internal iliac artery (MR), aortic aneurysm with concern for active rupture (CT), splenic artery aneurysm (XR) c. Trauma - knee dislocation with popliteal artery transection (CT), cervical spine trauma with vertebral artery injury (CT) d. Anatomical variants - aberrant anterior tibial artery (MR) 3. Recommendations for follow-up imaging and diagnostic management.

MK340-ED-THA11

Anatomy of Bone Nutrient Vessels Related to Avascular Necrosis

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #11

Participants
Jun Isogai, MD, Asahi, Japan (*Presenter*) Nothing to Disclose
Naoki Harata, Asahi, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuya Yoshida, MD, Asahi, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Kaneko, Hasuda, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Toriihara, Asahi, Japan (*Abstract Co-Author*) Nothing to Disclose
Mitsue Miyazaki, PhD, La Jolla, CA (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation

TEACHING POINTS

To visualize typical extraosseous and intraosseous small blood supply of susceptible bones vulnerable to avascular necrosis (AVN) by use of non-enhanced or enhanced MR angiography and cone beam CT. To understand the unique anatomy of bone nutrient vessels related to posttraumatic and non-traumatic AVN.

TABLE OF CONTENTS/OUTLINE

Traumatic AVN related to small and few nutrient vessels Scaphoid and lunate bone enclosed in articular cartilage supplied by the radial carpal artery Talus bone without secondary blood supply related to tendon attachment supplied by the tarsal canal artery and deltoid vessels Femoral head supplied by the retinacular arteries in the femoral neck arisen from the medial circumflex femoral artery in flexed manner Vertebral body collapse in Kümmell disease Non-traumatic AVN related to intramedullary pressure increase of the long bone Blockage of a communication in blood vessels between the epiphysis and metaphysis by the epiphyseal line in early childhood Bone shaft nutrient vessels in the humerus, femur and tibia Knee condyle nutrient vessels related to fragility fractures

MK341-ED-THA7

Meniscal Ramp Lesion: A Hidden Injury and Its Importance

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #7

Participants
Lucas A. Mendes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Andressa A. Dal Maso, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Deivis S. Brito, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Guinel Hernandez Filho, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Igor P. Silva, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rafael B. Jorge, Paraiso, Brazil (*Abstract Co-Author*) Nothing to Disclose
Lucas N. Silva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

- Define and characterize the ramp lesions in epidemiological, anatomical and biomechanical terms- Demonstrate the image patterns in magnetic resonance imaging (MRI) and how the computerized arthrotomography can help in the diagnosis of doubtful cases- Discuss the situations that make difficult the diagnosis of ramp lesions and how this impacts the therapeutic decision

TABLE OF CONTENTS/OUTLINE

Definition of Ramp lesionEpidemiology and risk factorsAnatomical and biomechanical review - Structures that compose the posteromedial compartment of the knee - Relationship between anterior cruciate ligament rupture and mechanical overload of the posterior horn of the medial meniscus - Meniscal slopeCharacteristics in MRI and computerized arthrotomography of the knee, highlighting the role of this last method in visualizing lesions of difficult perception to MRICorrelate the findings in the imaging tests with the intraoperative diagnosisDiscussion of situations that may hinder the diagnosis of Ramp lesions - Time between injury and imaging tests - Relationship of knee positioning with extension in imaging tests and reduction of meniscocapsular separation - Vertical tear in the periphery of the posterior horn of the medial meniscusReview of treatments and how the absence of diagnosis will impact the therapeutic decisionConclusions

MK342-ED-THA8

Dancing Feet: Biomechanism and Imaging Findings of Foot and Ankle Musculoskeletal Injuries in Dancers

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #8

Participants
Stephanie Y. Ogata, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

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TEACHING POINTS

- Biomechanism of foot and ankle musculoskeletal injuries in dancers' practice. - Imaging findings of the most common and peculiar foot and ankle musculoskeletal injuries in professional and amateur dancers.

TABLE OF CONTENTS/OUTLINE

Dance is an art that combines athleticism with artistry. To meet the professional demands, dancers are subjected to strenuous training routines, which can lead to the development of injuries. Previous studies have reported injury incidence rates of 67% to 95% among professional ballet dancers and 17% to 24% in modern dancers. The foot and ankle of a dancer are particularly vulnerable to injury and represent 34% to 62% of all injuries reported. Although dancers develop overuse injuries common in other athletes, they are also susceptible to unique injuries. Our purpose is to review the biomechanism and imaging findings of common and peculiar foot and ankle injuries in professional and amateur dancers, with emphasis in information that influence treatment choice.

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MK373-SD-THA1

Evaluation of Clinical Assessments and MRI Findings that Suggest Surgical Treatment for Patients with Medial Epicondylitis: A Retrospective Study in a Single Institution

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #1

Participants
Hyungin Park, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate which MRI findings combined with clinical factors are characteristic of patients who undergo surgery for medial epicondylitis

METHOD AND MATERIALS

In our retrospective study, 52 consecutive patients (mean age, 53.7 years; age range, 27 - 77 years; 16 men, 36 women) were included, who diagnosed as medial epicondylitis and performed elbow MRI between March 2010 and December 2018. Demographic and clinical data (age, gender, sides, initial VAS, symptom duration and history of injection therapy) were reviewed on electronic medical records. And MRI findings associated with medial epicondylitis (common flexor tendon [CFT] abnormality, ulnar neuropathy, joint effusion, MCL tear, traction spur, muscle edema and subchondral bone edema) were evaluated and measured. All review and image evaluation was performed by a radiologist who was blinded to the demographic data and patient's ultimate treatment. Demographic and clinical data, MRI findings were compared between conservative treatment and surgical treatment groups, and logistic regression analyses were conducted to identify which was significantly associated with surgical treatment.

RESULTS

The CFT tear size showed statistically significant in both transverse and longitudinal planes ($P < 0.001$, $P = 0.013$, respectively) bewteen the two groups. The grade of CFT abnormality on both transverse and longitudinal planes showed significant differences ($P = 0.022$ and $P=0.003$, respectively). A significant difference was also found for MCL tear grade ($P = 0.025$). The logistic regression showed that only the transverse diameter of the CFT tear size ($P = 0.002$; odds ratio: 1.864; 95% confidence interval [CI]: 1.264 - 2.750) was correlated with surgical treatment.

CONCLUSION

Patients diagnosed as medial epicondylitis with larger CFT tear size tend to ultimately undergo surgical treatment. Radiologists should pay attention to CFT tear size when interpreting elbow MRI for adequate treatment planning.

CLINICAL RELEVANCE/APPLICATION

Earlier decision of surgical treatment for medial epicondylitis can help patients save both time and money because they can avoid having to first undergo conservative treatment, which delays surgery.

MK374-SD-THA2

Brachial Plexus MR-Neurography in Patients with Parsonage-Turner Syndrome

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #2

Participants
Nadia I. Stefanoff, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
Jairo Hernandez, MD, MS, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
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Fabio Barroso SR, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Claudia P. Cejas, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The diagnosis of Parsonage-Turner syndrome (PTS) is usually based on medical history, physical examination and electrodiagnostic tests. Recently ultrasound studies have identified reduced caliber in or terminal branches of the brachial plexus, this has been confirmed surgically in some cases with implication in prognosis and therapy.Our purpose is to analyze if this morphological change is correlated with the images of the neurography by MR (MRN).

METHOD AND MATERIALS

We retrospectively reviewed clinical information and MRN images of 17 patients with confirmed diagnosis of PTS, who presented at our institution over a 5-year period. MRN were analyzed by two radiologists with experience in this technique. All brachial plexus images were obtained using 3T MR scanner (Discovery 750; GE Healthcare, Madison, WI, USA) with 16-channel neurovascular coil using 2D IDEAL coronal T2-WI, 3D IDEAL coronal T1-WI, 3D FIESTA axial and DWI axial sequences.Pathological nerve was defined as: hyperintense signal on T2-weighted images and changes in the nerve thickness.

RESULTS

17 patients met the inclusion criteria, media age was 42 years +/- 16.7 with 6 females and 11 males; the time between the symptoms and MRN was 90.5 +/- 78.9 days (range 8 to 240 days).61.5% patients presented clinical symptoms in the right arm, 23% in the left arm, and 15.3% in both arms, however we founded bilateral pathological nerve at MRN in all patients. All of our patients have multifocal nerve involvement.We founded 4 types of nerve constrictions in our cohort patients type I: incomplete focal constriction, type II: complete focal constriction (hourglass-like), type III [multifocal constrictions (string of pearls like)], type IV (segmental constriction) (fig 1); Inter-observer agreement was almost perfect (Cohen's kappa = 0.87) between MRN readers for this nerve findings.

CONCLUSION

In our patients we found bilateral and multifocal nerve affection of brachial plexus in all patients and identified different types of constrictions; this findings suggest that MRN may play a role in distinguish PTS from others polyneuropathies.Additional prospective studies to assess the prognostic and therapeutic value of these findings are necessary.

CLINICAL RELEVANCE/APPLICATION

MRN may be used as a diagnostic aid in PTS, which was hitherto a clinical and electrophysiological diagnosis.Nerve constrictions in the MRN may be highly accurate in the diagnosis of PTS.

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MK375-SD-THA3

MRI-based Radiomics Signature: A Potential Imaging Biomarker for Prediction of Histologic Grade, Preoperative Prediction of Recurrence, and Prediction of Survival Outcome for Liposarcoma in Extremities

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #3

Participants
Joohee Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Young Han Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sungjun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyo Song Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop MRI-based radiomics signature and assess its ability for preoperatively predicting tumor histology grade of extremity, the recurrence, and survival outcome of extremity liposarcoma.

METHOD AND MATERIALS

Following institutional review board approval, the database of a hospital information system (HIS) was queried for lists of MRI examinations for liposarcoma in extremities. A total of 78 patients who underwent preoperative MRI for liposarcoma were enrolled in this retrospective study. 42 patients were enrolled for model development, and all the patients were followed up at least within 5 year. 36 were enrolled for validation. Radiomics features were extracted from T1-weighted image(T1w), T2-weighted image(T2w), and contrast-enhanced T1-weighted MR images(CE), and a radiomics signature was built by the least absolute shrinkage and selection operator (LASSO) logistic regression model. Liposarcoma histologic grade, recurrence, and overall survivals were evaluated in the radiomics features. T1w+T2w model and combined with CE model were built, and the area under the curve (AUC) of operating characteristics (ROC) was used to explore for model validation in the 36 patients validation set.

RESULTS

For recurrence prediction, 7 radiomics features for T1w, 7 for T2w, and 6 for enhanced T1w were chosen. For overall survival prediction, 5 radiomics features for T1w, 4 for T2w, and 4 for enhanced T1w were chosen. Five radiomics features for T1w, 7 for T2w, and 5 for enhanced T1w were chosen from 315 candidate features to build a radiomics signature that was significantly associated with tumor histology of low or high grades ($P < 0.001$), and they presented good performance in the discrimination of low- and high-grades liposarcoma with AUC of 0.667 (95% CI: 0.415-0.918) and 0.744 (95% CI: (0.559-0.929) in two models (with no significance), respectively.

CONCLUSION

The radiomics features of MRI were significant predictors for tumor histology grade, recurrence prediction, and overall survival in liposarcoma.

CLINICAL RELEVANCE/APPLICATION

The radiomics features of MRI were significant predictors for tumor histology grade, recurrence prediction, and overall survival in liposarcoma. Incorporating radiomics signature into conventional radiologic reading can perform better for preoperative estimation of prediction recurrence and overall survival than with radiologic findings alone.

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MK391-SD-THA4

Virtual Bone Mineral Density Imaging with Third-Generation Dual-Source Dual-Energy CT for Diagnosis of Osteoporosis: A Preliminary Study

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #4

FDA Discussions may include off-label uses.

Participants
Lin Wang, MD, Nantong, China (*Presenter*) Nothing to Disclose
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Junfeng Xu, Nantong, China (*Abstract Co-Author*) Nothing to Disclose
Yang Lin, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantitatively assess the diagnostic value of dual-energy computed tomography (DECT) virtual bone mineral density (VBD) imaging for osteoporosis (OP) in patients with vertebral trauma.

METHOD AND MATERIALS

Forty-five consecutive patients (14 male; mean age 66.3 ± 9.8 years) with vertebral trauma were prospectively enrolled and underwent non-enhanced DECT (90 kV/Sn150 kV). DXA examination of lumbar vertebrae from L1 to L4 was performed in each patient subsequently. VBD images were derived from a three-material decomposition algorithm using commercially available post-processing software (syngo via dual energy; Siemens Healthcare). CT attenuation value (VBD_Att), calcium density (VBD_CaD) and fat fraction (VBD_Fat) on VBD images were measured for further analysis. CT value on conventional linear-blended image (LB_0.5) was recorded as well. Bone mineral density (BMD) and T-scores of lumbar vertebrae measured with DXA served as the gold standard. Pearson correlation analysis was performed to compare the DECT and DXA results. Diagnostic performance of VBD imaging was assessed by receiver operating characteristic (ROC) analysis.

RESULTS

A total of 166 lumbar vertebrae were evaluated in the study. LB_0.5 and VBD_Att were both significantly different in vertebral body with and without osteoporosis (all P<.001) (Table 1). VBD_Fat had no significant difference between osteoporotic and non-osteoporotic vertebral bodies (P=0.62). VBD_Att (r=0.74) and VBD_CaD (r=0.70) were significantly correlated with T-scores obtained from DXA (all P<.001) (Fig 1). However, no significant correlation existed between VBD_Fat and DXA-measured T-scores (r=-0.14,P=0.08). Furthermore, sensitivity and specificity of VBD_Att and VBD_CaD for diagnosis of OP were 86.00%, 80.17% and 84.00%, 81.03% with cut off values of 239.5 HU and 10.9 mg/(cm*cm*cm), respectively (Table 2). The diagnostic efficiency was significantly higher with VBD_Att and VBD_CaD (AUC, 0.89 vs 0.88; P=0.57) compared to LB_0.5 (AUC, 0.77; all P<.001) (Fig 2). Figure 3 showed VBD image of a 66-year-old male patient. VBD_Att (236.2 HU), LB_0.5 (172.5 HU), VBD_CaD (10.8 mg/(cm*cm*cm)) and VBD_Fat (39.2%) were calculated with a freehand ROI set in a vertebral body.

CONCLUSION

Dual-energy VBD imaging shows reliable diagnostic performance for OP in patients with vertebral trauma.

CLINICAL RELEVANCE/APPLICATION

VBD imaging at DECT is useful for the diagnosis of OP in patients with vertebral trauma.

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MK392-SD-THA5

Reduction of Metal Artifacts From after 3D Printed Patient-Specific Hip Arthroplasty for the Treatment of Bone and Soft Tissues Malignant Tumors in Computer Tomography: Value of Virtual Monochromatic Spectral and Metal Artifacts Reduction Software

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #5

Participants
Tingni Song, Chengdu , China (*Presenter*) Nothing to Disclose
Zhenlin Li, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To determine the feasibility of using Virtual Monochromatic Spectral (VMS) images in dual-energy spectral imaging and Metal Artifact Reduction (MAR) software in patients with 3D printed patient-specific hip arthroplasty for the treatment of bone and soft tissues malignant tumors.

METHOD AND MATERIALS

30 consecutive patients 3D printed patient-specific hip arthroplasty for the treatment of bone and soft tissues malignant tumors were prospectively scanned by fast kV-switching GSI between 80 and 140 kVp. Data sets were reconstructed with monochromatic energy (110keV), the 110keV with MAR, and only 140kVp image. The CT attenuation and image noise of the muscle tissue attached the affected femoral head were measured. Two blinded, independent readers evaluated axial and coronal CT reformations and 3D VR for the bladder wall, pelvic sidewall, bone-prosthesis interface and the overall diagnostic image quality, and the subjective scores were assessed with a 5-point scale system. Artifact reduction at 3 anatomical levels (femoral head, neck, and shaft) were evaluated,

RESULTS

Measurements of CT attenuation of muscle were more accurate for MAR and 110 keV+MAR when compared with 140 kVp ($p<0.05$). The image noise of 110 keV+MAR was significantly lower. The subjective scores of 110 keV+MAR was significantly higher than 110 keV and 140 kVp ($p<0.05$). VMS and MAR could reduce metal artifacts at all 3 levels (femoral head, neck, and shaft) ($p< 0.05$).

CONCLUSION

The VMS images with MAR showed very clear and reproducible boundaries with minimal noise surrounding the metal phantoms. VMS combining with MAR software can improve the image quality, display the metal hip joint and surrounding tissue clearly.

CLINICAL RELEVANCE/APPLICATION

VMS combining with MAR software could serve as a choice to evaluate after 3D printed patient-specific hip arthroplasty for the treatment of bone and soft tissues malignant tumors.

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MK393-SD-THA6

Real-Time Identification of Key Anatomical Features for Ultrasound-Guided Regional Anesthesia

Thursday, Dec. 5 12:15PM - 12:45PM Room: MK Community, Learning Center Station #6

Participants
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Nicholas Sleep, Cardiff, United Kingdom (*Abstract Co-Author*) Employee, Intelligent Ultrasound Ltd
Rob Evans, Cardiff, United Kingdom (*Abstract Co-Author*) Employee, Intelligent Ultrasound Ltd
Richard L. Davies, BSC, Cardiff, United Kingdom (*Abstract Co-Author*) Employee, Intelligent Ultrasound Ltd
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David Burckett-St.Laurent, MBBS, Newport, United Kingdom (*Abstract Co-Author*) Employee, Intelligent Ultrasound Ltd

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PURPOSE

Ultrasound-guided regional anaesthesia (UGRA) is a cognitively demanding procedure that requires a clinician to guide a needle to a target nerve to deliver anaesthetic. In this study, we investigate a real-time AI helper for UGRA. We show that an AI algorithm can be taught to recognise key anatomical features for the subsartorial femoral triangle block (also known as the adductor canal block). This potentially reduces the cognitive load of the clinician, simplifying the procedure and improving operator confidence.

METHOD AND MATERIALS

The selected block area on 84 healthy volunteers was scanned by a sonographer. Anonymised ultrasound video was recorded, resulting in 150,017 distinct images. These images were segmented by hand to identify the following key anatomical features: Subsartorial nerve complex, Femoral artery, Sartorius muscle, Adductor longus muscle and Femur bone. Data from 5 volunteers (9,745 images) were sequestered for validation. The remaining 140,272 images were used to train a deep-learning semantic segmentation model. The model was run on the validation set and the outputs used to highlight the original B-mode videos. These were validated by 1) clinical assessment by a consultant anaesthetist and 2) computation of mean pixel accuracy.

RESULTS

1) No clinically significant segmentation errors were found. 2) The model achieved the following mean-pixel accuracy scores on the validation data: Subsartorial nerve complex: 0.998 Femoral artery: 0.996 Sartorius muscle: 0.983 Adductor longus muscle: 0.971 Femur bone: 0.995 Figure 1 shows predicted segmentation on images from the validation set, where each row contains the original ultrasound image, the ground-truth segmentation and the predicted segmentation.

CONCLUSION

Our proof-of-principle shows that an AI algorithm can accurately highlight key anatomical features on an ultrasound image in real time, and that this produces clinically useful results. We believe this would be particularly useful to trainees or other clinicians who do not perform UGRA regularly. Future research will look to extend the model to other block regions, and to quantify the benefits of real-time anatomical feature display in clinical practice.

CLINICAL RELEVANCE/APPLICATION

A trained AI algorithm accurately highlights key anatomical features for ultrasound-guided regional anaesthesia, producing visually accurate and useful results.

Printed on: 10/29/20

MS228-ED-THA1

Contrast Enhanced Ultrasound: An Overview of Technique and Utility

Thursday, Dec. 5 12:15PM - 12:45PM Room: MS Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Participants
Gibran Yusuf, MBBS, London, United Kingdom (*Presenter*) Speaker, Bracco Group; Speaker, Siemens AG
Cheng Fang, MBBS,FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Stefanidis, MD, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Annamaria Deganello, MD, London, United Kingdom (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, Koninklijke Philips NV
Maria E. Sellars, MD, FRCR, London, United Kingdom (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, Samsung Electronics Co, Ltd
Dean Y. Huang, FRCR, 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; Speaker, Samsung Electronics Co, Ltd; Advisory Board, Samsung Electronics Co, Ltd; Advisory Board, Itreas Ltd

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TEACHING POINTS

Contrast Enhanced ultrasound is rapidly becoming an extension of traditional ultrasound, providing real time vascular phase imaging without radiation. CEUS is well recognised and FDA approved for hepatic use but has a range of utility in adults and childrenThis exhibit will aim to:Explain the premise of CEUS, how to perform it and guidelines for useDemonstrate the utility of CEUS in a clinical setting for both intravascular and intracavitary use.Provide pearls and pitfalls in conducting CEUS to optimise technique.

TABLE OF CONTENTS/OUTLINE

1) Objectives2) Physics & Safety - how CEUS works3) Technique - how to perform CEUS4) Guidelines - recommendations for CEUS5) Utilitya. Hepatobiliary - characterization of hepatobiliary lesionsb. Renal - identifying renal pseudotumours, cyst characterization and identifying infarctionc. Testicular - distinguishing malignant and benign intratesticular lesionsd. Vascular - assessment of peripheral and central vasculature including post EVARe. Pediatric - utilities in children and alteration to techniquef. Intracavity - assessing patency of tubes and physiological/non physiological cavitiesg. Intervention - how CEUS can guide intervention and reduce riskh. Miscellaneous - further utilities6) Pearls and Pitfalls - tips and tricks to optimise CEUS examinations

NM139-ED-THA6

How We Do It: A Multidisciplinary Approach to Lu- 177 Dotatate PRRT (Peptide Receptor Radionuclide Therapy)

Thursday, Dec. 5 12:15PM - 12:45PM Room: NM Community, Learning Center Station #6

Participants
Brian J. Burkett, MD , Rochester, MN (*Presenter*) Nothing to Disclose
Ayca Dundar, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jason Young, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ann Packard, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Pfizer Inc
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TEACHING POINTS

1. Introduce strategies to implement a formal, multidisciplinary approach to successfully and safely administering lutetium Lu-177 dotatate peptide receptor radionuclide therapy (PRRT) 2. Evaluate how to select appropriate patients for Lu-177 dotatate including evaluating prior imaging, prior therapies, hepatic and renal function, along with involving additional medical specialties such as nephrologists, as needed 3. Illustrate several examples of how to approach challenging scenarios while selecting patients for PRRT 4. Gain familiarity with typical and unusual imaging presentations related to PRRT

TABLE OF CONTENTS/OUTLINE

A. Introduction to Lu-177 dotatate: • Mechanism of action • NETTER-1 trial • FDA approval B. Workflow and approval for Lu-177 dotatate therapy: • Role of our Advanced Practice Provider • Initial ordering, approval, and patient selection for multidisciplinary discussion • Description of our multidisciplinary nuclear therapy tumor board, emphasizing factors of the neuroendocrine tumor histopathology, imaging features, patient prognosis, functional status, and systemic medical conditions C. Implementing therapy: • Preparing patients for treatment (paperwork provided to patients) • Nuclear Medicine Consultation • Review of Imaging • Day of therapy D. Challenging cases, presented in the format of a multidisciplinary conference discussion

NM140-ED-THA7

Tc-99m MAG3 Renogram is a Useful Non-Invasive Diagnostic Tool to Evaluate Renal Function After Carbon-Ion Radiotherapy (CIRT) in Patients with Renal Cell Carcinoma

Thursday, Dec. 5 12:15PM - 12:45PM Room: NM Community, Learning Center Station #7

Participants
Ryuichi Nishii, MD, PhD, Chiba-pref. , Japan (*Presenter*) Nothing to Disclose
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Tatsuya Higashi, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) 99mTc-MAG3 renogram is a useful non-invasive diagnostic tool to evaluate renal function after CIRT in patients with renal cell carcinoma, especially for the assessment of split renal function.2) With 99mTc-MAG3 renogram, it is possible to detect renal function deterioration of non-irradiated renal parenchyma.3) Serial assessment of renal function by measuring tubular extraction with 99mTc-MAG3 might permit earlier and more sensitive detection of renal damage after CIRT.

TABLE OF CONTENTS/OUTLINE

Background# Contents- Renogram before and after CIRT for RCC.- Renogram; Pre-, 3-6 months and 12-18 months after CIRT with comparison National Cancer Institute's Common Terminology Criteria for Adverse Events (CTCAE) version 4.0 as adverse event evaluation.- Relationship between total cERPF and eGFR# Case presentation, - Case: T1aN0M0, 66Gy/12Fr., Comorbidity: none- Case: T1bN0M0, 66Gy/12Fr., Comorbidity: none- Case: T1bN0M0, 66Gy/12Fr., Cerebrovascular disease- Case: T1aN0M0, 72Gy/12Fr., Cerebrovascular disease- Case: T1aN0M0, 72Gy/12Fr., Diabetic nephropathy- Case: T3aN0M0, 72Gy/12Fr., Diabetic nephropathy# Summary

NM224-SD-THA1

Association between 18F-fluoromisonidazole Uptake Heterogeneity and Isocitrate Dehydrogenase 1 Mutation in Patients with Newly Diagnosed High-Grade Gliomas

Thursday, Dec. 5 12:15PM - 12:45PM Room: NM Community, Learning Center Station #1

Participants
Yuka Yamamoto, MD, PhD, Kita-Gun, Japan (*Presenter*) Nothing to Disclose
Kengo Fujimoto, Kitagun, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuya Mitamura, Kita, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Norikane, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Beyond tumor histology, molecular alterations, such as isocitrate dehydrogenase enzyme isoforms 1 (IDH1) and 2 (IDH2) mutation as part of the 2016 world health organization classification of tumors of the central nervous system have been found to provide additional prognostic value in gliomas. The purpose of this study was to evaluate association between 18F-fluoromisonidazole (FMISO) uptake heterogeneity using texture indices and IDH1 mutation status in patients with newly diagnosed high-grade gliomas.

METHOD AND MATERIALS

FMISO PET/CT was investigated in 38 patients with newly diagnosed high-grade gliomas. Tumor lesions were identified as areas of focally increased uptake, exceeding that of background uptake. For semi-quantitative analysis, the maximal standardized uptake value (SUVmax) and 6 texture indices (homogeneity, entropy, short-run emphasis, long-run emphasis, high-gray-level-zone emphasis, and low-gray-level-zone emphasis) were measured. The presence of IDH1 mutation in tumor specimens was examined by immunohistochemistry and compared with PET parameters.

RESULTS

All high-grade gliomas showed hypoxia on FMISO PET/CT. The value of SUVmax ($p<0.02$) and 5 of 6 texture indices [homogeneity ($p<0.02$), short-run emphasis ($p<0.003$), long-run emphasis ($p<0.002$), high-gray-level-zone emphasis ($p<0.03$), and low-gray-level-zone emphasis ($p<0.02$)] significantly differed between IDH1-mutated tumors and IDH1-nonmutated tumors.

CONCLUSION

These preliminary results indicate that FMISO PET parameters including texture indices seem to be useful for assessment of IDH1 mutation status in patients with newly diagnosed high-grade gliomas.

CLINICAL RELEVANCE/APPLICATION

FMISO PET parameters including texture indices seem to be useful for assessment of IDH1 mutation status in patients with newly diagnosed high-grade gliomas.

NM225-SD-THA2

The New Perspective of PET/CT for Axillary Node Staging in Breast Cancer Patients According to ACOSOG Z0011 Trial

Thursday, Dec. 5 12:15PM - 12:45PM Room: NM Community, Learning Center Station #2

Participants
Eun-Jung Kong, MD, Daegu, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jungeun Choi, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

According to the results of the ACOSOG Z0011 trial, the use of sentinel lymph node (SLN) dissection alone did not result in inferior survival compared with axillary lymph node dissection (ALND) in patients with limited SLN disease treated with breast-conserving surgery (BCS). We investigated the diagnostic performance of FDG PET/CT with respect to negative or 1-2 ALN metastasis from 3 or more.

METHOD AND MATERIALS

We retrospectively analyzed preoperative contrast enhanced PET/CT images taken from Jan 2010 to June 2012. The patients had cT1-2 primary invasive breast cancer without palpable adenopathy and underwent BCS with ALND within 2 weeks from the scan. We excluded the patients with neoadjuvant chemotherapy or distant metastasis. We counted the number of suspicious LN, considering FDG avidity with morphologic change; Image analysis was as follows: FDG PET evaluation for any focal hypermetabolism, then a morphologic evaluation was done. Images were considered positive if areas in the axillary basin took up more FDG than background. The criteria for abnormal LN on CT included a round/ovoid, or cortical thickening with enhancement. The sizes of the LNs did not enter the PET/CT finding criteria. We compared our PET/CT results with histology reports.

RESULTS

222 women (26-75 y-o) with 225 axilla (3 bilateral) were enrolled and their tumor size was 1.66 ± 0.72 cm. 214 cases had limited metastasis (0 - 2), and 11 had extended metastasis (3 or more). 23 women had recurrence during follow up period. The mean tumor size was 1.64 cm in limited (L)group and 2.19 cm in extended (E)group ($p = 0.056$). The mean SUVmax for tumor was 5.16 in L group and 7.16 in E group ($p = 0.073$). The sensitivity, specificity, NPV and PPV of PET/CT for extended metastasis was 72.7%, 100 %, 100% and 98.6% respectively. Regarding 3 false negative patients, 7.2 in tumor SUVmax and 2.4 cm in tumor size. Regarding 23 recurred patients, 7.56 in tumor SUVmax and 1.95 cm in tumor size, they had higher SUVmax and larger tumor size than those who did not ($p=0.005$ and $p=0.046$).

CONCLUSION

Preoperative PET/CT scan predict 3 or more positive ALN metastasis with high specificity and have evolving role to treat plan in patients with clinical T1-2 IDC and no palpable adenopathy.

CLINICAL RELEVANCE/APPLICATION

FDG PET/CT in detecting 3 or more positive axillary LN metastasis has high specificity and is recommended in the initial evaluation to surgical plan.

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NM226-SD-THA3

Multi-Molecular Probe-Based Micro PET Imaging Combined with Tumor Markers in Predicting Colorectal Cancer Liver Metastasis

Thursday, Dec. 5 12:15PM - 12:45PM Room: NM Community, Learning Center Station #3

Participants
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Huijie Jiang, PhD, MS, Harbin, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

This study aimed to explore the application of 3′-deoxy-3′-18F-fiuorothymidine (FLT) and 18F-fluoromisonidazole (FMISO) union imaging combined with tumor metastasis-related biomarkers to predict a liver metastasis for colorectal cancer (CRC).

METHOD AND MATERIALS

Radiotracer-based cellular uptake in vitro were performed anterior to Micro-PET imaging. Mouse models of CRC hepatic metastases were established by implantation of human CRC cell lines LoVo and HT29 via intrasplenic injection. Tumor-bearing mouse models were established by subcutaneously injecting LoVo and HT29 cells. Radiotracer-based micro-positron emission tomography imaging of liver metastasis and tumor-bearing mice was performed and the cellular levels of each tracer in the tumor tissues were quantified as tumor to liver maximum standardized uptake ratio values (T/L SUVmax ratio). Pearson correlation coefficient were used to analyze the relationship between tumor markers (hypoxia inducible factor 1 alpha (HIF-1a) and proliferating cell nuclear antigen (Ki67) and radioactive parameters.

RESULTS

The incidence of liver metastases in LoVo-xenografted mice was significantly higher than that in HT29-xenografted ones. Both the SUVmax ratio values of 18F-FMISO and 18F-FLT in LoVo xenografts were significantly greater than those in HT29 ones. The areas of tumor hypoxia and reproductive can be reflected in tumor-bearing models. For in vitro study, LoVo cells exhibited a stronger metastatic potential and a higher radiotracer uptake ability than HT29 cells. Mechanistically, the expression of Ki67 and HIF-1a in LoVo cells and LoVo tumor tissues was remarkably higher than those in HT29 cells and tissues. Pearson correlation coefficient demonstrated significant correlations between cellular 18F-FLT/18F-FMISO uptake and Ki67/ HIF-1a expression in vitro, as well as between 18F-FMISO SUVmax ratio and HIF-1a expression in vivo.

CONCLUSION

The union imaging of 18F-FLT and 18F-FMISO PET can better reflect the different biological behavior of CRC. 18F-FLT and 18F-FMISO union SUVmax ratio parameter may be used as a promising predictive biomarker for CRC hepatic metastases.

CLINICAL RELEVANCE/APPLICATION

18F-FLT and 18F-FMISO union SUVmax ratio parameter may be used as a promising predictive biomarker for CRC hepatic metastases.

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NM236-SD-THA4

Prediction of Therapy Response in Soft Tissue Sarcoma Based on Multi-Dimensional PET/MRI

Thursday, Dec. 5 12:15PM - 12:45PM Room: NM Community, Learning Center Station #4

Participants
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Ken Herrmann, Essen, Germany (*Abstract Co-Author*) Co-founder, SurgicEye GmbH Stockholder, SurgicEye GmbH Consultant, Sofie Biosciences Consultant, Ipsen SA Consultant, Siemens AG Research Grant, Advanced Accelerator Applications SA Research Grant, Ipsen SA
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PURPOSE

To assess the clinical applicability of simultaneously acquired PET- and MR-derived quantitative imaging parameters for response assessment of patients with soft tissue sarcomas (STS) under neoadjuvant isolated limb perfusion (ILP).

METHOD AND MATERIALS

A total of 45 patients with confirmation of an STS manifestation underwent a 18F-FDG PET/MR examination before and after ILP, followed by tumor resection. For each patient, the maximum tumor size, contrast-enhancement of solid tumor parts and the SUVpeak in pre- and posttherapeutic examinations were measured and changes during treatment were calculated. ROC analysis was performed and the AUC values as well as the optimal threshold for percentage changes were calculated to predict treatment response under ILP. A combined score was used and relative changes as well as all interactions were computed by a LASSO regression. Histopathological results served as the reference standard and patients were classified as responder/non-responder according to the grading scale by Salzer-Kuntschik.

RESULTS

A total of 27 patients were categorized as histopathological responder and revealed a mean reduction in tumor size of -8.4%, contrast-enhancing solid tumor parts of -33.2% and the SUVpeak of -58.7%, respectively. Patients classified as non-responder (n=18) showed a lower decrease of the quantitative parameters (mean reduction: -6.9%, -23.3% and -20.1%). ROC analysis revealed an optimal threshold for percentage changes of the quantitative variables under ILP of -7.2% (AUC: 0.59) for the maximal tumor diameter, -26.0% (AUC: 0.60) for contrast-enhancement of the tumors and -34.3% (AUC: 0.82) for the SUVpeak. The combined regression model showed a significantly higher AUC value (0.90) than for tumor diameter and contrast-enhancement (p-values: <0.001), whereas, differences to the results of SUVpeak did not reach the significance level (p-value: 0.067).

CONCLUSION

Our study demonstrates the superiority of 18F-FDG PET over MR-datasets for response assessment of STS under neoadjuvant ILP. However, combining the information of 18F-FDG PET/ MR-derived imaging parameters shows a tendency to enable a more accurate prediction of histopathological tumor response.

CLINICAL RELEVANCE/APPLICATION

Considering the valuable information of MRI for presurgical assessment, integrated PET/MRI could serve as a valuable tool for pretherapeutic evaluation as well as monitoring of neoadjuvant treatment strategies of STS.

NR358-ED-THA7

Optimizing Collateral Evaluation and Distal Vessel Occlusion Detection in Acute Stroke with Colorized Multiphase CTA Summation Maps

Thursday, Dec. 5 12:15PM - 12:45PM Room: NR Community, Learning Center Station #7

Participants
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Nima Razaghi Kashani, MD, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose
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Bijoy Menon, MBBS, MD, Calgary, AB (*Abstract Co-Author*) Grant, Medtronic plc

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TEACHING POINTS

Colorized mCTA summation maps are a new display format that provide a "time resolved vasculature map" of the cerebral vasculature. This exhibit points out advantages of this display format and illustrates its various applications in acute stroke imaging.

TABLE OF CONTENTS/OUTLINE

Colorized mCTA summation maps are derived from standard multiphase CTA series and simultaneously display all mCTA phases in one color-coded time-resolved map. Vessels are displayed in red (early arterial filling), green (intermediate) and blue (late filling).Advantages: Standard CTA technique - no need for extra equipment or contrast volume, all information merged into one series, ability to quantitate collateral status, only minimal additional radiation compared to single phase CTA, facilitated detection of distal and posterior circulation occlusions and multiple clots in the same territory, assessment of thrombus length and perviousness.Practical applications: 1) Assessment of collateral flow dynamics (fig1) 2) Distal occlusion detection in the anterior and posterior circulation (fig2) 3) Detection of multiple clots in the same vascular territory (fig3) 4) Distinguishing pseudo-occlusions from real occlusions (fig4) 5) Identifying ante- and retrograde flow patterns (fig5) 5) Accurate assessment of thrombus length and clot perviousness (fig5)

NR359-ED-THA8

Refreshing Middle Cerebral Artery Anatomy in Stroke thrombectomy Era: A CT-Angiography and Perfusion-CT Radiologic Tool

Thursday, Dec. 5 12:15PM - 12:45PM Room: NR Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
Santiago Medrano, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Maria Pumar, MBBS, Barcelona, Spain (*Presenter*) Nothing to Disclose
Laia P. Desmeules, MBBS, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Sofia Gonzalez-Ortiz, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

• To review the segments and cortical branches of the Middle Cerebral Artery (MCA), with its anatomic limits, as well as to recognize the most common branching patterns and anatomical variants. • To provide an easy tool for emergency radiologists facing acute ischemic strokes to precisely localize and name the occluded cortical branch, which will help thrombectomy planning. It is based on perfusion maps and its correlation with the Angio-CT and digital angiography findings.

TABLE OF CONTENTS/OUTLINE

• Introducing the importance of precisely localizing the cortical branch occluded due to Thrombectomy era in Acute Ischemic Stroke (2018 Guidelines) • Anatomical illustration of MCA segments and its correlation with Angio-CT • Anatomical variants of MCA • Territorial illustration of MCA cortical branches and its correlation with perfusion maps and Angio-CT • Illustrative cases • Summary chart

NR360-ED-THA9

Neurologic Complications in Patients with Hematologic Malignancies: A Review of Imaging Findings

Thursday, Dec. 5 12:15PM - 12:45PM Room: NR Community, Learning Center Station #9

Participants
Paul S. Sander, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

a. List the three different ways neurologic complications occur in patients with hematologic malignancies (primary disease, effects of treatment, and immunosuppression/infection) b. Explain how both the disease and the treatment can increase the risk of neurologic complications c. Identify the imaging features and differential diagnosis for various neurologic complications

TABLE OF CONTENTS/OUTLINE

1. Introduction - Epidemiology - Basics of stem cell transplantation 2. Imaging findings and treatment of neurologic complications a. Tumor related - CNS involvement - Tumor-related infarcts b. Infection - Virus (PML, HHV6, CMV, VZV) - Fungal (Mucor, Aspergillus) c. Therapy related - Methotrexate - PRES (calcineurin inhibitor) - Dural Sinus Thrombosis (L-Asparaginase) - All-trans retinoic acid induced intracranial hypertension - Lumbar puncture related intracranial hypotension d. Coagulopathy related hemorrhage e. Metabolic - Osmotic myelinolysis - Wernicke's encephalopathy Summary A substantial number of patients with hematologic malignancies have neurologic complications due to the primary disease, treatment, and associated immunosuppression. Making the correct diagnosis is crucial, as delayed treatment may render a reversible condition irreversible.

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NR388-SD-THA1

Reliability of Functional Neuroimaging for Prediction of Eloquent Brain Function as Determined by Intraoperative Mapping in Brain Tumor Patients

Thursday, Dec. 5 12:15PM - 12:45PM Room: NR Community, Learning Center Station #1

Participants
David Ellis, MSc, Omaha, NE (*Presenter*) Nothing to Disclose
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PURPOSE

Accurate identification of areas of eloquent brain function is critical to reduction in patient morbidity during resection of a brain tumor. Functional neuroimaging provides a means of assessing proximity of eloquent function to a brain tumor. The presence of the pathology can affect accuracy. Our aim was to evaluate the benefits of performing MEG in addition to fMRI for presurgical localization of eloquent function as well as determine the optimal distances to maximize functional mapping accuracy in brain tumor patients.

METHOD AND MATERIALS

The eloquent function of 22 subjects was mapped prior to tumor resection with either fMRI, MEG, or both. The mapping results were then validated using direct cortical stimulation (DCS) mapping performed immediately after craniotomy and prior to resection. The subset of patients with equivalent MEG and fMRI tasks performed for motor (n=12) and language (n=8) were evaluated as both individual and combined predictions. Furthermore, the distance resulting in the maximum accuracy, as evaluated by Youden's J statistic, was determined by plotting the sensitivities and specificities for the entire cohort (n=22) against a linearly increasing distance threshold.

RESULTS

MEG mapping resulted in greater specificity compared to fMRI for both motor ($p<0.0001$) and language ($p<0.05$) detection. Combining MEG and fMRI using an either positive approach significantly improved the likelihood ratios over fMRI for both motor and language analysis ($p<0.05$). MEG showed a maximum combination of sensitivity and specificity at 26mm for motor and 20mm for language mapping. Functional MRI showed a maximum accuracy at 6mm for both motor and language mapping.

CONCLUSION

Using MEG in addition to fMRI for preoperative localization of eloquent function in brain tumor patients enhances accuracy. This study also illustrates that the distances used when evaluating mapping accuracy have a large effect on the resulting sensitivity and specificity and suggests that MEG and fMRI should be evaluated with distinct considerations for distance.

CLINICAL RELEVANCE/APPLICATION

Functional mapping accuracy for brain tumor patients can be improved by combining MEG and fMRI results.

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NR390-SD-THA3

A Study on the Computer-Assisted Diagnosis with Deep Learning Architecture (CADDELAC) for the Detection of Brain Metastases

Thursday, Dec. 5 12:15PM - 12:45PM Room: NR Community, Learning Center Station #3

Participants
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PURPOSE

To evaluate deep-convolutional-neural-network programs (DCNNs) using postcontrast-3-dimension-T1-weighted MR images for brain metastases.

METHOD AND MATERIALS

We investigated two DCNNs, AlexNet and GoogLeNet, using positive 3,117 images with metastases and negative 37,961 images without in regard to the following issues; (1) accuracy errors; K-fold-cross-validation tests (K-CVs) with K ranging 3-20 using a pair of negative 1,558 images, (2) K values of K-CV; K-CVs with K ranging 3-20 for positive 3,117 and negative 3,117 images, (3) positive-negative sample ratio; 10-CVs for negative-positive image ratio ranging 1/4 to 10-times of 3,117 images, and (4) learning curves; 10-CVs for equal-sized positive and negative images with ranging 500-2,495 images each.

RESULTS

Respectively, AlexNet and GoogLeNet had (1) 4.6% and 4.9% of the maximal mean±95%confidence-intervals (95%CIs) measured with equal-sized negative-negative and positive-positive image datasets, (2) 74% of the highest accuracy with equal positive-negative image ratio dataset and 91% of that with 4-times of negative to positive image ratio dataset, (3) no less than 10 and 4 of K values in K-CVs fell within the respective maximum biases of 4.6% or 4.9%, and (4) learning curves increasing from 69% to 74% and 73% to 88% as the image number increased.

CONCLUSION

Accuracy errors, K values of K-CV, positive-negative sample ratio, and learning curves should be considered when DCNNs were used.

CLINICAL RELEVANCE/APPLICATION

Our research presented methodological fundamentals to evaluate diagnostic features in the visual recognition of DCNNs. Our series will help to conduct the accuracy investigation of computer diagnosis in medical imaging.

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NR412-SD-THA4

Increase in Cerebral Blood Flow after a Single Hypoxic Hypobaric Exposure

Thursday, Dec. 5 12:15PM - 12:45PM Room: NR Community, Learning Center Station #4

Participants
Paul M. Sherman, MD, Boerne, TX (*Presenter*) Nothing to Disclose
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Bianca Cerqueira, PhD, Joint Base San Antonio - Lackland, TX (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Occupational exposure to hypobaria (high altitude) is associated with reduced white matter integrity, increased hyperintensive lesion burden, and decline in cognitive function. Pathophysiological mechanisms underlying these changes are unknown but may involve an inflammatory response triggered by the presence of microbubbles/particles in blood/tissue or perturbations in cerebral blood flow. The objective of this study was to utilize perfusion-MRI to investigate if a single hypoxic hypobaric exposure (standard USAF altitude chamber training protocol) induces alterations in cerebral blood flow.

METHOD AND MATERIALS

Healthy aircrew undergoing standard U.S. Air Force altitude chamber training (AFC, n=117) were compared to active duty controls who were not exposed to hypobaria (NOR, n=67). Study participants underwent sequential MRI using a pseudocontinuous arterial spin labeling (pcASL) imaging sequence to quantify CBF at baseline (one day prior to training), 24 hours after hypobaric chamber training, and 72 hours after training. CBF was quantified in ml/g/min using the ASLtbx with SPM8.

RESULTS

Altitude chamber trainees had a significant increase in white matter CBF 24 hours after experiencing hypoxic hypobaria (AFC: 7.65 ☐ 1.61 ml/g/min, NOR: 7.13 ☐ 1.64 ml/g/min, p=0.04). At 72 hours, chamber trainee white matter CBF was higher than controls (AFC: 7.72 ☐ 1.61 ml/g/min, NOR: 7.25 ☐ 1.50 ml/g/min, p=0.06). No differences between the two groups at any time point were found for gray matter CBF.

CONCLUSION

Our findings suggest that a single hypoxic hypobaric exposure may provide a model to study alterations in CBF that may be associated with occupational hypobaric exposure.

CLINICAL RELEVANCE/APPLICATION

Understanding the effects of a single exposure to high altitude upon the brain may lead to understanding the neuropathological etiology of reduced white matter integrity seen in those exposed to repeated hypobaria.

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NR413-SD-THA5

Deep Learning-Enabled Acceleration for Multi-Contrast High-Resolution Intracranial Vessel Wall Imaging with 40x Reconstruction Speedup

Thursday, Dec. 5 12:15PM - 12:45PM Room: NR Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Multi-contrast isotropic high-resolution intracranial vessel wall imaging (VWI) is a valuable imaging tool to provide detection and follow-up monitoring of intracranial vessel wall pathologies. For clinical adoption, the acceleration of scanning time for high-resolution VWI is important, which can be partially addressed by random-undersampling but the existing reconstruction process available is too time-consuming. The goal of this work is to use AI/DL to improve both reconstruction accuracy and efficiency to benefit real clinical usage of VWI.

METHOD AND MATERIALS

Deep Learning: A 20-layer ResNet based model is trained to reconstruct the undersample image into ground-truth fully-sample images as shown in subfigure a). Data and Experiments: The multi-contrast intracranial VWI datasets including PD, pre- and post-contrast T1 weighted 3D volumetric isotropic turbo spin echo acquisition (VISTA) scans were acquired on a Philips Ingenia 3.0T MR scanner using 32-channel head coil with FOV=180mmx180mmx45mm, isotropic 0.5mm resolution, NSA=2, x4(PD)/x4.5(T1) variable density random undersampling. 13 cases were exploited for training and validation with 3 cases for testing. Further evaluation of 60 cases was conducted.

RESULTS

For the testing cases, it shows good pixel-correlation-coefficient (ρ=0.9911) and RMSE (12.86%, fig.b) between reference STEP slow reconstruction and the proposed method, indicating a reasonable generalization capability of the method across contrasts. The image quality of the proposed method provides comparable/improved delineation of vessel wall boundaries in comparison to STEP method, and the plaques can be clearly identified on all contrasts (fig.c). Critically, the average 3D volume reconstruction is reduced from ~20mins using STEP to ~30secs.

CONCLUSION

Deep Learning can enables significant time reduction (x40) for multi-contrast high-res intracranial VWI reconstruction while preserving details, providing comparable/improved quality for wall delineation and plaque visualization.

CLINICAL RELEVANCE/APPLICATION

It has the potential to achieve further improved image quality by considering the multi-channel signal encoding model and enable the whole brain coverage with the reasonably clinical acquisition and reconstruction time. This highly accelerated image reconstruction method provides a promising solution to promote the clinical translation of multi-contrast intracranial VWI for intracranial stroke evaluation.

OB187-ED-THA2

Diagnosis and Characterization of Female Pelvic Floor Dysfunction: Ultrasound Takes the Challenge

Thursday, Dec. 5 12:15PM - 12:45PM Room: OB Community, Learning Center Station #2

Participants
Maria Pilar Aparisi Gomez, FRANZCR,MBChB, Auckland, New Zealand (*Presenter*) Nothing to Disclose
Sheryl Watkin, Auckland, New Zealand (*Abstract Co-Author*) Nothing to Disclose
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Helen M. Moore, MBChB, FRANZCR, Auckland, New Zealand (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Become familiar with the indications and technique for pelvic floor assessment with ultrasound.Recognize the appearances of normal anatomy and funcionality of pelvic floor structures and some of the most common pathological findings Understand the role of ultrasound in the evaluation of postsurgical appearances,.

TABLE OF CONTENTS/OUTLINE

The wide availability and development of imaging techniques has provided new horizons for the diagnosis in female urogynecology. MR is a technique with exceptional spatial resolution and high sensitivity for the detection of soft tissue abnormalities, but presents the important limitation of cost and complexity, and is more frequently used as a static method of assessment. Ultrasound is universally available and offers the possibility of real time observation of maneouvres such as Valsalva and pelvic floor contraction, which aid in the visualisation of structures and help to uncover defects. 3D and 4D ultrasound allow axial plane reconstruction, and therefore assessment of the levator hiatus. The transperineal approach is favoured, due to the absence of distortion.Ultrasound presents the great advantage of being a superb tool for identification, evaluation of placement and functional assessment of surgical tapes and meshes, because of their physical properties, significantly superior in its performance to MR.

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PD184-ED-THA7

Evaluating the Feasibility of ACR-TIRADS Classification System for Pediatric Thyroid Nodules

Thursday, Dec. 5 12:15PM - 12:45PM Room: PD Community, Learning Center Station #7

Participants
Larissa de Andrade Defendi, MD, Sao Paulo , Brazil (*Presenter*) Nothing to Disclose
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Yoshino T. Sameshima, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

The ACR TI-RADS classification seems to discriminate well between malignant and benign thyroid nodules in adults. Nonetheless, further studies are needed to validate the tool in the pediatric population. Due to the biologic behavior of thyroid cancer in children, a different approach regarding biopsy is sometimes demanded. The aim of this exhibit is: to review the ACR TI-RADS lexicon employed in the evaluation of thyroid nodules; to review and illustrate ultrasonography features that are predictive for malignancy, focusing on the pediatric age group; to illustrate the ACR TI-RADS classification with pediatric cases (up to 18 years old).

TABLE OF CONTENTS/OUTLINE

1.Understanding the ACR TI-RADS classification; 2.Current state of the literature regarding epidemiology and management of pediatric thyroid nodules; 3.TI-RADS classification applied to pediatric cases, presented in a quiz format. Key differential diagnostic points and pitfalls will be highlighted in the discussion of each case. The list of cases includes: TIRADS 1 - colloid nodule; TIRADS 1 - spongiform nodule; TIRADS 2 - mixed solid and cystic nodules; TIRADS 3 - mixed solid and cystic nodules; TIRADS 3 - follicular neoplasia; TIRADS 4 - lymphocytic thyroiditis; TIRADS 4 - papillary carcinoma; TIRADS 5 - intrathyroidal thymus; TIRADS 5 - papillary carcinoma; TIRADS 5 - lymphocytic thyroiditis

PD185-ED-THA8

Chest Wall Neoplasms in Children

Thursday, Dec. 5 12:15PM - 12:45PM Room: PD Community, Learning Center Station #8

Awards
Certificate of Merit

Participants
Allison Weinstock, MD, Hummelstown, PA (*Abstract Co-Author*) Nothing to Disclose
Sparsh Gola, MD, Hershey, PA (*Presenter*) Nothing to Disclose
Asef B. Khwaja, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Nancy A. Chauvin, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

- Review chest wall embryology. - Identify the most useful advanced imaging techniques for localizing and characterizing chest wall neoplasms in children. - Recognize unique imaging findings to distinguish common bony, cartilaginous, and soft tissue neoplasms in children.. - Learn the spectrum of common and uncommon pediatric chest wall neoplasms.

TABLE OF CONTENTS/OUTLINE

- Overview of Imaging Techniques - Embryology of Chest Development - Bony and Cartilaginous Neoplasms: incidence, imaging findings, management - Soft Tissue Neoplasms: incidence, imaging findings, management - Discussion: pitfalls, mimickers

PD225-SD-THA2

Effect of Radiation Dose Outside Scan Range with Lower Tube Voltage in Pediatric CT Examination: Phantom Study

Thursday, Dec. 5 12:15PM - 12:45PM Room: PD Community, Learning Center Station #2

Participants
Takanori Masuda, Hiroshima, Japan (*Presenter*) Nothing to Disclose
Yoshinori Funama, PhD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yasutaka Baba, MD, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Takayuki Oku, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yoriaki Matsumoto, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukari Yamashita, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

One method of reducing radiation dose is by using low tube voltage scans. However, there are no reports about the effect of radiation dose outside the scan range in pediatric CT studies using lower tube voltages. The purpose of this study was to clarify the effect of radiation dose outside the scan range at different tube voltages in the anthropomorphic phantom simulating infant subjects.

METHOD AND MATERIALS

We used the anthropomorphic phantom simulating a newborn (ATOM Phantom, CIRS, Norfolk, VA, USA). All CT scans were performed on a 64 detector row scanner (Lightspeed VCT; GE Healthcare, Milwaukee, WI) from the thorax to the lower abdomen including the entire lungs. The tube voltage was used at 80-, 100-, and 120 kVp, and the tube current used by automatic tube current modulation set at noise index 12. To measure the radiation dose outside the scan range, radiophotoluminescence glass dosimeters were inserted into the brain, bone surface, bone marrow, salivary glands, lends, thyroids, skin, rectum colon, and hip joints of the phantom.

RESULTS

The mean and standard deviation of the radiation dose were 0.57±0.06, 0.59±0.07, and 0.68±0.07 mGy at 80, 100, and 120 kVp, respectively. There were no significant differences among the tube voltages (80 vs 100 kVp; p=0.71, 80 vs 120 kVp; p=0.87, 100 vs 120 kVp; p=0.57).

CONCLUSION

By using lower tube voltage with automatic tube current modulation in the new born, radiation doses outside the scan range are almost equivalent.

CLINICAL RELEVANCE/APPLICATION

The use of lower tube voltage has no effect on radiation dose reduction outside the scan range.

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PD238-SD-THA4

Connectomics: A Novel Imaging-Based Approach to Characterize Brain Network Changes in Children with Post-Surgical Posterior Fossa Syndrome

Thursday, Dec. 5 12:15PM - 12:45PM Room: PD Community, Learning Center Station #4

Participants
Avner Meoded, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Lisa Jacobson, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Colleen Bauza, St. Petersburg, FL (*Abstract Co-Author*) Nothing to Disclose
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Eric M. Jackson, MD , Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ann Liu, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Posterior fossa syndrome (PFS), characterized by severe loss of language ability, ataxia, and other neurological impairments within two days post-operatively, occurs in approximately 25% of children who undergo surgical resection of posterior fossa tumors. We aimed to determine differences in pre-op and post-op structural brain connectivity between the following groups: PFS children and children with mild and no language deficit after midline posterior fossa tumor resection.

METHOD AND MATERIALS

Pre- and post-operative structural connectivity analyses from neuroimages acquired by MRI, including topology and connectometry analysis, were applied and compared among children with PFS, mild deficits and intact language.

RESULTS

35 patients were included in the study. Of which 23 patients with pre-op MRI data and 24 with post op were included in the analysis. Mean age: PFS- 8.5 y, mild - 3.1 y, intact language - 9.4 y (p=0.02). Diagnoses included medulloblastoma (44.1%), astrocytoma WHO1 (28.6%), ependymoma (8.6%), other (11.4%), and unknown (8.6%). Fourteen (60.9%), had intact language, five (21.7%) had PFS and 4 (17.4%) had mild deficits. The assortativity coefficient was significantly higher in PFS when compared to the mild deficit group (p=0.023). In the connectometry analyses, decreased connectivity was found in PFS when compared to the intact language group, involving the corpus callosum, right corticothalamic pathway, and right corticostriatal pathway.(Figure 1)

CONCLUSION

Our findings revealed significant differences in pre-operative neural connectivity involving the corticothalamic and other pathways among children who did, versus did not, develop PFS post-operatively. Brain network analysis offers a unique opportunity to study the effect of the posterior fossa tumors on cerebello-cerebral networks and provide new insights into the mechanism of the structural plasticity/reorganization after surgery. Further investigation of these findings via larger, multicenter cohorts offers great potential to aid in presurgical planning to optimize functional outcomes following surgical resection in children with posterior fossa tumors.

CLINICAL RELEVANCE/APPLICATION

Brain network analysis of preoperative and postoperative MRI offers a unique opportunity to study the effect of the posterior fossa tumors on cerebello-cerebral networks and provide new insights into the mechanism of the structural plasticity/reorganization after surgery.

PD239-SD-THA5

Advanced Hemodynamic Monitoring of the Heart and Fetal Channels in Newborn Infants Using Ultrafast Ultrasound Blood Flow Imaging

Thursday, Dec. 5 12:15PM - 12:45PM Room: PD Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
Anne Saris, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Teun Minkels, MSc, S-hertogenbosch , Netherlands (*Presenter*) Partner, Koninklijke Philips NV
Willem de Boode, Nijmegen , Netherlands (*Abstract Co-Author*) Nothing to Disclose
Chris L. De Korte, Nijmegen , Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

There is much controversy about the optimal management of a patent ductus arteriosus (PDA) in preterm infants, with the risk of over- and undertreatment. Ultrafast ultrasound blood flow imaging makes it possible to accurately quantify 2D flow patterns through this fetal channel, whereas conventional Doppler ultrasound is limited to 1D information. It is hypothesized that this new technique will provide new qualitative and quantitative measures, which will potentially enable us to find new parameters to objectively determine the PDA significance and predict its spontaneous closure. So far ultrafast ultrasound blood flow imaging has shown promising results for carotid artery measurements in healthy adults. The purpose of this study is to adjust the acquisition and post-processing algorithms for ultrafast ultrasound blood flow measurements in order to acquire 2D flow images of the heart and fetal channels in newborn infants.

METHOD AND MATERIALS

So far, four newborn infants were included in this proof-of-concept study. Within 48 hours after birth, each participant undergoes a conventional Doppler ultrasound exam of the heart, as well as an ultrafast (4000 fps) ultrasound exam. During the course of the study, acquisition as well as post-processing parameters for the ultrafast ultrasound examinations were iteratively optimized to meet the challenging conditions which arise when imaging neonates. The information obtained from the ultrafast measurements is compared to the Doppler measurements to reveal the added value of ultrafast blood flow imaging in the assessment of hemodynamic significance of the PDA.

RESULTS

2D blood flow measurements of the heart of newborn infants could be obtained and visualized using ultrafast ultrasound, showing additional information when compared to Doppler measurements.

CONCLUSION

With ultrafast ultrasound imaging, 2D velocity vectors in the heart of newborn infants can be visualized. Optimization of this technique will give new information about blood flow patterns before, during and after closure of the ductus arteriosus. This could lead to the establishment of parameters predicting spontaneous closure of the PDA, reducing the risk of over- and undertreatment.

CLINICAL RELEVANCE/APPLICATION

Ultrafast ultrasound could provide additional blood flow information, which will enable us to find new parameters to predict closure of the patent ductus arteriosus, reducing over- and undertreatment.

PH137-ED-THA8

Variable Skull Density Ratio for Transcranial MR-Guided Focused Ultrasound Thalamotomy: Is it Possible to Correlate Different Venders

Thursday, Dec. 5 12:15PM - 12:45PM Room: PH Community, Learning Center Station #8

Participants
Hiroki Hori, Kanagawa, Japan (*Presenter*) Nothing to Disclose
Toshio Yamaguchi, MD, PhD, Kawasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiichi Abe, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is to summarize how to match skull density ratio (SDR), that show different value for each vender, by applying frequency filtering process. SDR is an index which shows how well ultrasound wave can pass through the skull for transcranial MR-guided focused ultrasound (TcMRgFUS) thalamotomy. Since skull with low SDR may be difficult to rise up the temperature of targeted tissue, it is one of the biggest obstacles in selecting the patients for treatment of TcMRgFUS thalamotomy. Although SDR is an important index to predict the temperature for the treatment of TcMRgFUS, it is varying not only in different venders, but also in different conditions of CT for the same patient. It is important to standardize the SDR which does not depend on each vender in TcMRgFUS thalamotomy.

TABLE OF CONTENTS/OUTLINE

Relationship between TcMRgFUS and SDR a. Thermal ablation by TcMRgFUS b. What is SDR? What is frequency filtering process a. How frequency filtering process works? b. Image change after processing SDR after frequency filtering process Future outlook

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PH208-SD-THA1

Deep Learning-Based Liver Segmentation in Abdominal CT Images to Support Automatic Contouring in Radiotherapy Treatment Planning

Thursday, Dec. 5 12:15PM - 12:45PM Room: PH Community, Learning Center Station #1

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Liver segmentation is a prerequisite for measuring hepatic volume in liver transplantation, modeling of the liver anatomy in hepatic surgery planning, and contouring in radiotherapy treatment planning. The main challenges of liver segmentation are the appearance similarity of liver and surrounding stomach, heart, and spleen in 2D images and are the large shape variations of liver in 3D volume. In this study, we propose a deep learning-based liver segmentation method through the localization of the liver in abdomen using global context and the delineation of the liver in a bounding volume using shape-enhanced prior.

METHOD AND MATERIALS

Our dataset included 155 artery phase CT images obtained for radiation therapy from patients with liver cancer, which were divided into 75 subjects for training, 33 subjects for validation, and 47 subjects for test. The pixel spacing and slice thickness of the images varies from 0.65 to 0.79 mm and 3.0 to 7.0 mm. To localize the liver in the abdomen and exclude outliers, 2D segmentation networks based on axial, coronal, and sagittal FCNs are learned and a shape-enhanced prior is generated by the weighted fusion of three prediction maps. To correct the fine details of the liver in the bounding volume, 3D segmentation network based on 3D U-net is learned along with shape-enhanced prior.

RESULTS

Segmentation performance was evaluated as 91.2%, 94.3%, and 89.5% for the DSC in the 2.5D segmentation network, and proposed network with and without shape-enhanced prior, respectively. Experimental results showed that the 2.5D segmentation network excluded outliers near the liver and localized the liver in the abdomen. The proposed network corrected under-segmentation area of the 2.5D segmentation network considering the spatial local context and avoided over-segmentation into neighbor structures considering the shape-enhanced prior.

CONCLUSION

Our method improved segmentation accuracy by the localization of the liver in abdomen using global context and the delineation of the liver in a bounding volume using shape-enhanced prior. (This work was supported by Radiation Technology R&D program through the NRF of Korea(NRF-2017M2A2A7A02070427))

CLINICAL RELEVANCE/APPLICATION

Our method can be used for not only auto-contouring in radiotherapy treatment planning but also hepatic volume measurement in liver transplantation or liver anatomy modeling in hepatic surgery planning.

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PH220-SD-THA2

Chronic Liver Disease Assessment Using Deep Learning on Shear Wave Elastography Image Sequences

Thursday, Dec. 5 12:15PM - 12:45PM Room: PH Community, Learning Center Station #2

Participants
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PURPOSE

To compare the diagnostic performance of two popular Deep Learning schemes on Chronic Liver Disease having as input temporally stable Shear Wave Elastography (SWE) images.

METHOD AND MATERIALS

Clinical dataset includes 200 subjects (88 Healthy and 112 with Liver Biopsy validation CLD). Each subject had an Ultrasound (US) SWE liver examination performed on Aixplorer (Supersonic Imagine) US device. From each examination, 4 SWE images of the same liver area having 2 seconds time distance each were extracted. For each set of the 4 images, an RGB to Stiffness process was implemented according to Aixplorer's provided color-bar. For each stiffness-box, the Dyadic Wavelet Transform (DWT) "Atrous" algorithm was calculated. Then, the first stiffness-box and its corresponding DWT box are subtracted from each of the remaining three stiffness and DWT boxes to produce 6 image-boxes which are fed to a Fuzzy C-Means clustering algorithm to provide 2 clusters of high and low temporal stability. The low temporal stability areas were excluded from the first image and the resulting masked images along with the unmasked were fed to Alexnet and GoogLeNet Deep Learning schemes for comparison using transfer learning. The classification process was repeated 30 times to have a robust estimation of both networks' performance.

RESULTS

The difference of mean accuracies for the masked and unmasked images (ACCmasked -ACCunmasked) for Alexnet and GoogLeNet respectively were 0.13% (p-value = 0.62) and 1.92% (p-value < 0.01) for F01-F234, 0.27% (p-value = 0.54) and 4.12% (p-value < 0.01) for F0-F1234, and -1.27% (p-value < 0.01) and 2.27% (p-value < 0.01) for F01-F23-F4. Alexnet's range of accuracies in all classification schemes was 84% - 94.2% while GoogleNet's accuracies range was 80.8% - 91.6%.

CONCLUSION

Both Deep Learning schemes performed well in differentiating CLD fibrosis stages using the masked and unmasked images. Alexnet seems to perform better in both masked and unmasked images than GoogleNet but has no difference in performance between masked and unmasked images. GoogLeNet seems to perform better with the masked SWE images.

CLINICAL RELEVANCE/APPLICATION

This study compares the diagnostic performance of two popular deep learning schemes on CLD using SWE image sequences. This algorithm could be employed in a CAD system for CLD diagnosis.

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PH222-SD-THA4

Size-Specific Analysis of Patient Doses From CT Localizer Radiographs

Thursday, Dec. 5 12:15PM - 12:45PM Room: PH Community, Learning Center Station #4

Participants
Keiichi Nomura, MS, Kashiwa, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

The aim of this study was to estimate organ doses based on Monte Carlo (MC) simulations for individual patients in CT localizer radiograph and evaluate the organ doses for different patient size.

METHOD AND MATERIALS

In CT localizer radiographs, X-ray was irradiated from two directions of anterior-posterior (AP) and lateral (LAT). AP localizer protocols were set at the tube voltage of 120 kV, tube current of 30 mA, beam width of 2 mm. LAT localizer protocols were set at tube current of 50 mA, which corresponded to the default settings by the manufacturer. The length of CT localizer radiographs was adult chest-abdomen-pelvis region. Dose simulations of CT localizer radiographs were performed using MC simulation software ImpactMC (Advanced Breast CT). The voxelized models created from CT images of 24 patients (3 male and female underweight, normal weight, over weight, and obese patients which were classified based on patient's body mass index), and detailed descriptions of an Aquilion ONE CT scanner (Canon Medical Systems) were input into the software. The organ doses of thyroid, lung, esophagus, breast, liver, stomach, and bladder were estimated from the dose simulation results. The detectability of anatomical landmarks of lung and pelvic bone in each CT localizer radiograph was also subjectively evaluated.

RESULTS

The liver dose in AP direction was 0.59 mGy for underweight,0.49 mGy for normal weight, 0.36 mGy for overweight, and 0.35 mGy for obese patients. The patient doses for underweight patients in AP and LAT localizer protocols were higher than for obese patients because more X-rays in the protocols for underweight patients reached to the deeper organ position. Anatomical landmarks of lung and pelvic bone for all patients CT localizer radiographs could be detected. This makes it possible to determine the chest-abdomen-pelvis range.

CONCLUSION

Patient doses in CT localizer radiographs varied according to the patient size. Lung and pelvic bone on the CT localizer radiographs were detectable in all patient size. The doses for underweight patients in CT localizer radiographs could be reduced by at least one-third of doses for obese patients.

CLINICAL RELEVANCE/APPLICATION

The dose distributions and patient doses of the CT localizer radiograph were estimated. The exposure conditions of the CT localizer radiograph should be adjusted according to the patient size as well as the helical scan.

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PH242-SD-THA6

Dose and Image Quality in Ultra Low-Dose CT for Urolithiasis: Added Value of Automatic Tube Current Modulation and Deep Learning Image Reconstruction

Thursday, Dec. 5 12:15PM - 12:45PM Room: PH Community, Learning Center Station #6

FDA Discussions may include off-label uses.

Participants
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Shuai Zhang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare dose and image quality of a baseline low-dose CT vs an ultra-low dose CT (automatic tube current modulation, ATCM) in patients with suspected urinary stone disease and to assess the added value of Deep Learning Image Reconstruction

METHOD AND MATERIALS

CT examination was performed on 18 patients (10 baseline low-dose, 8 ultra-low-dose).Filtered back projection (FBP), Adaptive Statistical Iterative Reconstruction-V (ASIR-V) was used for both protocols and Deep Learning Image Reconstruction(TrueFidelity)was used for the ultra-low dose protocol only. Dose and stones information were collected for both protocols. Subjective image quality was assessed by two radiologists scoring noise, visibility of the stone and overall image quality. Objective image quality (contrast-to-noise ratio, CNR) was assessed for the ultra-low dose protocol only (ASIR-V and TrueFidelity).

RESULTS

The ultra-low dose protocol (ATCM) showed a 80% decrease in mean effective dose and improved visibility of the Urinary system . CNR was higher for TrueFidelity.

CONCLUSION

TrueFidelity improves the objective image quality, but not the subjective image quality for the chosen clinical task

CLINICAL RELEVANCE/APPLICATION

Urolithiasis is a worldwide problem with a high recurrence rate. Many patients will be affected by multiple stones throughout their lifetime. Among techniques available to reduce patient dose in the latest generation of CT scanners, automatic tube current modulation (ATCM) and Deep Learning Image Reconstruction have proved useful in clinical practice

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PH243-SD-THA7

The Application of Monochromatic Images in Spectral CT for Reducing Metal Artifacts in Chest Biopsy Procedure

Thursday, Dec. 5 12:15PM - 12:45PM Room: PH Community, Learning Center Station #7

Participants
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Chunyu Gu, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Lanxin Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
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Xinhui Bai, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the value of using monochromatic images in dual-energy spectral CT for reducing metal artifacts in chest biopsy procedure.

METHOD AND MATERIALS

A total of 20 patients for CT-guided chest percutaneous biopsy were scanned using low dose dual-energy spectral CT imaging mode. After scanning, 9 sets of virtual monochromatic images with photon energies from 60-140keV in a 10keV increment were generated and analyzed on an AW4.6 workstation using the Gemstone Spectral Imaging (GSI) Viewer software. The degree of metal artifacts was evaluated using an artifact index (AI) and was calculated using the formula: AI=sqrt(SDadj - SDmuscle), where SDadj represents the standard deviation measurement in the area adjacent to the needle, and SDmuscle for the chest muscle. Higher AI values indicated worse quality. Two experienced radiologists also evaluated the subjective image quality independently and blindly using a 4-point scoring system including features like metal artifact, contrast resolution between needle and adjacent lesion tissue. Scores greater or equal to 2 were considered clinically acceptable.

RESULTS

The value of AI decreased with the increase of photon energy and plateaued after 120keV. The subjective evaluation indicated that the images at 120keV had the highest quality score. There was an excellent agreement in scores between the 2 observers (k=0.82) .

CONCLUSION

Low dose spectral CT imaging can significantly reduce the needle metal artifacts in chest CT biopsy to improve biopsy accuracy; and the 120keV is the optimal energy level to balance artifact reduction and contrast resolution.

CLINICAL RELEVANCE/APPLICATION

Spectral CT imaging may be used to improve chest CT biopsy accuracy with significantly reduced metal artifacts.

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PH244-SD-THA5

Accuracy of Volumetric Trabecular Bone Mineral Density Assessment Using Dual-Source Dual-Energy CT: Phantom Study and Comparison with Quantitative CT

Thursday, Dec. 5 12:15PM - 12:45PM Room: PH Community, Learning Center Station #5

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PURPOSE

To assess the accuracy of volumetric trabecular bone mineral density (BMD) assessment based on dedicated material decomposition using dual-source dual-energy computed tomography (DECT) in comparison to quantitative CT (QCT).

METHOD AND MATERIALS

Data from a validated anthropomorphic spine phantom consisting of three lumbar vertebra equivalents containing 50, 100 and 200 mg/cm³ calcium hydroxyapatite (HA) concentrations which had been scanned using third-generation dual-source DECT, QCT and dual x-ray absorptiometry (DXA) was analyzed. For volumetric BMD assessment based on DECT, dedicated postprocessing software using material decomposition was applied, which enables phantomless BMD assessment of the trabecular bone through semi-manual definition of the volume of interest (VOI). Scans of all modalities were repeated three times and measurements per vertebrae were also repeated three times, and averaged values were recorded. The accuracy of DECT and QCT for BMD assessment was compared and calculated BMD values were correlated with DXA, which served as the standard of reference.

RESULTS

Significantly higher correlations between actual and measured HA concentrations were found for DECT (r=0.98) compared to QCT (r=0.93, p<.001). Mean error for all measurements was -2.8 ± 3.3 mg/cm³ (DECT) and -8.3 ± 9.5 mg/cm³ (QCT) (p<.001). There was significantly higher correlation between BMD values of DECT and DXA (r=0.99) compared to BMD values of QCT and DXA (r=0.94, p<.001).

CONCLUSION

Phantomless DECT using dedicated material decomposition achieves substantially improved accuracy in measurement of volumetric trabecular BMD and significantly higher correlation with DXA in comparison to QCT.

CLINICAL RELEVANCE/APPLICATION

DECT yielded significantly higher accuracy for volumetric trabecular BMD assessment compared to QCT by application of material decomposition and furthermore may enable opportunistic osteoporosis screening on routinely performed DECT through phantomless BMD assessment as a potential clinical relevant advantage over established methods.

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QI001-EB-THA

Strategies for Implementing and Three Years Results of a National Quality Accreditation Program in Diagnostic Imaging in a Developing Country

Thursday, Dec. 5 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

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PURPOSE

Radiology is a core specialty for most clinical and surgical practice nationwide. Therefore, improving Quality and Safety in Radiology have major impact on the national's healthcare system. To address the issue, the National Health Agency and the College of Radiologists joined efforts to structure a National Accreditation Program that will help diagnostic imaging facilities achieve minimum quality and safety requirements and spread the culture of constant improvement. We present the steps that made it possible to develop the first National Accreditation Program for radiology. The results of the first three years are shown and discussed. A critical analysis is made demonstrating the strengths, weakenesses and the opportunities of betterment. We aim to share our experience and doing so contribute to amplify the awareness on the importance of quality for radiology.

METHODS

The following steps were taken to create the National Accreditation Program: 1. Creation of a committee to manage the accreditation program: formed by radiologists, a nuclear medicine specialist, a medical quality specialist, and a radiologic administrator. The mission of the committee was to foster the idea of the radiology providing a medical service in a more comprehensive way, and guaranteeing the quality not only as the excellence in the execution of the imaging tests, but quality as a whole that could beneficiate the patient. 2. Elaboration of the Program Requirements: A research was made in all the normative resolutions published by the National Council of Health since 1988. These resolutions were then organized and detailed to simplify the understanding and help facilities meet the requirements. The National College of Radiology reached for the radiology subspecialty commissions to contribute to the construction of the requirements in each particular area: neuroradiology, head and neck, thoracic, cardiovascular, abdominal, muskuloskeletal, mammary radiology and ultrasound. 3. Public consultation, discussion and adequation of the requirements to meet the mission of the committee. 4. Submission of the document to an international accreditation of quality programs (International Society for Quality in Healthcare - ISQua). 5. Accreditation of auditors: periodic auditor courses throughout the country were performed to spread the word of quality and accredit internal and program auditors to rapidly increase the reach and the understanding of the Quality Program. 6. Recognition of the Program by The National Healthcare Agency: the Quality Program was recognized by our national agency which recommended that an accredited radiology facility should have reimbursement advantages.

RESULTS

The Program Requirements were successfully completed after two years, producing a final document with 191 items covering six major topics: 1. governance, 2. executive / finance management, 3. quality (planning and documentation, risk assessment and safety managment, non-compliance management, patient satisfaction, adverse events, quality improvement planning), 4. Service performance (customer service, imaging exam deliver process, radiologic reporting, post analytic management), 5. Diagnostic support service (human resources management, worker's safety, equipment / products / services acquisition process, equipment maintenance, information technology, sanitation, disinfection and sterilization, clothing processing), 6. Infrastructure, radiation and environmental safety. The technical guidelines containing the best practices requisites were also created and published online in seven documents each one representing one of the radiologic methods: computerized tomography, magnetic resonance, sonography, radiography, nuclear medicine, osseous densitometry and interventional radiology. During the first three years of the program, 80 facilities have applied, five failed, and 19 were approved. Thirty progam auditors and more than 400 internal auditors were trained. Twenty eight local audits were performed. The mean cycle of the program was 100 days. The main causes of failure were exams reproval, and failure to demonstrate quality and safety documentation. Satisfaction with the process of accreditation was high as expressed by the net promoter score of 56, assessed by a self-assessment questionnaire. The same assessment indicated the positive impacts were: executive management improvement (100% totally or partially agree); exam process improvement and reduction of adverse event risks (78% totally or partially agree). A negative aspect, pointed by 61% was the perception that the accreditation haven't brought additional financial gain. However, the majority of the facilities declared that some non-quantifiable gain was achieved.

CONCLUSION

We presented the steps and challenges to structure a National Program of Accreditation in Radiology with the mission of promoting quality and safety for our specialty, which will certainly influence the improvement of healthcare delivery countrywide.

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QI020-EB-THA

Lean MRI Protocol Process Improvement and Software Solution

Thursday, Dec. 5 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

Lean is a philosophy that embraces the power of continuous process improvement to add value to customers (patients) and society, while empowering employees and building people and teams as part of "learning organizations" that can adapt and thrive in challenging environments.1 The Institute of Medicine recognizes such continuous learning and improvement as the key to addressing the increasing costs and "unmanageable complexity" of the science of health care,2 and reducing diagnostic error.3 Lean improvement may also reduce burnout through participants' empowerment and engagement, team building and efficiencies allowing more time for personally meaningful work activities. 4-6 9 years ago, our neuroradiologists commonly worked 11+ hours per day. The most visible cause of this problem was the late (5:30-6pm) arrival of folders containing imaging protocols and contrast prescriptions to be completed for the next day. We initiated a lean improvement project targeted toward increasing time available for meaningful activities by eliminating waste from the imaging and contrast prescription process.

METHODS

1. Employed Toyota's Practical Problem Solving Process including the "Five Whys" to define and clarify the problem, identify the root cause and iteratively develop countermeasures 2. Standardized MR imaging protocols through consensus, beginning with most frequently used protocols, based on a clear set of principles and a checklist for implementation 3. With a multidisciplinary team, developed software to support radiologist and technologist workflow that integrated a new protocol database with curated clinical information from the EMR (labs, history, allergies, medical device MRI compatibility), capability to prescribe contrast bounded by ACR guidelines, and permitted archiving of radiologist/technologist notes and protocol customization 4. Developed and implemented a plan/checklist for folder/paper retirement 5. Developed a workflow for continuous imaging protocol improvement (DRIVE - Development, Review, Implementation, Vaulting/archiving and (re)Evaluation). Technologist and radiologist labor time was assessed before and after implementation through surveys and observation, and descriptive statistics calculated.

RESULTS

Radiologists' protocol process time was reduced by approximately 60%, or the equivalent of 1 academic day (8 hours). Overall, technologist process time was reduced by approximately 70% (100% for Technologist 1, 50% for Technologist 2), saving 37.5 technologist hours per week (almost 1 FTE). This translated into shorter reading room days for neuroradiologists, and increased technologist availability for advanced image processing and other value-added and meaningful tasks, gains which have been maintained despite steadily increasing imaging volumes. Other benefits: • Consistency of imaging protocols, facilitating acquisition and improving comparison and diagnosis • Standardization permitted differentiation of clinical versus research imaging, facilitating billing • Compliance with electronic medical record mandate • Enhanced safety of intravenous contrast prescription • Electronic record of patient-specific imaging needs, improving patient experience • Process for continued imaging improvement (DRIVE), which continues today, leveraging advances in technology for improved diagnosis, while promoting teamwork and mutual respect Lessons learned: • Processes that worked 10 years ago may not be scalable to increasing imaging volumes and complexity. • Software alone is not a solution for inefficient or poorly defined processes, which should be aggressively reviewed and streamlined before a software solution is considered. • Software is logical, while people frequently are not. Hiccups in software development/implementation usually indicate ambiguity in processes and should be considered an opportunity for process review and improvement. • Participation and buy-in of key end users is critical to the success of any process improvement effort.

CONCLUSION

Lean process improvement can introduce efficiencies accommodating increasing imaging volumes and meaningful value-added activities, while enhancing consistency and safety in patient imaging care and promoting a culture of continuous improvement. With judicious implementation, the inherent logic of software can be leveraged for further process improvement.

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QI025-EB-THA

Improving Radiology Protocoling Efficiency through Quality Improvement: An Initiative to Improve Resident Productivity and Speed of Patient Diagnosis

Thursday, Dec. 5 12:15PM - 12:45PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

In most radiology residencies across the nation, protocoling is primarily the responsibility of radiology residents. The process is an essential skill to learn, but is also quite laborious, erroneous and more importantly can detract from learning imaging interpretation, diagnosis, and management. To this end, we aimed to improve radiologist protocoling workflow efficiency by decreasing time spent on protocoling studies that could be better spent on interpreting studies as well as improve order-to-reporting time.

METHODS

We utilized a Plan-Do-Study-Act (PDSA) cycle and A3 problem solving methodology to investigate the workflow for CT exams from ordering to protocol completion. We surveyed our institution's radiology residents to identify major areas of waste and gauge resident satisfaction towards our program's protocoling process. We also surveyed other radiology residencies for comparison. Root cause analysis was performed and we determined the first phase was to streamline the protocoling dashboard interface. Proposed changes were approved by key stakeholders and subsequently implemented in the Abdominal Division of our Radiology Department. Data on resident protocoling, study interpretation, dashboard length, and protocoling time (by a first and third year radiology resident) were obtained before and after interventions. Post-implementation feedback and EPIC error reporting metrics were monitored.

RESULTS

Retrospective analysis of data between June and September 2018 revealed that our residents protocoled 79% of the protocoling volume while only reading 24% of the imaging volume. Compared with other radiology residents, our residents spent more time protocoling and less time reading and interpreting CT studies and 84% were dissatisfied with the current protocoling workflow as compared with 36% from other institutions. Changes included development of a more user-friendly dashboard interface, strategic reorganization of essential information, and elimination of irrelevant information and protocols. Post-implementation, we decreased patient information for each study by greater than 80%, thereby reducing excessive time and energy spent on locating relevant information. The average protocoling time was 39.8 seconds before implementation and 23.4 seconds after implementation, which represents a 41% reduction in time spent per protocol and nearly met our target goal of 50% reduction. Overall feedback from the faculty, residents, and technicians were positive and only 1% of all errors reported through the Epic QA reporting system were attributed to incorrectly protocoled exams by radiologists.

CONCLUSION

Streamlining the protocoling dashboard at our institution has improved our protocoling workflow efficiency. Post-implementation, residents can more quickly complete protocols for ordered exams and dedicate more time to interpreting studies, thereby minimizing delays in patient diagnosis and clinical care due to protocoling. By making additional changes going forward based on our root cause analysis, continued feedback, and careful monitoring of error metrics, we believe we are one step closer to optimizing radiologist productivity.

QI128-ED-THA1

Dose Optimisation in Multiphasic Computed Tomography Imaging of the Liver with High-concentration Contrast Media

Thursday, Dec. 5 12:15PM - 12:45PM Room: QR Community, Learning Center Station #1

Participants
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PURPOSE

To reduce radiation dose to patients undergoing multiphasic CT of the liver by exploiting the intrinsic properties of iodine enhancement at low kVp.

METHODS

59 oncology patients underwent multiphasic CT of the liver using a 256 slices scanner either with our standard acquisition protocol (100 kVp in all phases; N=27) or an optimised weight-based acquisition protocol in the arterial phase (80 kVp in patients <=80 kg; N=21 with an average BMI of 23,2 and 100 kVp in patients >80 kg; N=11, average BMI 30,1). High-concentration contrast agent (Iomeprol 400 mgI/ml) at 1,3 ml/kg with a 3 ml/s injection rate and automatic tube current modulation were used in all patients. The standard dose and the optimised protocols were compared with t test for average CTDIvol, liver dose, and peak aortic enhancement measured in the aorta at the level of the coeliac trunk (significance threshold p <0.05).

RESULTS

When the optimised protocol was used, patients <=80 kg showed a significant increase in peak aortic enhancement (466±134 HU vs 324±59HU; p=0,003) and a significant reduction in average CTDIvol (from 14±4.8 to 8.6±1.5 mGy; p=0,000001) and liver dose (from 17.7±5.9 to 10.7±1.8 mSv; p=0,002) for the arterial phase. As expected, patients >80 kg did not show any significant difference in aortic enhancement and radiation dose compared to the standard protocol.

CONCLUSION

Our optimised protocol with use of 80 kVp and high iodine concentration resulted in a substantial improvement of aortic attenuation and radiation dose reduction in patients <=80 kg undergoin a multiphasic CT of the liver. Adopting a tailored approach to the individual patient has been a success: we have seen an increase in peak aortic enhancement by 44% and a reduction to liver dose by 40% in the arterial phase. The optimised protocol has been successfully implemented in our institution and it is now the standard protocol for patients within normal BMI range. This has been a pilot project for the dose team, which is gradually overhauling all CT protocols in our institution.

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QI129-ED-THA2

Cross-sectional Interventional Procedures in A Diagnostic Radiology Residency: Establishment of an Effective Comprehensive Simulation Based Procedural Training Program

Thursday, Dec. 5 12:15PM - 12:45PM Room: QR Community, Learning Center Station #2

Participants
Brianna Oliver, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
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PURPOSE

Patient care and procedural skills is one of 6 competency-based American Board of Radiology (ABR) milestones for radiology residents, the components are largely assessed during procedural rotations. While the basics of performing a procedure are constant, there is variability in how each faculty performs and teach procedures, as well as methods utilized to perform the procedure depending; thus it is difficult to homogenize training and to accurately assess procedural competence. Moreover, exposure to procedural rotations and ability to perform a procedure varies tremendously. These are challenges when trying to safeguard adequate training of procedures in order to ensure competence. Literature shows that hands-on simulation is a way to provide 'deliberate' training in a safe environment. The purpose of this project was to create a simulation-based training program for radiology residents in order to enhance the basic procedural education. The simulation-based training program focused on education pertaining to multiple aspects of cross-sectional procedures, including: pre-procedure, intra-procedural and post-procedural care, and ultrasound-guided procedural skills using a physical phantom for training.

METHODS

An initial curriculum structure was developed for cross-sectional interventional radiology (CSIR) procedural training in order to: 1. improve knowledge by providing an understanding of pre-, intra- and post-procedure details, including indications and contraindications for procedures, procedure technique, and post-procedure management, and 2. improve procedural skills, particularly dexterity with ultrasound when performing percutaneous biopsies and catheter placement. In order to ensure maximum resident participation, the program was built into the pre-existing noon-conference schedule, and occurred at the institutional simulation center. There were four components to the curriculum: initial pre-training written test, 2-hour didactic lecture, small group hands-on procedural training, and post-training written exam. Post-training survey evaluation allowed residents to subjectively evaluate the effectiveness of the program. Written pre- and post-test allowed objective evaluation of knowledge. Hands-on simulation training required trainees to follow a check list of steps (n=23 steps) to successfully perform ultrasound guided targeting of "lesions" on a chicken phantom. Utilizing a whole chicken as the phantom allowed a semi-real time experience, with skin, subcutaneous fat, bone, and muscle. At the end of the session one CSIR faculty evaluated each resident perform a procedure, with evaluation criteria being the procedural checklist residents used during the hands-on training session.

RESULTS

Written pre-test examination was administered to identify baseline gaps in knowledge and measure improvement after simulation based training. Written pre-test assessed patient care and procedural knowledge, questions covered medications, indications, anatomy and procedural techniques and was followed by a 2-hour didactic session. Thereafter, small group (n=6-8) hands-on didactic training sessions occurred, each with one CSIR faculty who reviewed cases with residents as they practiced US-guided needle placement. After training, the CSIR faculty administered a practical test, in which each resident performed a procedure using the checklist steps. Finally, a written post-test was administered. Improvement in written test results were evaluated for each trainee (n=34), each year of training as a group (n=4), and overall as a residency group (n=1). The largest increase in results was 30%. The PGY-2 year (first year of radiology residency), demonstrated the largest gains, with an average increase of 11.8%. All residents successfully completed the practical test, with an average checklist score of 20/23. Post-simulation questionnaire utilizing a Likert scale was administered to allow each trainee to objectively assess the program, improvement in skills and knowledge, increase in procedural confidence, and if this program should be implemented in residency training. 64.7% of trainees reported inadequate procedural skills and knowledge pre-simulation training and 100% of trainees reported gains in knowledge post-training. 100% agreed simulation training should become a part of the residency curriculum.

CONCLUSION

Effective procedural training is a critical component of radiology residency training and has become one of the ABR core competency milestones. CSIR procedural training is an important tool to help radiology residents become proficient at percutaneous procedures; a skill necessary for almost all subspecialties of radiology. Our simulation-based CSIR training program has shown to improve trainees' confidence in performing the technical aspects of a procedure, as well as improve a trainees' knowledge base on subjective measures. Further studies showing the translation of these skills into real-time clinical work is still necessary.

RO214-SD-THA1

Intra-Fractional Dose Variation of Organs at Risk in High Dose Rate Image-Guided Brachytherapy for Cervical Cancer

Thursday, Dec. 5 12:15PM - 12:45PM Room: RO Community, Learning Center Station #1

Participants
Kana Edamitsu, MS,MMed, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Takayuki Yamamoto, MS,MMed, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the intra-fractional dose variation of organs at risk (OARs) in high dose rate (HDR) computed tomography (CT)-based brachytherapy (BT) for cervical cancer.

METHOD AND MATERIALS

Twenty-one patients (56 HDR fractions) received CT-based BT for cervical cancer. For all cases, treatment plans (Original Plan) were generated with CT-images (Original CT) after applicator insertion. Additional CT-images (After CT) were acquired immediately after HDR BT fraction. We generated the virtual treatment plans (After Plan) using After CT, and the dose distribution was created with the same source position as that of the Original Plan. In the present study, we investigated the intra-fractional dose variation of OARs (rectum and bladder) by comparing the dose volume histogram (DVH) parameters (D2cc, D1cc, and D0.1cc) between the Original Plan and After Plan. Furthermore, we analyzed whether the intra-fractional dose variation has a correlation with the intra-fractional volume variation of OARs or the time from planning to irradiation.

RESULTS

The dose differences (mean ± SD) of D2cc, D1cc, and D0.1cc for rectum were -0.03 ± 0.50, -0.06 ± 0.57, and -0.19 ± 0.81 Gy, and for bladder were 1.06 ± 0.99, 1.23 ± 1.22, and 1.66 ± 1.95 Gy, respectively. No statistically significant difference was observed for rectum; however, a significant difference was seen in all DVH parameters for bladder ($p < 0.05$). The volume variation of OARs had a significant correlation with the dose variation of all DVH parameters for rectum and bladder. On the other hand, no significant correlation was found between the dose variation of all DVH parameters and the time from planning to irradiation.

CONCLUSION

In the CT-based BT, the dose distribution at the planning stage can be different from the dose distribution after irradiation. Intra-fractional volume variation of OARs affects the dose distribution; however, the time from planning to irradiation does not affect the dose variation.

CLINICAL RELEVANCE/APPLICATION

The dose distribution of OARs differs between the planning stage and application, which may affect treatment outcomes and adverse events.

UR192-ED-THA7

Suspected Renal Colic: Multispecialty Consensus Imaging and CT Dose Reduction Recommendations

Thursday, Dec. 5 12:15PM - 12:45PM Room: GU/UR Community, Learning Center Station #7

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TEACHING POINTS

1. CT is overused in acute flank pain imaging. 2. While CT is the most accurate imaging method to detect stones, it is not needed in all patient who present with suspected renal colic. 3. Recent patient-centric multispecialty (Radiology-ACR, Emergency Medicine-ACEP, Urology-AUA) consensus recommendations have been developed based on published evidence and have been operationalized using clinical vignettes. 4. Further, recent publications suggest that radiologists are not adequately reducing patient dose during flank pain CT.

TABLE OF CONTENTS/OUTLINE

1. Review of evidence for CT overuse and reduced exposure underuse.2. Description of multispecialty consensus panel guideline development. 3. Case-based Review of imaging recommendations. 4. Review methods to decrease CT dose during flank pain CT.

VI143-ED-THA9

When It's Not a Deep Venous Thrombosis (DVT): A Pictorial Review of Alternate Causes of Swollen Limb or Pain in 'Rule-Out' DVT Exams

Thursday, Dec. 5 12:15PM - 12:45PM Room: VI Community, Learning Center Station #9

Awards
Certificate of Merit

Participants
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Meghan G. Lubner, MD, Madison, WI (*Abstract Co-Author*) Grant, Koninklijke Philips NV; Grant, Johnson & Johnson;
Maitray D. Patel, MD, Paradise Valley, AZ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Extremity ultrasound exams are frequently ordered to exclude a diagnosis of deep vein thrombosis (DVT). While Doppler ultrasound represents an excellent diagnostic test for DVT, a wide variety of non-DVT pathology exists that may be incidentally found or can result in overlapping physical exam findings that prompt a 'rule-out DVT' ultrasound study. 2. Radiologists should be aware of these non-DVT etiologies and their corresponding sonographic features on studies that are otherwise 'negative' for DVT. 3. This educational exhibit will provide a pictorial review of this differential, which can be categorized into: vascular, traumatic, malignant, or extravascular fluid-based etiologies.

TABLE OF CONTENTS/OUTLINE

1. Brief summary of DVT and extremity DVT ultrasound ordering patterns 2. Explore non-DVT pathology and corresponding ultrasound findings that in some cases prompt DVT ultrasound assessment 3. Vascular: thrombophlebitis, retained fibrin sheath, pseudoaneurysm or fistula. 4. Traumatic: achilles tear, tennis leg, intramuscular hematoma, Morel-Lavallee lesion 5. Extravascular fluid: subcutaneous edema, popliteal cyst, post-surgical seroma 6. Malignancy 7. Miscellaneous: Cellulitis, lymphadenopathy, muscle hernia, tenosynovitis etc.

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VI218-SD-THA1

Classification of Geniculate Arterial Patterns with Implications for Interventional Radiologist

Thursday, Dec. 5 12:15PM - 12:45PM Room: VI Community, Learning Center Station #1

Participants
Maziar Sighary, MD, New York, NY (*Presenter*) Nothing to Disclose
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PURPOSE

Geniculate Artery Embolization (GAE) has demonstrated efficacy in alleviating knee pain associated with osteoarthritis. A thorough understanding of the classical anatomy and variations in branch patterns are essential in order to optimize target therapeutic selective embolization. We plan to anatomically review the geniculate arteries (GA) as there is a lack of detailed anatomy in the literature most notably at the cadaveric level.

METHOD AND MATERIALS

A mixed sex sample of medically embalmed donor bodies from 3 medical schools were utilized for this study. 102 cadaveric limbs were dissected for gross anatomical appearance, presence of the descending genicular artery (DGA), recurrent tibial artery (RTA) and all 5 main branches off the popliteal artery including the superior lateral genicular artery (SLGA), superior medial genicular artery (SMGA), middle genicular artery (MGA), inferior lateral genicular artery (ILGA) and inferior medial genicular artery (IMGA). The location of origin, diameter of vessels and variation in patterns were documented using a Neiko 01409A electronic Vernier digital caliper with an accuracy to 1/10 of a mm.

RESULTS

96 limbs were adequately preserved and reviewed. Results showed the establishment of 7 specific arterial patterns off the popliteal artery of which the highest statistical frequency was revealed to be 2 superior and 2 inferior geniculate branches with the middle emanating from, and supplying the medial side of the popliteal fossa. 4 limbs demonstrated independent DGA trunks off the femoral artery. The origin of the SMGA (47.0 mm) was the furthest from the reference line, followed by SLGA (40.2 mm), MGA (22.2), IMGA (-0.8), and ILGA (-6.5).

CONCLUSION

This quantitative study documents the GA patterns in a large sample size of donor bodies in order to establish a baseline of variation permitting a navigational guide for interventionist performing GAE. Results showed the establishment of 7 specific arterial patterns. Understanding of the variations is essential in targeting embolization and reducing complications associated with non-target embolization. We propose a new classification system for the Geniculate Artery branching patterns in order to help in reducing these risks.

CLINICAL RELEVANCE/APPLICATION

During Geniculate Artery Embolization knowledge of the most common vascular anatomy and variations in branching is essential for safe embolization, good clinical practice, and optimal outcomes.

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VI219-SD-THA2

Doppler-Based Renal Perfusion Variations After Fenestrated/Branched Endovascular Repair and Post-Operative Renal Function Outcomes

Thursday, Dec. 5 12:15PM - 12:45PM Room: VI Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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PURPOSE

To assess parenchymal renal perfusion changes, as determined by variations on Doppler Resistance index (RI), after fenestrated/branched endovascular aortic aneurysm repair (F-BEVAR) and the impact of RIs variations on renal perioperative outcomes and renal function deterioration after F-BEVAR in patients with chronic kidney disease (CKD).

METHOD AND MATERIALS

A total of 102 patients who underwent F-BEVAR between 2015-2018 for suprarenal, juxtarenal, and type I-IV TAAAs were included. All procedures were performed using investigational customized and off-the-shelf devices under physician-sponsored investigational device exemptions. Post-operative acute renal failure (ARF) and CKD were defined using RIFLE criteria and CKD staging system (stage >3, GFR <60 ml/min/1.73m2), respectively. For those without baseline CKD, renal decline was defined as a drop in GFR <60 mL/min/1.73m2. For patients with baseline renal dysfunction, GFR decline > 20% or progression in CKD stage was considered as renal decline. RI was calculated as follows: RI=(Peak Systolic Velocity-End Diastolic Velocity)/ Peak Systolic Velocity. Renal parenchymal Doppler assessment was performed at upper and lower pole inter lobar arteries. Mean RI was calculated for each kidney. Highest RI was used for analysis.

RESULTS

CKD was present in 83 patients (45%). Median pre-operative RI was 0.68 (Interquartile range [IQR], 0.65-0.71). Post-operative ARF was diagnosed in 27 patients (14.5%). Renal Doppler ultrasound within 30 days demonstrated a significant increase RI compared to baseline (0.71 IQR-0.65-0.74) (p=0.01). Peri- operative RI variations, however, did not demonstrate association with the occurrence of ARF (0.2). At a median follow-up period of 12 months (IQR 6-23 months), RI was higher compared to baseline (0. 72 IQR, 0.68-0.75) (p=0.02). Renal decline was observed in 32 patients (31%). Among patients with history of CKD, RI was higher than in patients without CKD (p=0.02). Follow-up RI variations, however, were not associated with renal function decline (p=0.1).

CONCLUSION

ARF and renal function decline are common after FEVAR especially in patients with previous CKD. Similarly, renal perfusion variations occurred after F-BEVAR with increased RIs. Renal perfusion changes, however, are not associated with renal function decline.

CLINICAL RELEVANCE/APPLICATION

Renal function deterioration is common after F-BEVAR. However, post-operative renal perfusion variations are not associated to function decline. Reasons may be related to intrinsic renal disease.

VI220-SD-THA3

MR-Guided Focused Ultrasound (MRgFUS) Compared to the Main Current Therapeutic Approaches for the Treatment of Uterine Fibroids: MR-Guided Focused Ultrasound (MRgFUS) Compared to the Main Current Therapeutic Approaches for the Treatment of Uterine

Thursday, Dec. 5 12:15PM - 12:45PM Room: VI Community, Learning Center Station #3

Participants
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PURPOSE

To prospectively evaluate clinical outcome of Magnetic Resonance Focused Ultrasound (MRgFUS), Uterine Artery Embolization (UAE) and Surgery for Symptomatic Uterine Fibroid

METHOD AND MATERIALS

600 symptomatic uterine fibroids underwent pre-treatment MR evaluation in order to assess myoma characteristics. 202 (34%) were considered eligible to MRgFUS and treated with ExAblate-InSightec 2100 system, while 398 resulted ineligible and were directed toward other therapeutic strategies. Of these, 137 underwent to UAE, 143 to myomectomy and 61 to hysterectomy. Clinical outcome was evaluated comparing pre-treatment Symptoms Severity Score (SSS) with post-treatment SSS at 3-month and 12-month follow-up. Data concerning number and type of complications, days of hospitalization and days of convalescence were also collected and compared

RESULTS

SSS mean reduction at 3 and 12-months was of 27,4% and 56,3%, respectively, for MRgFUS group; 48,7% and 56,9% for UAE group; 69,8% and 67,1% for myomectomy group; 96,6% and 94,5% for hysterectomy group. MRgFUS group demonstrated fewer complications (4 patients, 2,0 %), while the major adverse events rate was reported in UAE group (33 patients, 25,4 %). All MRgFUS patients were treated in outpatient setting, while mean days for hospitalisation and convalescence for other groups were respectively 3,4±2 and 11,7±9 days for UAE group; 4,1±2 and 16,9±12 days for myomectomy group; 4,5±1 and 24,6±14 days for hysterectomy group

CONCLUSION

Clinical efficacy of MRgFUS for uterine fibroids treatment is comparable to UAE but slightly lower than myomectomy. However, MRgFUS is feasible in an outpatient setting and adverse events rate is significantly lower than other therapeutic strategies

CLINICAL RELEVANCE/APPLICATION

MRgFUS treatment has clinical efficacy comparable to UAE but lower than myoectomy for the treatment of uterine fibroids. MRgFUS has an advers events rate significantly lower than UAE and myoectomy.

VI245-SD-THA6

Biodegradable versus Multiple Plastic Stent Implantation in Benign Biliary Strictures: A Systematic Review and Meta-Analysis

Thursday, Dec. 5 12:15PM - 12:45PM Room: VI Community, Learning Center Station #6

Participants
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Paulo Donato, MD, Coimbra, Portugal (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Benign biliary strictures arise mostly from iatrogenic injuries during surgical procedures and various inflammatory causes. Endoscopic placement of multiple plastic stents is often regarded as the first-line therapy, albeit not without limitations. Biodegradable biliary stents present a novel therapeutic option aimed at overcoming these shortcomings. The purporse of this work is to analyze and compare long-term stricture resolution rates between biodegradable and multiple plastic biliary stent implantation in patients with benign biliary strictures, regardless of etiology.

METHOD AND MATERIALS

A systematic review of original articles was conducted on MEDLINE, EMBASE and The Cochrane Library databases. Additional studies were identified by manually searching through article references. Randomized controlled trials, cohort studies and case series regarding biodegradable biliary stent and/or multiple plastic stent use in the bile duct for strictures of benign etiology were selected. Articles were excluded according to predefined criteria. Two authors independently extracted the articles using predefined data fields. Any disagreements between authors on study selection were resolved by consensus.

RESULTS

3 studies for biodegradable stent (n = 133) and 6 for multiple plastic stent technique (n=441) met the inclusion criteria. The overall success rate (defined as no stricture recurrence during follow-up) for biodegradable biliary stent implantation was 83% (95% confidence interval [CI], 0.76-0.89), compared to 84% (95% confidence interval [CI], 0.78-0.89) in the multiple plastic stent group.

CONCLUSION

The insertion of biodegradable biliary stents in the treatment of benign biliary strictures does not seem to be inferior to multiple plastic stents in maintaining long-term biliary duct patency.

CLINICAL RELEVANCE/APPLICATION

Biodegradable biliary stents (BDBS) are a safe and viable option in the treatment of benign biliary strictures (BBS) arising from various etiologies, which may provide a more patient-friendly and possibly cost-effective alternative to multiple plastic stents (MPS), whilst exhibiting low complication rates. However, these findings are greatly limited by the total lack of RCTs and low number of published studies regarding the use of BDBS for BBS.

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VI246-SD-THA7

Combined CT-Guided Biopsy with Tissue Examination and Outer Cannula Washing Cytology: Technique and Outcomes

Thursday, Dec. 5 12:15PM - 12:45PM Room: VI Community, Learning Center Station #7

Participants
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PURPOSE

We aimed to retrospectively examine the effectiveness of the combined use of outer cannula washing cytology and histology in CT-guided tissue-core biopsy. Here, we report the results of this approach.

METHOD AND MATERIALS

At our hospital, 95 patients (mean age, 68 [range, 33 to 84] years; 59 males and 36 females; 63 Thoracic, 24 abdominal, 6 musclockeletal region) were diagnosed between June 2016 and March 2019. As a biopsy needle, we used FINECORE 18 G 100 mm (Toray Medical Doctor Japan). While the inner needle was washed with formalin and submitted for tissue examination, the washing solution inside the outer cannula was submitted for cytodiagnosis.

RESULTS

In 94 patients, we successfully performed the procedure without any serious complications. In 80 patients, we observed malignant findings in histopathology or cytodiagnosis. Although two cases were negative for histological diagnosis and cytological examination, they were malignant after that. Remaining thirteen other cases were benign. Of note, we obtained only cytological malignant findings in the five patients. The sensitivity of the cutting-needle histological biopsy were 91%(75/82), of histology and cytology were 98%(80/82), respectively.

CONCLUSION

In CT-guided biopsy, outer cannula washing cytology can be helpful for diagnosis in addition to conventional histopathology. Our combined approach is effective and useful for the diagnosis of malignant tumors.

CLINICAL RELEVANCE/APPLICATION

Malignancy can be diagnosed despite histodiagnosis being negative. Our approach with cytodiagnosis does not increase the physical burden on patients.

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VI247-SD-THA8

The Utility of Test Bolus for Improving Low Iodine Dynamic 4D CTA in the Diagnosis of Lower Extremity Peripheral Vascular Disease

Thursday, Dec. 5 12:15PM - 12:45PM Room: VI Community, Learning Center Station #8

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

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PURPOSE

To determine the diagnostic accuracy of low iodine 4D dynamic CTA (4D CTA) with a test bolus in lower extremity peripheral vascular disease (PVD).

METHOD AND MATERIALS

68 pts with suspected PVD underwent dynamic 4D CTA of the lower extremities with 40mL Iohexol 350 using either fixed delay (of 13 sec, n=34) or with test bolus (10 cc of Iohexol 350, n=34). Subsequent conventional CTA using a weight-base protocol served as the reference standard. 4D-CTA exams (± test bolus) consisted of 11 low-radiation-dose acquisitions. A vascular radiologist interpreted thin temporally-resolved MIPs (tMIPs) of each lower extremity, a dynamic series displaying the 4D temporal runoff, and thick tMIPs with and without calcium removal. For each lower extremity, arterial stenoses in each of 7 vascular segments was compared to conventional CTA, and was graded as <50%, 50 -70%, >70% or occluded.

RESULTS

Runoff to the level of the ankle was observed for 76% (26/34) patients using 4D CTA with fixed delay compared to 97% (33/34) with test bolus. In patients with runoff to the ankle, overall accuracy for peripheral vascular disease (requiring identical stenosis grading per segment) was 89.6% (326/364; 95% CI: 86 - 95%) for 4D CTA with fixed delay compared to 94.0% (355/378; 95% CI: 91 - 96%) using the test bolus. For stenosis > 70%, 4D CTA demonstrated a sensitivity of 90.3% (56/62; 95% CI: 86 - 95%) with a fixed delay and 90.4% (104/115; 95% CI: 82 - 98%) with a test bolus. For patients with runoff to the ankle, 4D temporal runoff images provided useful information about asymmetrical or collateral flow in 5/26 cases (19.2%) and in 9/32 cases (28.1%), respectively, with one technical failure to generate temporally resolved images in the test bolus arm. Thick tMIPs, with calcium displayed or removed, were only helpful in 15% (4/26) cases with fixed delay, but were helpful in the majority of patients with test bolus 63% (20/32).

CONCLUSION

Using a test bolus, low iodine dynamic 4D-CTA results in high accuracy for the prediction of PVD. It increases the number of patients with runoff to the ankles compared to fixed delay techniques, and provides additional information about asymmetric and collateral flow.

CLINICAL RELEVANCE/APPLICATION

Low iodine dynamic 4D CTA results in accurate prediction of significant peripheral vascular disease, with a test bolus improving runoff to the ankles and providing additional temporal information compared to fixed delay techniques.

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VI248-SD-THA4

Inpatient Placement of a Subcutaneous Venous Access Ports is Not a Risk Factor for Port Infection

Thursday, Dec. 5 12:15PM - 12:45PM Room: VI Community, Learning Center Station #4

Participants
Mohammad-Kasim H. Fassia, BS,MS, Grand Rapids, MI (*Presenter*) Nothing to Disclose
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PURPOSE

Inpatient placement of subcutaneous venous access ports has been associated with increased risk of both short-term (< 30 day) and long-term infectious complications. Streamlining of patient care at our institution has lead to an increase in inpatient referrals for port placement. The purpose of this study was to determine if patients who were admitted to the hospital at the time of port placement were at increased risk of port infection compared to patients who underwent port insertion as an outpatient procedure.

METHOD AND MATERIALS

All ports placed by the interventional radiology department at a single institution in 2018 were identified (N = 892) and retrospectively analyzed. Data were collected regarding the patient's status at time of insertion (inpatient/outpatient), indication for port placement, and the indication for port removal. Infections were defined as clinically suspected port pocket infection or culture positive bacteremia which resulted in antibiotic treatment and/or port removal.

RESULTS

Over the study period, a total of 892 ports were placed by one of 13 attending interventional radiologists. Median patient age was 62 (range: 19 to 91). Of these ports, 751 were inserted in the outpatient setting and 141 placed on inpatients. The most common indication for port placement was solid organ malignancy (146 outpatient, 38 inpatient), followed by hematologic malignancy (26 outpatient, 11 outpatient) and poor peripheral access (5 outpatient, 1 inpatient). The most common indication for port removal was therapy completion (70 outpatient, 7 inpatient) followed by infection (16 outpatient, 7 inpatient). In 118 patients the port was still implanted at the time of death. No statistically significant difference in the port infection rate was observed between ports placed in the inpatient setting versus the outpatient setting ($p = 0.89$).

CONCLUSION

Inpatient status at the time of port insertion does not increase the risk of infectious complication of a subcutaneous venous access port.

CLINICAL RELEVANCE/APPLICATION

Inpatient placement of subcutaneous venous access ports do not increase the risk of port infection

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AI002-EC-THB

Generative Adversarial Network Models for Prediction of Survival in Patients with Interstitial Lung Diseases

Thursday, Dec. 5 12:45PM - 1:15PM Room: AI Community, Learning Center Custom Application Computer Demonstration

Participants
Tomoki Uemura, MS,BA, Boston, MA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Generative adversarial networks (GANs) can be used for predicting survival of patients from their chest CT images. The teaching points of this exhibit are (1) to explain the role of GAN in survival analysis, (2) to introduce state-of-the-art GAN models for survival estimation of patients with interstitial lung disease (ILD), and (3) to provide recommendations for GAN-based survival estimation in chest CT images.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Generative adversarial networks (GANs) 3. GAN-based survival analysis methods in chest CT images 4. Interstitial lung diseases (ILDs) 5. GAN-based survival estimation of patients with ILDs 6. Recommendations

Printed on: 10/29/20

AI009-EC-THB

Common-Space-Learning from Multi-Modality for Missing MRI Synthesis and Glioma Grading

Thursday, Dec. 5 12:45PM - 1:15PM Room: AI Community, Learning Center Custom Application Computer Demonstration

Participants
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Conclusion

Our model achieved more accurate glioma grading than simply using single modality and eventually led to a comparable performance to that with complete modalities.This provides a clinically feasible grading solution with limited imaging modality

Background

Gliomas is one of the most lethal cancers.Early and accurate preoperative glioma grading based on MRI is important for personized therapy.Despite multimodality data provide complementary information,a complete set of high-resolution multimodality MRI is costly and usually impossible to acquire in clinical settings,where T1 MRI is more commonly acquired.To leverage more comprehensive multimodality information for better glioma grading instead of doing so with T1 MRI only,we introduce a novel common-space-learning-based deep-learning model for missing MRI image synthesis based on T1 MRI and use the comprehensive feature from the common space to achieve a clinically feasible glioma grading

Evaluation

In the training set,common space is estimated by utilizing four MRI modalities(T1,T1c,T2,FLAIR) with adversarial context-aware learning.In the testing set where only T1 MRI is available,we synthesize other three modalities,compute their features in the common space,and perform the glioma grading.Results show that our method achieves greatly improved accuracy,sensitivity,and specificity of 0.879,0.851,and 0.909 against the conventional T1 MRI-based grading of 0.812,0.791,and 0.833.In particular,the tumor core is correctly estimated in the synthesized T1c,which is better than the state-of-the-art methods(i.e., c-GAN).Gradient-weighted Class Activation Mapping(GradCAM)further verifies that the tumor lesions contribute to the grading

Discussion

Our model has three main innovations:1)It is trained with four modalities,both the inherent inter-modality relationship and the lesion-specific representation are explicitly encoded in common space to jointly guarantee the robustness;2)The common space can comprehensively represent multimodality information,making the grading more accurate than traditional single modality-based grading;3)The edge-ware and tumor-aware learning strategy enable to capture the context information for improvement of the synthesized tumor

AI200-SD-THB1

A Federated Convolutional Denoising Autoencoder for MRI Applications

Thursday, Dec. 5 12:45PM - 1:15PM Room: AI Community, Learning Center Station #1

Participants
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CONCLUSION

The proposed federated approach improves the performance of independent CDAEs without direct access to the data, enabling us to effectively address the critical issues of data availability (in terms of both sample size and restricted access) and model generalization for clinical applications.

Background

Denoising is an essential part of medical images preprocessing and autoencoders became the state-of-the-art method for it. Their performance depends on training images with noise characteristics ideally as heterogeneous as that found in the real word. This is best achieved by pooling images from different hospitals with varied noise sources, which crucially entails data privacy limitations.

Evaluation

240 MPRAGE MRI volumes from the publicly available ADNI dataset (adni.loni.usc.edu) were equally divided into 4 virtual hospitals (VHs). Data were first interpolated to a common matrix size (96x128x128) and rescaled. Noisy volumes were then created from these by simulating, five noise sources commonly found in clinical MRI: thermal noise, Gibbs ringing, k-space spikes, ghosting and zipper artifacts. For each VH a unique combination of the noise artifacts was used. For the denoising we trained 3D convolutional denoising autoencoders (CDAEs): 1. on the dataset of a single VH; 2. on the pooled dataset; 3. with a federated learning approach. The federated CDAE (3.) is obtained by training single models for each VH independently and combining them after random intervals. We quantified the performances of the three models by calculating the structural similarity index (SSIM) comparing the original images and the calculated test denoised images using the single-VH CDAE (SSIM=0.69), the pooled CDAE (SSIM=0.79) and the federated CDAE (SSIM=0.73).

Discussion

Image denoising with the federated CDAE outperforms results obtained with the single-hospital CDAE, showing the effectiveness of the federated learning approach. This indicates that it is possible to train CDAE models with relatively small local datasets and high noise heterogeneity and then combine them with federated learning into a more accurate and transferable model.

AI202-SD-THB3

Vulnerability of Deep Learning based Computer-Aided Diagnosis: Experimental Adversarial Attack Against CT Lung Nodule Detection Model

Thursday, Dec. 5 12:45PM - 1:15PM Room: AI Community, Learning Center Station #3

Participants
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CONCLUSION

Deep learning models possessed vulnerability to perturbed input, and showed varying degree of performance degradation to different attacks. Deep learning models for CAD system needs to be verified with respect to their vulnerability to perturbation and adversarial attacks.

Background

Recent developments of deep learning technique have drawn attention from medical imaging community with outstanding performance and appear to give promise for future applications in computer-aided diagnosis. However, there still exist concerns about inherent uncertainty of the behavior of deep learning models, which needs to be thoroughly investigated before clinical translation. Adversarial attack is a useful technique for testing deep learning models by exposing them to a set of intentionally perturbed examples and evaluating the performance degradation. This study investigates the vulnerability of deep learning models for basic object classification and CT nodule detection tasks.

Evaluation

We evaluated the vulnerability of three deep learning models each trained with MNIST, CIFAR-10, and LIDC-IDRI dataset. Four latest adversarial attack algorithms were employed to generate adversarial examples for perturbing the first two deep learning models, and selected an appropriate attack algorithm for use in the test of the deep learning model for CT lung nodule detection.

Discussion

The classification performance of MNIST-trained deep learning model degraded from 0.98 before attack to 0.70, 0.78, 0.01, and 0.02 after attack by four different algorithms. The performances of CIFAR-10-trained model also degraded from 0.73 before attack to 0.11, 0.16, 0.13, and 0.02 after attacks. Performance of the CT lung nodule detection model showed gradual degradation according to the increasing degree of perturbation: AUROC was 0.95 before attack, and decreased to 0.915, 0.903, 0.890 after attack; sensitivity was 0.877 before attack, and decreased to 0.854, 0.807, 0.717 after attack.

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AI250-SD-THB2

Medical Federated Deep Learning (MedFDL) for Automatic Body Part Labeling of CT Scout Images

Thursday, Dec. 5 12:45PM - 1:15PM Room: AI Community, Learning Center Station #2

Participants
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Anouk Stein, MD, Paradise Valley, AZ (*Abstract Co-Author*) Consultant, MD.ai, Inc; Stockholder, MD.ai, Inc
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PURPOSE

Body part information in radiology exam metadata is often unreliable. Deep learning models that can determine body parts from CT scout images could help estimate radiation dose and improve clinical workflow through hanging protocols and relevant priors. Patient privacy concerns limit data sharing across institutions which otherwise might facilitate a more generalizable model. We hypothesize that a multi-label, multi-class deep learning model can reliably identify body parts in CT scout images and that sequential federated training on two different datasets can attain comparable performance to pooled data.

METHOD AND MATERIALS

565 CT scout images from institution 1 and 534 from institution 2 were anonymized, cropped to remove blank space, resized to 256 x 256, and then labeled with any number of 7 body parts (head, neck, chest, abdomen, pelvis, upper extremity, lower extremity). Labeled data was randomly split into 80% train, 10% validation, and 10% test sets. A multi-label, multi-class model based on MobileNetV2 architecture using the Keras deep learning library was trained first on data solely from institution 1, then institution 2, and then on pooled and shuffled data. Accuracy was compared for single institution models, naive cross-testing, single institution models retrained sequentially, and pooled data.

RESULTS

Frequency of body part labels ranged from 7.9-41.1% for institution 1 and 6.1-43.0% for institution 2. For institution 1, 81.5% of test predictions were completely correct for all labels while 98.1% were at least partially correct (92.6-100% across all body parts); results were 84.9% and 96.2% for institution 2 (90.6-100%). Many incorrect labels were defensible as scout images often partially included additional body parts. Results for the model from institution 1 were 58.5% and 75.5% when tested naively on institution 2; the reverse was 55.6% and 96.3%. If model 1 is re-tuned on data from institution 2, results are 79.2% and 98.1% with the reverse 77.8% and 98.1%. When all data is pooled to generate a single model results are 79.4% and 96.3%.

CONCLUSION

A deep learning model can reliably detect most body parts from CT scout images. Sequential federated training on two different datasets across institutions produces comparable results to isolated training on pooled data.

CLINICAL RELEVANCE/APPLICATION

Reliably detecting body part from CT scout images can help with radiation dose estimation as well as clinical workflow.

BR218-ED-THB6

Developing Asymmetries without Sonographic Correlates: Our Experience, Teaching Points, and Review of Literature

Thursday, Dec. 5 12:45PM - 1:15PM Room: BR Community, Learning Center Station #6

Participants
Shawdi Manouchehr-Pour, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
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Linda Hovanessian-Larsen, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

- Review definition, prevalence, and significance of developing asymmetry - Present how we approach developing asymmetries using illustrative case examples, with emphasis on cases without sonographic correlate - Review current literature and recommendations including utility of MRI and tomosynthesis

TABLE OF CONTENTS/OUTLINE

I. Introduction - Definition - Significance: risk of underlying malignancy - Differential diagnosis II. Assessment of developing asymmetry - Additional mammographic views to confirm and help localize finding - Targeted ultrasound to look for sonographic correlate - Percutaneous biopsy under sonographic or stereotactic guidance unless definite benign US correlate (e.g. simple cyst) - Radiologic-pathologic correlation - Role of digital breast tomosynthesis - MRI as a problem solving tool: (1) inconclusive or equivocal mammographic and sonographic work up, (2) no sonographic correlate and unable to perform stereotactic biopsy, or (3) radiologic-pathologic discordance - Pitfalls (e.g. skin lesions) III. Pictorial case examples of developing asymmetries without sonographic correlates presented with benign and malignant histopathology, clinical pearls, and relevant literature review

BR219-ED-THB7

Papillary Lesions of the Breast Diagnosed at Percutaneous Biopsy: Is Surgery Mandatory?

Thursday, Dec. 5 12:45PM - 1:15PM Room: BR Community, Learning Center Station #7

Participants
Maria P. Swiecicki, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
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Maria Jose Chico, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

To identify imaging criteria that may assist in the diagnosis of papillary lesions and eventually in their management.To discuss the role of percutaneous biopsy (ultrasound guided core biopsies and vacuum-assisted biopsies with stereotactic guide) in the diagnosis of papillary lesions.To consider factors related to upgrade rates at surgical biopsy and their correlate at imaging.To describe the current controversies in the management of these lesions and the role of imaging and interventional radiology in this subject-matter.

TABLE OF CONTENTS/OUTLINE

Introduction and review of current literature.Evaluation of papillary lesions at imaging, the role of percutaneous biopsies at diagnosis and the risk of upgrade after surgical excision.Illustration with cases from our institution.Discussion of benefits and pitfalls of percutaneous biopsies regarding the management of papillary lesions.Conclusions.

BR220-ED-THB8

Make RHEUM for Breast Disease

Thursday, Dec. 5 12:45PM - 1:15PM Room: BR Community, Learning Center Station #8

FDA Discussions may include off-label uses.

Awards
Certificate of Merit

Participants
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Rifat A. Wahab, DO, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Mary C. Mahoney, MD, Cincinnati, OH (*Abstract Co-Author*) Researcher, General Electric Company

TEACHING POINTS

To characterize the clinical and pathological presentation of breast disease in patients with a concurrent rheumatologic disease or connective tissue disorders. To discuss when radiologists should include rheumatologic patterns of disease in their differential considerations. To summarize the imaging findings associated with rheumatologic and connective tissue manifestations in the breast. To utilize sample cases to better equip the radiologist in differentiating mimics of breast malignancy from other entities, such as lupus, sarcoid, and vasculitis.

TABLE OF CONTENTS/OUTLINE

Common breast manifestations of Sarcoid, Lupus, vasculitis and other granulomatous and connective tissue diseases. Incidence/prevalence of breast cancer in patients with a rheumatologic disease. Rheumatologic and connective tissue disease mimickers. Common breast imaging findings and complications seen with rheumatologic diseases. Sample cases including: Systemic Lupus Erythematosus Rheumatoid Arthritis Sjogren's Syndrome Vasculitis Cogan's Syndrome Dermatomyositis Scleroderma Polymyalgia Rheumatica Sarcoidosis

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BR249-SD-THB2

Staging Nodal Ultrasound in Breast Cancer: Can Metastases Skip Contiguous Nodal Basins or Do They Always Follow Expected Pathways?

Thursday, Dec. 5 12:45PM - 1:15PM Room: BR Community, Learning Center Station #2

Participants
Hannah L. Chung, MD, Houston, TX (*Presenter*) Nothing to Disclose
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Jia Sun, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To identify the patterns of nodal disease in newly diagnosed invasive breast cancers and to determine the frequency of skipped metastases and associated tumor characteristics.

METHOD AND MATERIALS

This is a HIPPA compliant and IRB-approved retrospective cohort study, consisting of 1100 ultrasound (US) exams performed for nodal staging of newly diagnosed invasive breast cancers in a 15-month period at a single institution. The US nodal staging protocol consists of imaging the axillary levels I, II, III and internal mammary chain (IMC) ipsilateral to the cancer, with additional imaging of the supraclavicular (SC) space if any of the axillary levels or IMC is positive. Electronic medical records were reviewed. We recorded and analyzed the following: patient age, tumor size, location, histology, grade, ER/HER2 status, US findings, and nodal biopsy results.

RESULTS

US and biopsy excluded nodal involvement in 705 cancers. 395 cases had any positive nodal disease (N+). The highest level of nodal involvement: 223 (56%) level I, 43 (11%) level II, 48 (12%) level III and 77 (20%) SC. 4 (1%) cases had isolated IMC disease without axillary involvement. Among the 395 N+ cases, US detected an additional 172 N+ cases beyond level I. Excluding level II disease, there were 129 cases involving the higher nodal basins. US beyond axillary level I thus changed the N staging in 33% (129/395) of all new breast cancers. Skipped metastases (SM) were defined as non-contiguous spread from axillary level I to II to III to SC. In total, there were 16 SM (Figure), yielding a 4.0% (16/395) incidence (95% exact binomial CI .023, .065). By Fisher's exact test, lower grade and lobular histology were significantly associated with SM. No association was found with patient age, tumor size, location, or ER/HER2 status.

CONCLUSION

Nodal metastases may not be contiguous and unpredictable patterns of nodal spread occur. SM may occur at any level but most commonly skipped to the SC region with an observed 4% incidence.

CLINICAL RELEVANCE/APPLICATION

Comprehensive nodal basin US identifies unsuspected disease. If axillary level I is positive, then the remainder of regional nodal chains should be imaged. Accurate US staging has important effects on treatment planning and prognosis.

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BR250-SD-THB3

Machine Learning Model Generalizes Across Manufacturers and Clinical Sites

Thursday, Dec. 5 12:45PM - 1:15PM Room: BR Community, Learning Center Station #3

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Participants
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William Lotter, PhD, Cambridge, MA (*Abstract Co-Author*) Officer, DeepHealth Inc
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PURPOSE

Generalization is critical for the successful clinical application of machine learning and cannot be assumed; recent studies have shown that indeed many machine learning algorithms (or models) do not transfer across populations or even across different imaging equipment manufacturers. Applying machine learning to screening mammography has shown promise in classifying the presence of cancer, but many of the results presented so far have been tested on data taken from the same distribution from which the algorithms were trained, including the same manufacturer and the same clinic. Therefore, we sought to develop and test a model that could translate from one manufacturer to another and from one site to another.

METHOD AND MATERIALS

We compiled two separate testing data sets consisting of de-identified images and linked reports, collected from two mammography centers (Site A and Site B) following an IRB-approved protocol. Data originated from GE equipment and included presentation FFDM studies from both sites. We developed a novel convolutional neural network (CNN) architecture and trained this model using entirely Hologic data, including the Digital Mammography DREAM Challenge training data set. The model was tested on the DREAM challenge test set and additionally on the two different data sets described: Site A: 1880 studies and 41 biopsy-confirmed malignancies, and Site B: 1792 studies and 83 biopsy-confirmed malignancies. The receiver operating characteristic (ROC) curves and the corresponding area-under-the-curve (AUC) were calculated for each of the two data sets. The AUC was obtained from the DREAM test set but due to the data being protected, the ROC curve was not reported to us.

RESULTS

AUC values for performance on the test datasets were: DREAM: 0.90, Site A: 0.91, and Site B: 0.89.

CONCLUSION

The developed machine learning model demonstrated successful transfer across different manufacturers and different clinical sites.

CLINICAL RELEVANCE/APPLICATION

Machine learning can be developed so that testing at new sites and with new manufacturers does not result in significant loss of performance; such robustness is critical for deploying machine learning to the clinic.

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BR263-SD-THB4

Preoperative Prediction of Regional Lymph Node Metastasis of Breast Cancer by Radiomics of DCE-MRI with an Ensemble of Deep Learning Models

Thursday, Dec. 5 12:45PM - 1:15PM Room: BR Community, Learning Center Station #4

Participants
Pengfei Deng, Xian, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Accurate staging of regional lymph nodes (RLN) provides important prediction and prognostic information in the management of breast cancers. Therefore, we tried to preoperatively predict regional lymph node (RLN) metastasis of breast cancer by radiomics analysis of dynamic contrast-enhanced MRI (DCE-MRI) with an ensemble of deep learning models.

METHOD AND MATERIALS

The DCE-MRI images of 108 breast cancer patients in this retrospective study included five phases (from first phase to fifth phase) of contrasted images, which were partitioned to training set (n=76) and testing set (n=32). Centered on the geometrical center of each breast mass, we cropped the original image into squared region of interest (ROI) with 80×80 pixel. Then, five phases of contrasted images were used to train five deep learning (DL) models, respectively. Each DL model was modified from inception V3 by adding a fully connected layer with 128 nodes before reaching the prediction output. During validation, the prediction for each slice of a patient derived from the ensemble of five predictions made by the five DL models. Finally, the metastasis characteristic of a patient was determined by summarizing the predictions on all of the slices with majority voting.

RESULTS

On the training set, the area under the curve (AUC) values of each one of the five DL models and the ensemble model were approximated to 1.00. On the testing set, the AUCs for the five models were 0.82, 0.92, 0.87, 0.91, and 0.91, respectively. However, the AUC for the ensemble of five models achieved a high value of 0.94.

CONCLUSION

The DL model has reached a high prediction accuracy on each contrasted MRI image, however the AUC values were not consistent among different phases. Especially, the AUC of the first phase of contrasted image was below 0.85. By using the ensemble strategy, this study achieved the highest AUC value, beyond the prediction accuracy on any DL model.

CLINICAL RELEVANCE/APPLICATION

Our proposed method can accurately predict RLN metastasis of breast cancers, which has great potential to be a powerful tool of clinical management of breast cancers.

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BR264-SD-THB5

Usefulness of Imaging Findings in Predicting Tumor Infiltrating Lymphocytes in Patients with Invasive Breast Cancer

Thursday, Dec. 5 12:45PM - 1:15PM Room: BR Community, Learning Center Station #5

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Tumor-infiltrating lymphocytes (TILs) have been determined as a new prognostic biomarker and the indicator of immunotherapy response in breast cancer. The aim of this study is to investigate the effectiveness of imaging features in predicting TILs levels in invasive breast cancer patients.

METHOD AND MATERIALS

From November 2015 through January 2019, a total of 158 patients with histopathologically confirmed invasive breast cancer included in our study. All lesions were evaluated based on BIRADS lexicon. Ultrasoun (US) was performed for all patients and 89 of these patients underwent magnetic resonance imaging (MRI) for preoperative assesment. The histologic stromal TIL (sTIL) levels were assessed based on the guidelines of the International Immuno-Oncology Biomarker Working Group on Breast Cancer. Associations between TILs and imaging features were evaluated. Comparison of variables were performed by Mann-Whithey U and Kruskal-Wallis test and based on the significant variables acquired from univariate analysis, logistic regression was performed. Finally, ROC analysis was applied to test the diagnostic power of a logistic regression analysis model.

RESULTS

Tumors with high TIL levels had a more circumscribed margin, a round shape , heterogen echogenity and larger size by ultrasonography ($p< 0.005$). There was a statistically significant positive correlation between TILs level and appearent diffusion coefficient (ADC) value ($p<0.001$). Tumors with high sTIL levels had more homogeneous enhancement than tumors with low TIL levels and statistically significant difference was found between them ($p= 0.001$). Logistic regression analysis showed that ADC was the most statistically significant parameter in predicting TILs level (The odds ratio was 90.952; $p=0.002$). The optimal cutoff value for ADC in predicting low and high TILs level was found 0,87x10-3 mm2 s-1 (AUC= 0.726).

CONCLUSION

Imaging findings, especially ADC may play an important role in predicting sTIL levels as a noninvasive method and improve the accuracy of biopsy results in uncertain situations and also give an opportunity for optimal treatment management and prognosis estimation.

CLINICAL RELEVANCE/APPLICATION

The prediction of sTIL levels using imaging findings may give an opportunity for optimal treatment management and prognosis estimation.

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CA227-SD-THB1

Quantitative Assessment of Myocardial Strain of LVNC Based on CMR Tissue Tracking

Thursday, Dec. 5 12:45PM - 1:15PM Room: CA Community, Learning Center Station #1

Participants
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PURPOSE

To explore the strain pattern of adult left ventricular non-compaction(LVNC) based on cardiac magnetic resonance tissue tracking(CMR-TT) and its diagnostic value.

METHOD AND MATERIALS

Twenty-four patients with LVNC were enrolled and were divided into two groups according to left ventricular ejection fraction(LVEF). We defined LVNC with LVEF>50%(12 patients) as group A and LVNC with LVEF<50% as group B(12 patients), and 20 normal people were included as control group(group C). We used CVI42 software to measure the radial strain (RS), circumferential strain (CS) and longitudinal strain (LS) of global myocardial deformation and various levels strain (basal strain, mid-cavity strain, apical strain).We define the strain differences between basal level and apical level as basal-apical gradient. Chi-square test was used to compare numbers of non-compacted segments between group A and group B, and independent T test was used to compare non-compacted segments mass percentage between the two groups. The differences of strain parameters of the three groups were compared by Kruskal-Wallis H test.

RESULTS

(1)Group B had more non-compacted segments than group A(49vs22, P=0.017), while there was no significance of non-compacted segments mass percentage between the two groups. (2)Compared with group C, global strain and different level strains of group B were significantly lower (P<0.05), while group A had lower GLS and apical RS (P<0.05), other strain parameters were not significantly different (P>0.05). GLS, basal CS, mid-cavity LS, apical LS of group B were significantly lower than group A.(3)Group B had lower basal-apical CS and LS gradient strain compared with other two groups, but there was no significance of basal-apical RS gradient strain among three groups.(4)When the cut-off of GLS was -11.08%, the sensitivity and specificity to identify LVNC with EF>50% and normal people were 87.5%, 75.0% respectively.

CONCLUSION

CMR-TT can quantitatively assess the strain pattern of left ventricular myocardium in LVNC patients and predict the occurrence of left ventricular systolic dysfunction. GLS is an important factor in differentiating LVNC with EF > 50% patients from normal people.

CLINICAL RELEVANCE/APPLICATION

CMR-TT can quantitatively assess the strain pattern of left ventricular myocardium in LVNC patients. GLS provides strong diagnostic information of LVNC with EF > 50% patients.

CA228-SD-THB2

Clinical Significance of Corrected Relative Flow Reserve Derived from N-13 Ammonia Positron Emission Tomography Combined with Coronary Computed Tomography Angiography

Thursday, Dec. 5 12:45PM - 1:15PM Room: CA Community, Learning Center Station #2

Participants
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PURPOSE

PET-derived relative flow reserve (RFR) is estimated a good indicator in the assessment of coronary artery disease compared to fractional flow reserve (FFR). However, it is difficult to calculate correct RFR because of different coronary territories among individuals. The purpose of this study was to evaluate corrected RFR derived N-13 ammonia PET combined with coronary CT angiography (CTA) .

METHOD AND MATERIALS

We analyzed 61 patients who underwent coronary CTA, N-13 ammonia PET and invasive coronary angiography. Conventional RFR was calculated as the ratio of hyperemic myocardial blood flow (MBF) of hypoperfusion area as target to hyperemic MBF of non-ischemic lesion as reference. Corrected RFR was calculated using coronary CTA to adjust the coronary territories to their feeding vessels. We compared the diagnostic performance to detect obstructive coronary lesion among quantitative PET measurements.

RESULTS

On a per-vessel basis, 180 vessels were analyzed and 50 of these were diagnosed as obstructive coronary lesion (>=70% stenosis and/or FFR <=0.8). Hyperemic MBF, conventional RFR and corrected RFR were significantly lower in territory by vessels with obstructive coronary lesion compared with those without obstructive lesion: 1.77±0.54 vs. 2.19±0.50 for hyperemic MBF, 0.694±0.153 vs. 0.896±0.081 for conventional RFR and 0.695±0.136 vs. 0.908±0.073 for corrected RFR, respectively (P<0.01). In receiver operating characteristic curve analysis, those quantitative PET measurements had an area under the curve of 0.71, 0.89 and 0.92 respectively. The diagnostic performance between corrected and conventional RFR was statistically no significant difference, but 15% of hypoperfusion areas were correctly reassigned to different coronary territories by corrected RFR.

CONCLUSION

Corrected RFR would be a better diagnostic tool for the assessment of individual patients for decision-making of treatment.

CLINICAL RELEVANCE/APPLICATION

Corrected RFR derived N-13 ammonia PET combined with coronary CTA enables us to assess regional myocardial perfusion accurately, and it can play a major role as a clinical tool for the assessment of obstructive coronary lesion.

CA229-SD-THB3

Comprehensive Morpho-Functional and Structural Characterization of the Left-Ventricle in a Mouse Model of Acute Ischemia/Reperfusion Injury with a Single CMR 3D Flash Intra-Gate Cine Sequence

Thursday, Dec. 5 12:45PM - 1:15PM Room: CA Community, Learning Center Station #3

Participants
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PURPOSE

To assess the feasibility of LGE semiautomatic quantification from a 3D cine-FLASH sequence for a single shot evaluation of morpho-functional features of the left ventricle and myocardial scar burden with LGE in a mouse model.

METHOD AND MATERIALS

16 mice underwent 7-T cardiac MR (Bruker, BioSpec 70/30) including optimized intragate cine-FLASH sequence acquired ~20 minutes post-Gd injection at different time points after acute ischemia/reperfusion injury (day 1, 5 and 28). At the same time points all mice underwent echocardiography for the evaluation of ejection fraction (EF) both on the short (SA-EF) and the long (LA-EF) axis of the left ventricle. Left ventricle end-diastolic volume (LVEDV) and the ejection fraction (LVEF) were semiautomatically measured in MR using a dedicated software (Circle, CVI42). LGE% was measured with different methods based on tissue reference ROI (+2SD, +3SD, +4SD, +5SD) and on auto-threshold. In order to identify the most accurate method for LGE evaluation, LGE% obtained were compared with LGE% at manual segmentation by an experienced operator and scar burden (%) at histological evaluation. LGE % was also correlate with LVEF at MR and echocardiography.

RESULTS

LVEDV slightly increase at day 28 (day 1: 0.080ml, day 5: 0.086ml and day 28: 0.086ml). EF dropped at day 1 (37.08%) and persisted significantly decreased at day 5 (36.41%) with a slight restore at day 28 day (44.53%). Manual LGE was larger at day 1 (18%) with a progressive reduction overtime (17% at day5 and 6% at day 28, $p>0.05$). The semiautomatic method which reached the highest agreement with manual segmentation for scar burden evaluation was +3SD (bias -0.67%, coefficient of repeatability 5.29% and a reproducibility of 73%). LGE% strongly correlated with LVEF with higher correlation for LVEF measured with MR ($p=5.595e-6$)rather than with echocardiography, especially if measured on short-axis ($p=0.001$).

CONCLUSION

Post contrast 3D cine-FLASH is a robust and fast technique for a combined global assessment of myocardial volume and function; moreover it provides an accurate quantification of LGE, which reflects myocardial tissue dynamic changes in acute ischemia/ reperfusion.

CLINICAL RELEVANCE/APPLICATION

Faster and "comprehensive" MRI sequences - such as 3D cine FLASH post contrast - allow a drastic reduction of total scan time, which is a critical point in both preclinical and clinical MRI setting.

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CA244-SD-THB4

Ultra-Low Radiation Dose with Third Generation DSCT for Trans-Catheter Aortic Valve Implantation Planning

Thursday, Dec. 5 12:45PM - 1:15PM Room: CA Community, Learning Center Station #4

Participants
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Giacomo Agliata, MD, Saint-Denis, France (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate image quality (IQ), aortic annulus CT derived area correlation with implanted prosthesis size, and radiation dose (RD) using third generation dual source computed tomography (DSCT) for trans-catheter aortic valve implantation (TAVI) planning.

METHOD AND MATERIALS

In this prospective study were enrolled, from September 2018 and February 2019, 185 consecutive patients (102 male and 83 female, mean age 73.5 ± 5.2 years, mean BMI 25.9 ± 3.1 kg/m2) undergoing CT examination for TAVI planning. All exams were performed using DSCT (SOMATOM Force, Siemens Healthineers, Germany) with turbo flash protocol (TFP) (pitch factor, 3.2) and 45 ml of contrast agent (370 mg of iodine per ml, Iopamidolo; Bracco Imaging, Italy). Mean intravascular attenuation (IA) and mean contrast-to-noise ratio (CNR) were calculated at level of aortic root, ascending/descending aorta, sub-renal aorta, and right and left common femoral arteries. Two reader radiologists used a 5-point visual scale to assess subjective IQ, and inter-reader agreement was evaluated with kappa agreement coefficient (k). Aortic annulus CT derived area were correlate with implanted prosthesis size with Pearson correlation coefficient (r). Mean dose length product (DLP) and mean effective dose (ED) were calculated.

RESULTS

Mean IA at the level of aortic root, ascending/descending aorta, subrenal aorta, and right and left common femoral arteries were, respectively, 572.4 ± 42.1 Hounsfield Unit (HU), 581.2 ± 56.2 HU, 585.9 ± 61.2 HU, 591.7 ± 51.2 HU, 596.4 ± 41.8 HU, and 597.2 ± 39.6 HU. Mean CNR, at the same levels, were, respectively, 15.8 ± 1.8, 16.1 ± 1.9, 16.3 ± 2.1, 17.5 ± 3.2, 19.2 ± 6.9, and 19.8 ± 7.4. Median subjective IQ score was > 4, and inter-radiologist agreement was excellent (k = 0.947). Aortic annulus CT derived area showed very good correlation with implanted prosthesis size (r = 0.951 %, p > 0.0001). Mean DLP and mean ED were 227.1 ± 11.2 mGy/cm and 3.18 ± 0.02 mSv, respectively.

CONCLUSION

Third generation DSCT with TFP for TAVI planning allowed, with ultra-low RD, high IQ and very good correlation between aortic annulus CT derived area and implanted prosthesis size.

CLINICAL RELEVANCE/APPLICATION

Third generation DSCT with TFP allows to reduce considerably radiation dose, compared to the works present in literature, with an accurate and excellent imaging quality for TAVI planning.

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CA245-SD-THB5

The Application Value of 'One-Stop' CT Myocardial Perfusion Imaging in the Quantitative Evaluation of Patients with Severe Coronary Artery Stenosis: Compared Against Cardiac Magnetic Resonance Imaging

Thursday, Dec. 5 12:45PM - 1:15PM Room: CA Community, Learning Center Station #5

Participants
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PURPOSE

To investigate the application value of 'one-stop' CT myocardial perfusion imaging [CT-MPI+coronary CT angiography (CCTA)+CT cardiac function (CTF)] in patients with severe coronary artery stenosis, and further compared with cardiac magnetic resonance (CMR).

METHOD AND MATERIALS

50 patients confirmed at least one coronary artery severe stenosis (>=90%) on coronary angiography (CAG) and referred for coronary stent implantation were prospectively enrolled. 'One-stop' CT-MPI was performed within one week before surgery, of which 22 patients underwent CMR. Quantitative perfusion parameters were calculated by the software Ziostation2 (Minato-kuTM, Japan), including myocardial blood flow (MBF), myocardial blood volume (MBV), mean transit time (MTT) and time to peak (TTP). ROIs were put at myocardium with and without perfusion defect respectively, which was judged referred to CAG results. And the left ventricular (LV) function parameters encompassing ejection fraction (EF), end-systolic volume (ESV), end-diastolic volume (EDV) and stroke volume (SV) obtained from CTF and CMR were also measured by Ziostation2. *T*-test was used to compare the perfusion parameters between the two types of myocardium. The relative perfusion parameters (defect/normal myocardium) of CT-MPI and CMR-MPI were calculated and analyzed by Person correlation analysis. Bland-Altman analysis was used to assess the consistence of LV function parameters between CT and CMR.

RESULTS

The number of patients with severe stenosis in LAD, LCX, RCA detected by CCTA were 39,14,27 respectively. Compared with normal myocardium, the MBF and MBV of myocardium with perfusion defect decreased significantly, while MTT and TTP prolonged (all $P<0.05$). The rMBV, rMBF, rMTT and rTTP of CT-MPI and CMR-MPI had a medium to high positive correlation. The LV function parameters measured by the two methods were highly consistent. And the effective dose of 'one-stop' CT-MPI was 3.5±0.3mSv.

CONCLUSION

'One-stop' CT-MPI can simultaneously assess coronary anatomy, myocardial perfusion and LV function with good agreement with CMR results, which provides an alternative assessment tool for patients with severe coronary artery stenosis.

CLINICAL RELEVANCE/APPLICATION

'One-stop' CT-MPI can be a reliable and accurate tool to comprehensively assess the condition of patients with severe artery stenosis and help clinical decision making and pre-operative evaluation.

CH239-ED-THB7

Imaging Assessment of Thoracic Vasculitis

Thursday, Dec. 5 12:45PM - 1:15PM Room: CH Community, Learning Center Station #7

Awards
Identified for RadioGraphics

Participants
Kaitlin Marquis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
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Sanjeev Bhalla, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Vladimir N. Despotovic, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Constantine A. Raptis, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Review imaging findings by affected vessel size that present on CT2. Discuss competing diagnoses that have imaging findings that overlap with thoracic vasculitides3. Present a framework for the utilization of CT imaging findings in developing a differential diagnosis in patients with a suspected thoracic vasculitis

TABLE OF CONTENTS/OUTLINE

A) Clinical considerations - Discuss the variable presentations of patients with thoracic vasculitidesB) Imaging findings - Large and medium vessel findings - Wall thickening - Surrounding inflammation - Stenoses - Aneurysms - Small vessel findings - Hemorrhage - Organizing pneumonia - Infarcts - Necrosis - Fibrosis - Mosaic attenuation - Non-vascular inflammationC) Mimics - Large and medium vessel mimics - Intramural hematoma - Periaortitis - Small vessel mimics - Septic embolism - Infections - Other inflammatory conditions - Bland infarcts - MalignanciesD) Forming a differential diagnosis - Present a hierarchy of imaging findings based on specificity for developing a differential diagnosis (see PDF)

CH240-ED-THB8

OnwARDS and UpwARDS TowARDS Understanding Acute Respiratory Distress Syndrome: A Comprehensive Imaging Review

Thursday, Dec. 5 12:45PM - 1:15PM Room: CH Community, Learning Center Station #8

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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Sara Zafar, MBChB, MRCP, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Aisling Fagan, MBBCh, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Acute respiratory distress syndrome (ARDS) is a stereotypical but catastrophic response to direct or indirect lung 'injury'. Patients with ARDS are commonly referred to the adult intensive care unit (ICU) at our tertiary cardio-respiratory centre and to ICUs worldwide. The purpose of this exhibit is: • To learn the 'typical' and 'atypical' imaging findings in acute respiratory distress syndrome • To understand the role of CT: o At diagnosis, including the concept of 'recruitment' at high positive end-expiratory pressure (PEEP) o In monitoring, including during extra-corporeal membrane oxygenation (ECMO) support • To appreciate the importance of prone positioning and the contribution of CT in assessing response • To recognise complications on imaging, occurring either as a consequence of the natural history of ARDS or as a result of ventilator-induced barotrauma • To understand the potential importance of airway abnormalities in ARDS as a sign of fibrosis • To review the long-term pulmonary sequelae in ARDS survivors

TABLE OF CONTENTS/OUTLINE

• Aim • Background and epidemiology • Definition and pathophysiology • Acute phase imaging findings, including recruitment and prone imaging • Monitoring progression and prognostication • ECMO imaging considerations • Complications • Long term sequelae • Novel imaging techniques

CH241-ED-THB9

Diagnosis of Suspected Pulmonary Embolism in Pregnancy: Review of Clinical Diagnostic Pathways, Key Components, Associated Data, and Guideline Recommendations

Thursday, Dec. 5 12:45PM - 1:15PM Room: CH Community, Learning Center Station #9

Participants
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TEACHING POINTS

1. To review key components of the diagnostic clinical pathway for diagnosis of PE in pregnancy 2. To discuss the differences in diagnostic tools utilized in pregnancy and non-pregnancy 3. To compare and contrast guideline recommendations from around the world and the clinical diagnostic pathways recommended for diagnosis of PE in pregnancy

TABLE OF CONTENTS/OUTLINE

A. Pulmonary embolism B. Pregnancy specific characteristics that amplify risk of PE C. Clinical manifestations D. Key components of diagnostic clinical pathways for diagnosing PE in pregnancy E. Key component discussion: role of Clinical prediction tools F. Key component discussion: role of Risk stratification G. Key component discussion: role of Empiric treatment H. Key component discussion: role of laboratory tests I. Key component discussion: role of ultrasound prior to advanced imaging J. Key component discussion: role of advanced imaging K. Key component discussion: role of additional testing for indeterminate imaging results L. Introduction of seven clinical guidelines M. Explanation of clinical guideline diagnostic pathway N. Compare and contrast guideline recommendations O. Conclusion

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CH269-SD-THB1

A Deep Learning Model to Aid in Pneumothorax Detection and Analysis Via Chest X-Ray: A Retrospective Cohort Study of the NIH-based Chest X-Ray Dataset

Thursday, Dec. 5 12:45PM - 1:15PM Room: CH Community, Learning Center Station #1

Participants
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PURPOSE

Pneumothorax (PTX) detection is challenging and treatment may be delayed for many reasons, including time needed for review by a radiologist in today's demanding health care setting. We created an artificial intelligence-based (AI) model for pneumothoraces that alerts radiologists to review the chest X-ray (CXR) urgently, translating to rapid recognition and improved patient care.

METHOD AND MATERIALS

A deep convolutional neural network (CNN)-based model (using a ResNet-152 architecture) was built to classify CXR images from the recent NIH CXR dataset. The dataset contains 14 unique diagnoses from 112,120 CXRs obtained from 30,805 patients. Diagnoses were considered to be >90% accurate. An internal cohort of radiologists and internists analyzed 23,744 images to augment diagnostic accuracy. Each CXR was represented by a 1,024x1,024 pixel image. Images were augmented using random cropping and image rotation. Two dimensionality reduction techniques were utilized: lung segmentation and bone shadow exclusion. The dataset was split into training (70%), validation (15%) and test (15%) sets. The model was constructed with Python programming language using the Pytorch deep learning platform and was evaluated primarily on the basis of area under the receiver operating characteristic curve (AUC-ROC). Random subsampling of the images without PTX was performed, as there was substantially less images involving PTX.

RESULTS

5,302 images had PTX (among 1,487 patients). In the training and test sets of the overall database, an AUC of 0.92 and 0.85 was achieved. Among stratified images (PTX size and chest tube presence), an AUC of 0.98 and 0.91 was achieved for the training and test sets, respectively. The diagnostic accuracy of the model was 95% in the test set once the model reached convergence.

CONCLUSION

Our CNN-based model represents a tool, still in its infancy, that with fine-tuning, may assist radiologists in more prompt and definitive detection of life-threatening pneumothoraces, allowing for timely intervention or follow up. Limitations are image resizing before processing (due to limited processing power) and retrospective analysis. Further work is ongoing to refine the model.

CLINICAL RELEVANCE/APPLICATION

An AI-based model for detecting and monitoring pneumothoraces can assist the radiologist when critical findings are present, providing superior patient care and, with further research, may translate to other life-threatening diagnoses.

CH270-SD-THB2

Volume Change in Pulmonary Solid Nodules During Respiration: Investigation with Dynamic-Ventilation Computed Tomography Image Data

Thursday, Dec. 5 12:45PM - 1:15PM Room: CH Community, Learning Center Station #2

Participants
Shigetaka Sato, MD, Otsu, Japan (*Presenter*) Nothing to Disclose
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Jun Hanaoka, Otsu, Japan (*Abstract Co-Author*) Research Grant, Konica Minolta, Inc

PURPOSE

To investigate the influence of respiratory level on pulmonary solid nodular volume (PNV) by using image data on four-dimensional dynamic-ventilation (4D-DV) CT.

METHOD AND MATERIALS

The Institutional Review Board approved this study, and written informed consent was obtained. Thirty-one patients with pulmonary solid nodules without pleural adhesion confirmed by thoracoscope underwent CT during a single respiration with a 16-cm coverage (2.4mSv). 4D-DVCT was performed for 5.5 seconds by a 320-row CT (Aquilion ONE, Canon Medical Systems, Otawara, Tochigi, Japan). Mean lung density (MLD) of scanned lung as a surrogate indicator of lung volume and PNV were continuously measured at 13 to 19 frame images included in a single respiratory cycle by using a dedicated workstation application, "Vitrea" (Canon Medical Systems, Otawara, Tochigi, Japan) with minimal manual interventions. Cross-correlation coefficients (CCCs) as an index of concordance in time curves between the MLD and PNV were calculated. CCC, PNV at peak-inspiration, maximal increase ratio in PNV during respiration (MIR), increase ratio at peak-expiration in PNV, MLD at peak-inspiration and patient-based frequency with MIR of more than 25% were compared between upper and lower lung fields, and between ventral and dorsal lung fields using Mann-Whitney U test.

RESULTS

Time curve of PNV correlated positively with that of MLD (CCC: 0.677 ± 0.281). As compared with the upper lung field, movements of the two curves during respiration were more independent in the lower lung field (CCC: 0.59±0.32 vs 0.78±0.19). MIR in the dorsal lung field was shown to be larger than that of ventral lung field (28.5 ± 15.0 % vs 12.8 ± 8.8 %). Patient-based frequency with MIR of more than 25% was higher in the dorsal lung field as compared with the ventral lung field (60 % vs 12.5%)

CONCLUSION

PNV measured on CT looked generally increased as MLD increased during expiration. Especially in the dorsal lung field, pulmonary solid nodules appeared larger in more frequently compared the ventral lung field.

CLINICAL RELEVANCE/APPLICATION

Overestimation tendency in the volumetry of pulmonary nodules in the dorsal lung field should be considered in cases without sufficient inspiration

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CH271-SD-THB3

Multi-Task, Multiscale Convolutional Neural Network for Active/Inactive Pulmonary Tuberculosis Classification on Chest X-Ray Images

Thursday, Dec. 5 12:45PM - 1:15PM Room: CH Community, Learning Center Station #3

Participants
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PURPOSE

Chest X-ray (CXR) has essential role in the diagnosis of patients with suspected active or inactive pulmonary tuberculosis (TB). To achieve comparable performance with attending radiologists in negative/active/inactive TB interpretation, we developed a new deep learning based method by enhancing existing convolutional neural network (CNN).

METHOD AND MATERIALS

Dataset: Training set included 53232 negative, 11841 active, and 722 inactive TB patients. All labels were agreed among at least 2 attending radiologists. Test set of 2521 patients were labelled by 3 attending radiologists, where majority voting was applied to form reference standard. Method: We developed a new CNN by enhancing existing network (Xception) with following methods. a) Multiscale pyramid was adopted to extract different size features hierarchically. b) Auxiliary regression task was added to differentiate misdiagnosis severities of active and inactive cases. Evaluation: The performance comparison with existing network was evaluated by quadratic weighted kappa and category-specified sensitivity. The performance comparison with attending radiologists was evaluated by quadratic weighted kappa. All statistical analysis were conducted using R 3.5.0.

RESULTS

Compared with existing network, our method was significantly ($p<0.004$) improved from quadratic weighted kappa 0.829 to 0.903. Sensitivities of negative, inactive and active categories respectively increased from 0.857 to 0.931 ($p=0.032$), from 0.548 to 0.804 ($p<0.001$) and from 0.866 to 0.929 ($p=0.021$). In contrary to attending radiologists (quadratic weighted kappa 0.891), our method (quadratic weighted kappa 0.903) also showed slightly superior capacity ($p=0.041$).

CONCLUSION

The new CNN can precisely classify negative/active/inactive of TB in CXR. It is significantly better than existing method, and achieves comparable performance to attending radiologists. We suggests the new deep learning method can be applied to aid radiologists for interpreting TB in CXR.

CLINICAL RELEVANCE/APPLICATION

This work demonstrates well-designed deep learning method can achieve attending radiologist's performance on negative/inactive/active TB interpretation on CXR.

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CH281-SD-THB4

Ferumoxytol-Enhanced MR Venography of the Central Veins of the Thorax to Evaluate Stenoses and Occlusions in Patients with Renal Failure

Thursday, Dec. 5 12:45PM - 1:15PM Room: CH Community, Learning Center Station #4

FDA Discussions may include off-label uses.

Awards
Trainee Research Prize - Medical Student

Participants
Christopher J. Gallo, BS, Durham, NC (*Presenter*) Nothing to Disclose
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PURPOSE

Hemodialysis patients have a high prevalence of central venous stenosis and frequently need imaging for access planning; however, these individuals cannot receive gadolinium due to concern for NSF. The purpose of this study was to assess the diagnostic performance of ferumoxytol-enhanced MR venography (MRV) for detection of stenoses and occlusions of the central veins of the thorax, with conventional venography as the reference standard.

METHOD AND MATERIALS

This retrospective study was approved by the IRB; a waiver of informed consent was obtained. Analysis was performed on 35 consecutive patients (mean age 48.6 years, 17 male, 18 female) who underwent ferumoxytol-enhanced MRV of the central veins and concurrent conventional venography. The central veins were divided into 7 segments for evaluation. Two radiologists interpreted MRVs in consensus for stenoses and occlusions. Confidence levels were scored on a scale of 1-4, with 4 being completely confident. Quantitative analysis consisted of measurement and calculation of the signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and intraluminal signal heterogeneity for all venous segments.

RESULTS

Of the 126 total venous segments with corresponding conventional venography, 80 were stenotic or occluded. The sensitivity and specificity for detection of stenosis or occlusion was 0.98 and 1.0, respectively, whereas the sensitivity and specificity for detecting occlusions alone was 0.98 and 0.99. Mean reader confidence was 3.5. The calculated mean intraluminal SNR, CNR, and heterogeneity was 219.7, 169.2, and 0.07, respectively. There were no adverse events related to contrast administration.

CONCLUSION

Ferumoxytol-enhanced MR venography demonstrated excellent sensitivity and specificity for detection of central venous stenoses and occlusions of the thorax. Given that ferumoxytol is an FDA-approved parenteral iron supplement for hemodialysis patients that does not carry a risk of NSF, this contrast agent is particularly well-suited for noninvasive vascular imaging in this population.

CLINICAL RELEVANCE/APPLICATION

Since gadolinium is contraindicated for hemodialysis patients, ferumoxytol-enhanced MRV is an excellent modality for evaluation of the central veins and avoids the risk of Gd-associated NSF.

ER174-ED-THB5

Vascular Injuries by Gunshot Wound: Pearls and Pitfalls

Thursday, Dec. 5 12:45PM - 1:15PM Room: ER Community, Learning Center Station #5

Participants
Gretchen A. Otero-Soto, MD, Carolina, PR (*Presenter*) Nothing to Disclose
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TEACHING POINTS

1. Review CT imaging characteristics of the typical sequelae of vascular injury and its distinguishing characteristics. 2. Describe possible pitfalls and ways to overcome them to avoid missing critical findings. 3. Provide correlation with interesting cases from our institution.

TABLE OF CONTENTS/OUTLINE

Vascular injuries are frequently encountered in the emergency setting and the pattern depends greatly on the causative agent. While many times they can occur as a result of blunt trauma or iatrogenic in nature, the incidence of vascular injuries secondary to penetrating or blast injury by gunshot wounds has increased. Radiologists must be familiar with these potentially life-threatening injuries in order to provide an adequate diagnosis. Also, optimal imaging acquisition is essential when diagnosing injury to the blood vessels due to its dependence on adequate technical factors. Through this pictorial review, we aim to discuss the common different patterns of vascular injury, critical findings, pitfalls in vascular imaging, and what to look for when reviewing these images in the emergency setting.A) ObjectivesB) IntroductionC) Pathophysiology of Gunshot WoundsD) Common Radiologic FindingsE) Sample Cases of CT angiography and DSAF) Pitfalls in Imaging Acquisition

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ER224-SD-THB1

Adrenal Hematomas and Associated Injuries in the Chest, Abdomen and Pelvis: A Level 1 Trauma Center Experience

Thursday, Dec. 5 12:45PM - 1:15PM Room: ER Community, Learning Center Station #1

Participants
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PURPOSE

-Identify the commonly associated thoracic, abdominal, pelvic and osseous injuries. -Investigate the side/sides of commonly injured adrenal, (right, left or bilateral) and identify which of the aforementioned has the most common associated injury. -Investigate the side of the adrenal hematoma and its relation to the ipsilateral and contralateral organ injury.

METHOD AND MATERIALS

Non-randomized retrospective study. Inclusion criteria: Patients (18-60 years) from both genders who had CT scan of the chest, abdomen, and pelvis in a trauma settings and found to have adrenal injury. Exclusion criteria: Patients with known adrenal lesions or incidental adrenal hematomas without history of trauma were excluded from the study. Concomitant injuries are evaluated and graded: Solid organs injury to the kidneys, liver, pancreas and spleen are graded according to AAST (American association for surgery of the trauma) grading and severity score. Hemoperitoneum is evaluated. Hemothorax, pneumothorax and lung parenchymal injuries are evaluated. Pelvic fractures are graded based on Tile hip fracture classification. Rib, scapula, spine and other included bones in the CT scan images are investigated. With regards to better characterization of the adrenal lesions in order to r/o incidentiloma, we used the CT density measurements (Hounsfield units) to exclude patients with fat containing adrenal lesions i.e incidental adenomas.

RESULTS

37 cases of adrenal hematomas were detected: Injuries were unilateral in 35 patients (31 cases involved the right-gland, 4 in the left-gland, and 2 with bilateral involvement). The hematomas had a mean maximum diameter of 2.7 cm and a mean attenuation of 66 HU.

CONCLUSION

The right adrenal gland is more commonly affected than the left. Adrenal gland hematoma on either side is noted to be associated with ipsilateral and/or contralateral organ injury. The bigger the hematoma the more concomitant injuries are present. Adrenal gland injury is noted to be associated with various severity of other organ involvement.

CLINICAL RELEVANCE/APPLICATION

Familiarity of the radiologist with the different patterns of adrenal gland and concomitant injuries are paramount for patient evaluation in trauma setting.

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ER225-SD-THB2

Cervical Spine Fracture Prevalence Using Machine Learning

Thursday, Dec. 5 12:45PM - 1:15PM Room: ER Community, Learning Center Station #2

Participants
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Bharti Khurana, MD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
Mitchel B. Harris, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Using machine learning for the evaluation of vertebral fracture prevalence in non-contrast CT scans of the cervical spine and classification of fracture by vertebral level.

METHOD AND MATERIALS

This is an IRB approved research project. Retrospective analysis of radiology reports for non-contrast CT scans of the cervical spine at a level 1 trauma center was performed over a period of ten years (2008-2018). By querying exam codes, 36,559 non-contrast CT scans of the cervical spine were identified as having been performed on 30,049 unique patients during this ten-year interval. Rather than manually reviewing each report, machine learning was applied to facilitate the identification of fractures. Using a combination of bootstrapping and natural language processing, the cohort was stratified by likelihood of containing pathology. Specifically, a classifier was iteratively trained to predict the presence of vertebral fracture in the radiology report. The most likely pathologic studies were reviewed in batches (batch size: 100) to confirm the presence or absence of fracture, and the classifier was retrained with the results to improve the predictive power of the model.

RESULTS

The trained classifier ultimately yielded 1,980 studies positive for cervical spine fracture. The median age of presentation is 67 years (min 4, max 110). Of the 1,980 cases, 1,140 patients (57.57%) are male and 840 (42.42%) are female. As per the radiology report, there are 3,060 individually fractured cervical vertebrae. The study-level percentage of fractures by vertebral level was found to be: 22.2% C1, 44.9% C2, 8.03% C3, 11.2% C4, 15.4% C5, 22.4% C6, and 30.4% C7.

CONCLUSION

This fracture-positive cohort represents an average annual incidence rate of 5.41% (5.05% min - 6.47% max). The demographics are 4:3 male: female with a median age of 67. There are 3,060 individually fractured vertebrae, yielding a range of 1 to 7 fractures (median 1) per study. 60.5% of the studies have a single cervical fracture. The distribution of fracture is bimodal with 55.2% occurring in the upper cervical vertebrae (C1 and C2) and 44.8% subaxial. The most common concurrent fractures are C1 and C2, representing 11.9% of the cohort. Concurrent C6, C7 fractures are the most common (11.3%) subaxial injury.

CLINICAL RELEVANCE/APPLICATION

Analysis will be extended to include an in-depth examination of mechanism of injury and anatomical description of fracture location on the vertebrae.

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ER226-SD-THB3

Small Bowel Obstruction (SBO) Predictors of Urgent Surgical Treatment and Bowel Resection

Thursday, Dec. 5 12:45PM - 1:15PM Room: ER Community, Learning Center Station #3

Participants
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Manuel Varo Alonso, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine which computed tomography (CT) findings can predict the need for urgent surgical treatment and bowel resection in patients with small bowel obstruction (SBO).

METHOD AND MATERIALS

Retrospective observational analysis of patients requesting attention in hospital emergencies due to SBO. Period 2015-2017. All patients are examined with CT after intravenous contrast administration. Two groups are established: (G1) conservative therapeutic management and (G2) urgent surgical treatment that is subsequently divided into two subgroups according to the need for bowel resection. Secondary variables: demographic, clinical (surgical history) radiological (reduced bowel wall enhancement, parietal thickening, local mesenteric haziness, mesenteric fluid, feces sign, free peritoneal gas, pneumatosis or venous gas, closed - loop mechanism, whirl sign and the cause of obstruction). The IBM SPSS Statistics was used to obtain results and statistical analysis (univariate and multivariate).

RESULTS

Initially, 98 patients were selected in the study, of which 15 were excluded (8 due to the dismissal of treatment due to low life expectancy, and 7 to undergo deferred surgery due to poor evolution after conservative treatment). Reduced bowel wall enhancement, parietal thickening, mesenteric fluid, closed loop mechanism and adhesive SBO were significantly associated with the need for urgent surgical treatment in the univariate analysis. In the logistic regression only reduced bowel wall enhancement and closed loop mechanism allow us to predict the need for urgent surgery.

CONCLUSION

All CT findings studied except mesenteric fluid allow us to predict the need for urgent surgery but do not have good sensitivity to determine the need for bowel resection.

CLINICAL RELEVANCE/APPLICATION

There are several radiological findings that predict the need for urgent surgery and bowel resection in the context of SBO

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ER233-SD-THB4

The Utility of Iodine Based Dual-Energy CT (DECT) in Triaging Patients with Blunt Bowel Injury

Thursday, Dec. 5 12:45PM - 1:15PM Room: ER Community, Learning Center Station #4

Participants
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PURPOSE

To assess the performance of DECT in triaging patients with blunt bowel injury

METHOD AND MATERIALS

IRB approved HIPPA compliant retrospective single institutional study was performed over a twelve month period. Using postprocessed DECT data, iodine concentrations were measured, both during arterial and portal venous phase in each segment of small and large bowel. Primary outcome measures were surgical findings and clinical follow-up. Association between iodine concentrations was examined using t-test or Wilcoxon Rank-sum test

RESULTS

Study group consited of 54 patients (mean age 44 years, males 32) with potential bowel injury. 64 patients aged matched (males 50, abdominal AIS =0) formed the control group for normal values of iodine concentration in each bowel segment. In the study group 25 patients underwent laparotomy, 16 patients were managed non-operatively had bowel wall thickening considered injury on CT, and 13 patients with isolated free intraperitoneal fluid. 10 patients had surgically proven bowel injury at least at one site. Iodine concentration at the injury site in this group was lower on arterial phase when the injury involved the jejunum (median [Q1, Q3]:1.1[0.5, 1.9] vs 2.45 [1.9, 3.05];p=0.01) and ileum (median [Q1, Q3]:1[1.4, 1.97];p=0.01). In the 16 patients with bowel wall thickenig there was no significant difference in iodine concentration, except in 3 patients with ascending colon injury the iodine concentrations were low: arterial phase (Mean SD: 0.43[0.5] vs 1.24[0.46]p=0.04); portal venous (Median [Q1, Q3]:0.2 [0.1,0.9] vs 0.9 [0.62, 1.2]p=0.04). No difference in iodine concentration in all bowel segments were observed in the 13 patient with isolated free fluid and control group.

CONCLUSION

Iodine concentraions measured at injury site on DECT is a potential biomarker for surgical small bowel injury.

CLINICAL RELEVANCE/APPLICATION

Iodine meaurements made at injury site on processed DECT data is a potential biomarker to triage patients with small bowel injury for surgery.

ER245-SD-THB6

The Role of Dual Source DECT to Detect Post-traumatic Bone Marrow Lesions in Emergency: A Preliminary Study

Thursday, Dec. 5 12:45PM - 1:15PM Room: ER Community, Learning Center Station #6

Participants
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PURPOSE

To evaluate the performance in Emergency of dual-energy computed tomography (DECT) with dedicated protocol in detecting post-traumatic bone marrow lesions (BMLs) in patients with acute musculoskeletal trauma with doubtful x-ray examination and positive clinical examination, in comparison with magnetic resonance (MR) images.

METHOD AND MATERIALS

We retrospectively considered the imaging findings of 15 adult patients (range age: 19 - 67 years; 13 males, 2 female) admitted in the Emergency Department of our Institutions for an acute musculoskeletal trauma. All patients were submitted to conventional radiograph with doubtful x-rays findings for bone injury but positive orthopedic clinical examination, with indication to the CT scanning. The traumas of all joints were included in the study, including vertebral traumas. CT examinations have been performed using dual source dual energy scanners (CT SOMATOM Definition Flash and SOMATOM Drive, Siemens) with specific DE protocols. Post processing were made on a dedicated workstation (SyngoVia), using multiplanar and 3D reformats as well as color-coded evaluation of the bone marrow edema. In all patients magnetic resonance images (MR) were acquired in an interval of 5 days following the traumatic event. Blind comparison between DECT and MRI images were performed by two independent readers expert in muscolo-skeletal imaging.

RESULTS

In all patients, our study shown that there was a correspondence between the bone marrow edema shown on the DECT examination and the MRI findings. In particular, it seems that DECT was more accurate in the study of the knee, followed by scaphoid, ankle, femur and shoulder.

CONCLUSION

Our study suggested that DECT could have a high sensitivity and specificity to investigate post-traumatic bone marrow lesions (BMLs) in patients in emergency departments with acute musculoskeletal trauma. Although further studies in prospective with a large number of patients should be required, DECT could be useful in the future in Emergency patients with a doubtful X-ray examination and positive orthopedic clinical examination, for a more effective and immediate diagnosis of traumatic bone lesions.

CLINICAL RELEVANCE/APPLICATION

1. Use of the DECT in Emergency 2. Support in detecting bone marrow lesions in Emergency when xrays findings are inconclusive

GI325-ED-THB9

Navigating the Canal: Inguinal Canal Pathology and Common Mimics

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #9

Participants
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TEACHING POINTS

1. Review male and female inguinal anatomy and embryology 2. Discuss the pathophysiology of inguinal canal abnormalities 3. Compare differential diagnosis of common and uncommon inguinal canal pathology 4. Review multimodality case examples of inguinal canal pathology and mimics

TABLE OF CONTENTS/OUTLINE

1. Background of inguinal canal anatomy and embryology 2. Review of pathophysiology leading to inguinal pathology 3. Clinical presentations of inguinal canal pathology (Slide 1) 4. Multimodality case review of inguinal pathology including (Slides 2-4): a. Hernias, simple and encysted hydroceles, Canal of Nuck and patent processus vaginalis, varicocele, benign and malignant lipomatous lesions, hematoma, gonadal pathology, and metastasis. 5. Multimodality case review of inguinal pathology mimics including (Slide 5): a. Hip osteochondromatosis, iliopsoas bursitis, soft tissue infections, endometriosis, adenopathy, femoral artery pseudoaneurysm and varices.

Printed on: 10/29/20

GI326-ED-THB10

Dual-Energy CT of Acute Bowel Ischemia

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #10

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS

There are different underlying pathologies for bowel ischemia. Dual-energy CT increases confidence for the evaluation of all forms of bowel ischemia. Virtual non-contrast (VNC) images can be used to differentiate venous phase hyperdense bowel segments as either contrast enhancing or natively hyperdense without contrast enhancement: VNC images can be generated additionally in cases with no initial suspicion for bowel ischemia where no true non-contrast scan was obtained. VNC images may replace non-contrast phase scans. Iodine maps or iodine overlays can be used to identify bowel loops with decreased or missing contrast enhancement. Low energy virtual monoenergetic images can be used to: Highlight the differences in contrast enhancement of different bowel segments. Increase vascular contrast of mesenteric vessels.

TABLE OF CONTENTS/OUTLINE

Review technical principles of DECT and the implications of different techniques for bowel imaging. Illustrate the benefits of DECT in clinical cases of bowel ischemia. Highlight pitfalls in the interpretation of DECT when evaluating studies for bowel ischemia.

GI327-ED-THB11

The Role of Hepatobiliary Agents and Different Imaging Modality in the Classification of Bile Duct Injuries

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #11

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TEACHING POINTS

1. To describe the difference between extracellular (gadodiamide) and hepatobiliary (gadoxetate disodium) contrast 2. To review different diagnostic imaging modalities for evaluating bile duct injuries 3. To describe the role of hepatobiliary contrast agents in the evaluation and treatment of bile duct injuries

TABLE OF CONTENTS/OUTLINE

1. Anatomy of the cystohepatic triangle 2. Common classification of the bile duct injuries Bismuth Strasburg 3. Common laparoscopic cholecystectomy complications 4. Hepatobiliary contrast agents for hepatic MR Imaging 5. Importance of hepatobiliary contrast agents in accurately recognizing and classifying different bile duct injuries 6. Benefits and limitations of different imaging modalities in assessing bile duct injuries 7. Role of hepatobiliary contrast in evaluating challenging cases

GI328-ED-THB12

Imaging of Extrahepatic Biliary Obstruction: Causes, Clinical Aspects, and Imaging Features

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #12

Awards
Certificate of Merit

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TEACHING POINTS

Recognize the different causes of extrahepatic biliary obstruction and their clinical presentations Describe the imaging features of various causes of biliary obstruction and how to reach a reasonable differential diagnosis

TABLE OF CONTENTS/OUTLINE

I. Intraluminal causes Biliary stones Parasitic infestation: Hydatid disease and Ascariasis Hemobilia Benign intraductal tumors: Intraductal papillary mucinous neoplasm of the biliary tract Malignant tumors invading into bile ducts II. Mural causes Primary sclerosing cholangitis IgG 4 sclerosing disease Portal biliopathy HIV-related cholangiopathy Ischemic cholangiopathy Bile duct carcinoma III. Extrinsic compression Mirizzi Syndrome Periportal adenopathy Pancreatic and periampulary tumors Lemmel syndrome (biliary obstruction by duodenal diverticulum) Hepatic artery aneurysm/pseudoaneurysm IV. Post cholecystectomy complications Postcholecystectomy clip migration Iatrogenic duct clipping

GI329-ED-THB8

Open Your Eyes! Similar but Not Equal: A Radiologic-Pathologic Correlation of the Pancreatic Cystic Neoplasms

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #8

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Aaron H. Perez Segovia, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review the general features of pancreatic cystic neoplasms. 2. To ilustrate the imaging findings and differences of pancreatic cystic neoplasms. 3.To describe the histopathologic characteristics of the pancreatic cystic neoplasms. 4. To associate the clinical presentation, the imaging findings and the histopathological result.

TABLE OF CONTENTS/OUTLINE

1.Introduction 2.General features of pancreatic cystic neoplasms 3.Corrrelation clinical-radiological-histopathological of the pancreatic cystic neoplasms 4.Conclusion

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GI361-SD-THB1

Robotic-Arm Assisted Tele-Sonography: Initial Clinical Results and Feasibility

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #1

FDA Discussions may include off-label uses.

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PURPOSE

To determine the clinical feasibility of robotic tele-ultrasound abdominal examinations using the ROSE (RObot Sensing for tele-Ecography) system.

METHOD AND MATERIALS

Twelve patients, 20 to 78 years, were randomly selected from a pool of healthy volunteers. Participants underwent two sets of full abdominal examinations (assessing liver structure, hepatic veins with measurement of the middle hepatic vein, display and measurement of portal vein, common bile duct, gallbladder diameter, head and body of pancreas, longitudinal diameter of spleen, left and right kidney). For each patient the US scans were performed by conventional ultrasound and the ROSE system, consisting in a tele-robotic US arm enabling remote autonomous examinations. All examinations were independently performed by a sonographer with 3 years of US practice submitted to 4 previous learning sessions with the robotic-arm US system.

RESULTS

The 12 volunteers have a mean age ± SD of 35.92 ± 17.4 years, presenting a BMI of 22.38 ± 2.40. Paired-sample t tests showed no statistically significant difference between conventional and robotic-assisted measurements of hepatic middle vein, portal vein and gallbladder. However, statistically significant difference was observed in measurements of spleen, right kidney and left kidney ($P < 0.05$), attributed to increased technical difficulty for the correct positioning of the robotic-assisted probe. Measurement precision seemed to improve with the examiner's experience with the operation of the robotic arm. All pre-determined structures were equally displayed when performing the conventional US scan and the ROSE system. Average time of examination for the robotic tele-ultrasound was 13m09s ± 3m08s while for conventional ultrasound was 6m38s ± 1m15s.

CONCLUSION

Tele-sonography with a dedicated robot-controlled US system is feasible for abdominal sonography. Examinations are longer and a learning curve seems necessary to ease the operation with the 'virtual' probe and master manipulation of the robotic system. No significant differences among measurements or organ display was observed using ROSE except for the left-sided more difficult 'virtual' probe poisoning.

CLINICAL RELEVANCE/APPLICATION

Robotic-assisted tele-sonography is feasible and may be an important tool to grant remote access to clinically relevant US examinations. Further technical improvements for easier "virtual probe" positioning on the left abdomen seems warranted.

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GI362-SD-THB2

Measurement of Circumferential Tumor Extent of Colorectal Cancer on CT Colonography: Relation to Clinicopatholical Features and Patient Prognosis

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #2

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PURPOSE

The purpose of this study was to examine the relation between circumferential tumor extent on CT colonography (CTC) of colorectal cancer (CRC) and clinicopathological features and patient prognosis.

METHOD AND MATERIALS

This retrospective study included 205 consecutive patients (110 men, 95 women; mean age, 64.7 years) with pathologically confirmed CRC who underwent CTC at our institution from 2006 to 2013. Circumferential extent rate (CER) was measured on virtual colon dissection view of CTC according to the following formula: maximal diameter of tumor/maximal diameter of normal mucosa×100. The CER was divided into 0-25%, 0-50%, 0-75%, 0-99%, and 100%. Clinicopathological features including tumor invasion depth, nodal involvement, distant metastasis, and stage (TNM classification) were compared according to the CER (0-25% vs 26-100%, 0-50% vs 51-100%, 0-75% vs 76-100%, 0-99% vs 100%). The continuous and categoric variables were examined by student t test and the X2 test or Fisher's exact test. Patient prognosis was also analyzed according to the CER using Kaplan-Meier method with log-rank test. Differences with p-values <0.05 were accepted as significant.

RESULTS

The CER were significantly correlated with tumor invasion depth for any grade of CER ($P < 0.0001$), nodal involvement (P=0.0025-0.0357) except for CER of 0-99% vs 100% (P=0.0855), and distant metastasis (P=0.0003-0.0130) except for CER of 0-25% vs 26-100% (P=0.0632). According to Kaplan-Meier method with log-rank test, overall survival was not significantly correlated with CER (P=0.1936-0.4026).

CONCLUSION

Circumferential tumor extent was significantly correlated with TNM stage of CRC, but not correlated with patient prognosis.

CLINICAL RELEVANCE/APPLICATION

Circumferential tumor extent could be one of the clinical issues for patients with CRC potentially associated with tumor occlusion. CER can be easily measured on virtual colon dissection view of CTC.

GI363-SD-THB3

Magnetic Resonance Diffusion Kurtosis Imaging in Early Diagnosis of Non-Alcoholic Steatohepatitis: A Preliminary Study in a Rabbit Model

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #3

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PURPOSE

To study the feasibility of MR diffusion kurtosis imaging (DKI) for the stratification of nonalcoholic fatty liver disease (NAFLD) and of particular for the early diagnosis of nonalcoholic steatohepatitis (NASH).

METHOD AND MATERIALS

Thirty-two New Zealand rabbits were induced into different severities of NAFLD by high fat feeding. Liver DWI and DKI were performed on a 3.0T MR scanner. The corresponding apparent diffusion coefficient (ADC) from DWI, and DKI-derived parameters FA (fractional anisotropy), MD (mean diffusion) and MK (mean kurtosis) were measured. The correlations between these parameters and hepatic pathological stages determined by NAFLD activity scoring system were analyzed by Spearman rank correlation analysis. The receiver operating characteristic analyses were applied to determine the cutoff values of MD, MK as well as ADC in distinguishing NASH from non-NASH. The diagnostic efficacies of MD and MK in detecting NASH were compared with that of ADC.

RESULTS

Both ADC and MD showed significantly decreased values as the severity of NAFLD increased ($\rho = -0.529, -0.904$, respectively; $p < 0.05$). An opposite pattern was however, found between MK values and NAFLD progress ($\rho = 0.761$; $p < 0.05$). In addition, both MD and MK values were significantly different between borderline and NASH groups (MD: 1.729±0.144 vs. 1.458 ± 0.240um2/ms; MK: 1.096 ± 0.079 vs. 1.237 ± 0.180; $p < 0.05$). Moreover, significant higher area under curve (AUC) values were found for both MD (0.955) and MK (0.905) than ADC (0.736), indicating more robust performance in distinguishing NASH from non-NASH groups.

CONCLUSION

Diffusion kurtosis imaging was feasible for stratifying NAFLD, and could more effectively predict NASH from non-NASH compared with DWI

CLINICAL RELEVANCE/APPLICATION

DKI could serve as a robust technique to stratify NAFLD and also had great potential in early diagnosis of nonalcoholic steatohepatitis. With this first evidence obtained in animal model, DKI will be tested in patients with NAFLD for further validation.

GI388-SD-THB4

Contrast Enhanced Ultrasound (CEUS) for Detection of Immediate Post-Operative Vascular Patency of Pancreas Transplant: Comparison with Doppler Imaging

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #4

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PURPOSE

Vascular complications such as arterial and venous thrombosis are the most common cause of pancreas transplant graft loss in the immediate post-operative period. Doppler ultrasound is currently utilized to evaluate pancreas transplant graft vascularity; however, it is performed as a spot evaluation of vessels, operator dependent and can be difficult to interpret. This study compares the ability of contrast enhanced ultrasound and Doppler ultrasound to identify vascular patency of pancreas grafts in the immediate post-operative period.

METHOD AND MATERIALS

An IRB waiver was obtained. Retrospective analysis of Doppler and CEUS images of 28 consecutive pancreas grafts from 2017 to 2018 was performed by two abdominal radiologists who were blinded to clinical outcomes. Images were obtained immediately following skin closure in the operating room. A total of 23 patients who did not require surgical re-exploration were considered normal. A total of 5 patients had surgically proven arterial or venous pathology at re-exploration. Two radiologists scored each case as vascularity normal or abnormal based on Doppler only and CEUS only image sets.

RESULTS

Both readers demonstrated increased sensitivity for vascular patency using CEUS (80.0% for both readers) compared to Doppler (40.0% and 60.0%). Specificity of CEUS was similar to Doppler imaging (69.6% versus 73.9%). The negative predictive value of CEUS was higher than that for Doppler (94.1% versus 85.0% and 89.5%). Inter-observer variability was higher in the CEUS data than in the Doppler data (kappa = 0.54 versus 0.24).

CONCLUSION

Contrast enhanced ultrasound has better sensitivity and similar specificity compared to Doppler ultrasound for identifying vascular pathology in pancreas transplant grafts in the immediate post-operative setting. A negative CEUS exam has a very high likelihood of excluding the presence of vascular pathology.

CLINICAL RELEVANCE/APPLICATION

Contrast enhanced ultrasound offers higher diagnostic potential than Doppler for the detection of vascular patency in pancreas transplant grafts. CEUS of the pancreas transplant can be performed during the immediate post-operative setting.

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GI389-SD-THB5

MRI versus CT for the Detection of Liver Metastases in Patients with Pancreatic Carcinoma: A Comparative Diagnostic Test Accuracy Systematic Review and Meta-Analysis

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #5

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PURPOSE

To perform a diagnostic test accuracy systematic review and meta-analysis comparing MRI and CT for the detection of pancreas cancer liver metastases.

METHOD AND MATERIALS

MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, Scopus and multiple radiology society meeting archives were searched until November 2018 to identify studies reporting on liver CT or MRI accuracy for detection of pancreas cancer liver metastases. Demographic, methodologic, and diagnostic test accuracy data were extracted. Accuracy metrics were pooled using bivariate random-effects meta-analysis. The impact of different covariates on accuracy estimates was assessed using a multivariable meta-regression model. These included study design, tumour characteristics, study quality, and MRI protocol. Risk of bias was assessed using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS)-2 tool. PROSPERO CRD42018115089.

RESULTS

Sixteen studies including 1002 patient with pancreas cancer on CT and 966 on MRI were included (210 and 213 patients with liver metastases, respectively). MRI was more sensitive than CT for the detection of liver metastases (84%, 95% confidence intervals [95CI] 75-89% vs. 33%, 95CI 13-62%), with no difference in specificity (96%, 95CI 93-98% vs. 97%, 95CI 91-99%). When four studies including only negative CT exams were removed on sensitivity analysis, there was no difference between MRI and CT sensitivity (85%, 95CI 75-92% vs. 70%, 95CI 53-82%). CT sensitivity was highest in patients without preceding neoadjuvant treatment (P = 0.03). MRI was highest in studies combining 1.5 and 3.0 T vs. 1.5 T (P = 0.04). MRI identified a significant number of metastases in patients with a prior negative CT; however, multiple sources of bias confounded this finding including a temporal delay between MRI and CT exams.

CONCLUSION

MRI and CT sensitivity for detection of pancreas cancer liver metastases do not significantly differ when selection bias is accounted for. Several studies demonstrated a possible benefit of MRI following a negative CT and further validation regarding imaging workup is required.

CLINICAL RELEVANCE/APPLICATION

MRI and CT accuracy for pancreas cancer liver metastases do not significantly differ. Further research is needed on the role of MRI following a CT showing potentially resectable pancreas cancer.

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GI390-SD-THB6

Differences on H-MR Spectroscopy-Based Hepatic Metabolite Concentrations Between Hepatocellular Lesions, Benign Cirrhotic Lesions and Patients without Hepatic Disease: A Pilot Study

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #6

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PURPOSE

To assess differences on metabolites concentrations between hepatocellular carcinoma (HCC) lesions, benign cirrhotic lesions and patients without hepatic disease, as determined by Hydrogen Magnetic Resonance Proton Spectroscopy (H-MRS).

METHOD AND MATERIALS

An observational, single center, controlled study was performed over a 10-month period. HCC lesions were defined according to LI-RADS criteria, version 2018. Cirrhotic lesions were classified as LI-RADS2 or 3. Control group was defined based on medical records and laboratory results, including infectious screening. Siemens Magnetom 3T-MRI scanner was used in all cases. All patients underwent routine MRI-LIRADS protocol and H-MRS scanning, using multi-voxel technique to quantify choline, lipids, creatine and choline/lipids ratio. Comparisons between groups were made with nonparametric analysis for continuous variables using the Kruskal-Wallis and Dunn's tests.

RESULTS

A total of 24 patients were enrolled, as follows: 12 with HCC lesions (46%), 5 with LI-RADS 2-3 lesions (19%) and 9 (35%) patients in the control group. Median Choline concentrations were as follows: 16.6 ppm (Interquartile [IQR], 9.25-25.2 ppm), 2.14 (IQR, 1.34-3.75 ppm) and 12 ppm (Interquartile ratio [IQR], 9.8-20.4 ppm) in HCC lesions, Li-RADS 2-3 lesions and control group, respectively (p=0.02). More significant differences on Choline concentration were found between the LI-RADS 2-3 group and the HCC lesions (p=0.02). Similarly, the choline/ lipids ratio was significantly higher in the HCC compared to the LI-RADS 2-3 group (0.39 (IQR, 0.13-1.24) versus 0.03 [IQR, 0.02-0.03] [p=0.05]) and the control group (0.08[IQR, 0.05-0.11]) (p=0.03). No significant differences on the concentration of Creatine and Lipids were observed between the groups. Among the HCC lesions, choline concentration was correlated with larger tumor size (r=0.57, p=0.05)

CONCLUSION

Concentrations of choline and choline/ lipids ratio were significantly higher in patients with HCC compared to benign cirrhotic lesions and controls. Among HCC lesions, choline concentration was correlated with larger tumor size.

CLINICAL RELEVANCE/APPLICATION

Opportune diagnosis of HCC is vital. Patients diagnosed at early stages of the disease may be candidates for surgical curative therapy. The use of H-MRS may contribute to early detection of malignant hepatic lesions.

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GI391-SD-THB7

Optimization of Contrast Medium for Abdominal CT in Oncologic Patient: A Prospective Comparison Between Fixed and Lean Body Weight-Adapted Injection Protocols

Thursday, Dec. 5 12:45PM - 1:15PM Room: GI Community, Learning Center Station #7

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PURPOSE

To compare the performance of fixed and LBW-adapted contrast media (CM) administration, in terms of objective and subjective image quality and parenchymal enhancement.

METHOD AND MATERIALS

This prospective randomized multicenter study was conducted at two center and was approved by the Institutional Review Board of both participating institutions. Oncologic patients referred clinically for multiphasic contrast-enhanced abdominal CT were prospectively enrolled and divided in two groups following a randomization list: patients in Fixed-Group received a fixed dose of 120 mL of CM while in LBW-Group the amount of CM was computed according to the patient's lean body weight. Patient's characteristics, CM volume, contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) of liver, pancreas, kidney, aorta and portal vein, and contrast enhancement index of liver (CEIL), pancreas (CEIP), and kidneys (CEIK) were measured on both arterial phase (AP) and portal venous phase (PVP) and compared between the two groups. Subjective image quality was assessed in duplicate by two experienced abdominal radiologists at each institution, who rated liver, pancreas, and kidney enhancement by using a 5-point Likert scale. Inter-reader agreement for subjective image quality assessment was assessed by using Cohen's K statistics.

RESULTS

The final population consisted of 100 patients (Fixed-Group: 50 patients, 24 males, 63.76 ± 13.21 years, mean BMI: 25.98 ± 4.03 kg/m2, mean LBW: 53.02 ± 9.94 kg; LBW-Group: 50 patients; 23 males, mean age: 67.80 ± 11.91 years, mean BMI: 27.05 ± 5.26 kg/m2, mean LBW: 51.73 ± 8.83; all p >= 0.111). Patients in LBW-Group received a significantly lower amount of CM (103.47 ± 17.65 mL vs 120.00 ± 0.00 mL; p<0.001). LBW-Group accounted for significantly higher arterial CEIL ($p < 0.001$) and CEIP ($p < 0.001$), pancreatic arterial CNR ($p = 0.004$), kidney arterial SNR ($p = 0.016$), and CNR ($p = 0.003$). CEIK was superior in LBW-Group for both AP ($p = 0.002$) and PVP ($p < 0.001$). Significantly lower portal vein SNR ($p = 0.015$) and CNR ($p = 0.020$) were observed in LBW-Group. No significant differences were observed in any of the remaining image quality parameters evaluated on both AP and PVP (all P >= 0.079). Qualitative image quality assessment returned overall comparable results between the two group (all p >= 0.213). Overall inter-rater agreement was excellent for both Fixed- ($\kappa = 0.81$ [95% CI 0.76-0.87]) and LBW- ($\kappa = 0.87$ [95% CI 0.81-0.93]) Groups.

CONCLUSION

LBW-adapted CM administration for abdominal CT reduces the volume of injected CM without affecting image quality and parenchymal enhancement

CLINICAL RELEVANCE/APPLICATION

Lean body weight-adapted contrast media administration protocol provide for significant reduction of injected volume compared to fixed-dose protocol without affecting image quality

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GU227-SD-THB1

Study of 3D Unenhanced MR Lymphography and Unipedal Direct Lymphangiography plus CT in Patients with Chyluria

Thursday, Dec. 5 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #1

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PURPOSE

To explore abnormalities of lymphatics and thoracic duct(TD) in patients with Chyluria, using 3D Unenhanced magnetic resonance lymphography(MRL) and Unipedal Direct lymphangiography (DLG) plus CT.

METHOD AND MATERIALS

The study was conducted on 26 patients with Chyluria. The examinations were reviewed separately by two radiologists. Dilated renal lymphatics and other retroperitoneal lymphatics, dilation of TD , multiple tortuous dilated lymphatics around TD, were recorded in MRL. Abnormal distribution of contrast medium, lympho-urinary leakages, and retrograde flow were noted, and the range and distribution of lymphatic vessel lesions were recorded in DLG plus CT. Statistical analyses were performed.

RESULTS

MRL depicted lymphourinary leakage in 20 cases(76.9%):2 cases in bilateral kidneys,6 in left kidney, 10 in right kidney ,2 in bladder. DLG plus CT depicted the level of lymphourinary leakage:6 cases in bilateral kidneys,7 in left kidney, 10 in right kidney ,3 in bladder. The level of agreement between MRL and DLG plus CT is moderate (kappa=0.60 $p<0.01$). In 3 cases the cervical section of TD were not distributed by contrast medium at DLG plus CT, can all be observed in MRL.In 2 cases unilateral double renal pelvis and ureter were found by MRL, which were misdiagnosed in DLG plus CT.

CONCLUSION

MRL combined with DLG plus CT could provide more comprehensive assessment of TD and lymphourinary leakage.

CLINICAL RELEVANCE/APPLICATION

Surgical Treatment such as renal lymphatics stripping and ligation were performed in some patients based on the Lymphourinary leakage location indicated by DLG plus CT and MRL.

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GU228-SD-THB2

Unenhanced Computed Tomography (CT) Findings as Predictors of Success of Conservative Management of Emphysematous Pyelonephritis (EPN)

Thursday, Dec. 5 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #2

FDA Discussions may include off-label uses.

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PURPOSE

To study CT radiological findings predicting success of conservative treatment in cases of emphysematous pyelonephritis (EPN).

METHOD AND MATERIALS

Patients with EPN admitted from Jan 2000 to Dec 2018 were retrospectively analyzed. Pre-admission NCCT findings including presence of hydronephrosis, urinary obstruction, and grades of EPN (four grades according to the laterality of air locule distribution in renal pelvis, parenchyma and peinephric spaces) and air locule volume were investigated for success of the conservative treatment. Air locule volume was estimated by summation of air locules volume using the following formula (W x H x L x0.52). In all cases conservative treatment were initiated till availability of urine culture and antibiotic is changed accordingly. Persistence of symptoms for >3 days is considered failure of conservative treatment and patients were managed by renal drainage (PCN or JJ stent). Patients' age, sex, presenting symptoms, diabetes, type of urine culture organism, serum creatinine, hemoglobin, WBCs, platelets, albumin, platelet/ WBCs ratio,. Multivariate analysis for statistically significant variable was done using logistic regression analysis.

RESULTS

The study included 54 patients (12 males and 42 females) with mean age± SD of 48±10 years. The grades of EPN were grade I, II, III and IV in 20, 10, 20 and 4 patients, respectively. Conservative treatment was successful in 10 patients (18.5 %). In two cases urgent nephrectomy was done (stage III). In 42 cases, renal drainage was required (17 by JJ stent and 25 by PCN). In univariate analysis, air locule volume and presence of hydronephrosis were statistically significant variables associated with failure of conservative treatment (p= 0.002 and 0.04, respectively). Air locule volume of 54 cc has 70% sensitivity and 90 % specificity as a predictor of conservative treatment success (AUC= 0.82 and P=0.002). In multivariate analysis, Presence of hydronephrosis and air locule volume > 54 cc were associated with 5.5 and 12 folds risk of failure of conservative treatment with p value and OR (95% CI) were [0.04, 5.5 (1.03-9.5) and 0.007, 12.1 (1.96-7.6), respectively]

CONCLUSION

Conservative treatment should be considered in selected cases of EPN. Presence of hydronephrosis and large air locule volume >54 cc in preadmission CT were predictors of conservative treatment failure.

CLINICAL RELEVANCE/APPLICATION

Prediction of EPN outcome

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GU229-SD-THB3

Uronephropathy in Erdheim-Chester Disease (ECD)

Thursday, Dec. 5 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #3

Participants
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PURPOSE

To assess radiologic manifestations of urologic involvement in an ECD cohort and to investigate associations between imaging findings of uronephropathy and the BRAFV600E mutation.

METHOD AND MATERIALS

This prospective study included 62 ECD patients (47 men; mean age, 52) who gave informed consent. Abdominopelvic images (45 MRI, 17 CT) were reviewed by two expert radiologists. Imaging findings related to kidney, renal vasculature, ureter, and urinary bladder were recorded. ECD and BRAFV600E status were confirmed by histopathological and molecular analysis of samples. The association between BRAFV600E mutation and imaging findings was analyzed via Fisher's exact test.

RESULTS

Fourteen of 62 patients (23%) had no urologic imaging findings. Forty-one of 48 (85%) cases with renal involvement had perinephric histiocytic infiltration, also known as 'hairy kidney'. Twenty-three had hydronephrosis (17 bilateral), 15 showed hydroureter (10 bilateral), and 4 had cystomegaly. Ten had renal artery stenosis (3 bilateral), with 3 requiring renal artery stents. Two (3%) developed end-stage renal disease (ESRD) from urologic involvement and underwent renal transplantation. Three renal biopsies showed extracapsular infiltrate without parenchymal infiltration and characteristic xanthomatous changes. In patients with renal involvement, the mean estimated glomerular filtration rate was 89.5 mL/min, and the mean creatinine was 1.09 mg/dl. The BRAFV600E mutation was positive in 52% (32/59) of samples. Perinephric infiltration ($p= 0.002$) and hydronephrosis ($p= 0.01$) showed significant association with the BRAFV600E mutation. However, hydroureter ($p= 1$), renal artery stenosis ($p= 0.11$), and cystomegaly ($p= 0.61$) were not associated with mutation status.

CONCLUSION

ECD commonly manifests with urologic disease and may lead to renal dysfunction. Patients should be screened for urological complications through laboratory and imaging studies. Significant associations exist between the most frequent urologic imaging findings and the BRAFV600E mutation.

CLINICAL RELEVANCE/APPLICATION

Due to high incidence of urologic involvement in ECD, knowledge of imaging features is crucial in clinical management. BRAF status could potentially stratify patients, by detecting high risk sub-group, for screening measures.

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GU244-SD-THB5

IntraVoxel Incoherent Motion Imaging Detect Placental Microvascular Impairment in Fetal Growth Restriction: A Prenatal MR Study

Thursday, Dec. 5 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #5

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PURPOSE

To investigate the potential of Intravoxel Incoherent Motion (IVIM) model in the study of placental microvascular and microstructural characteristics in Fetal Growth Restriction (FGR) pregnancies and in normal placentae.

METHOD AND MATERIALS

63 subjects including normal and FGR pregnancies were enrolled. Placental MR examinations were performed using a 1.5 T scanner, including a prototype Diffusion-Weighted Echo-Planar Imaging sequence with 10 different b values (0, 10, 30, 50, 75, 100, 150, 400, 700, 1000 s/mm2). Six ROIs were manually placed on each placenta on different areas of both Fetal and Maternal side. The mean values of fraction of perfusion fp, Pseudo-Diffusion Coefficient D* and Diffusion Coefficient D were obtained for normal and pathological placentae. Differences between ROIs f, D, D* mean values and IVIM parameters correlation with gestational age (GA) were investigated in both normal and FGR group.

RESULTS

IVIM parameters showed statistically significant differences in both normal and pathological groups. In both normal and FGR placentae fetal side ROIs are more perfused, especially in U-ROI, with general higher fp and D* values ($p<0.05$). In FGR group, there is a decreased microperfusion and diffusivity than normal placentae, with significant lower IVIM parameters fp, D and D* (fp: p=6*10-10; D: p=0,006; D*: p=0.01). In pathological placentae, D has a statistically significant negative correlation with GA in both maternal and fetal ROIs, depicting a decreased diffusivity trend with placental aging ($p<0.0001$).

CONCLUSION

DW imaging with IVIM model highlighted a lower perfusion and an impaired diffusivity in dysfunctional placental parenchyma of FGR pregnancies. Therefore, IVIM parameters have the potentiality to reflect microstructural and microvascular characteristics of placental impairment occuring in pregnancies complicated by fetal growth restriction.

CLINICAL RELEVANCE/APPLICATION

This prenatal MR study suggests that IVIM model could be a useful additional noninvasive tool in the in vivo detection of microperfusion impairment occurring in FGR placentae. Based on our experience, the use of placental MR with IVIM-DW imaging has clinical relevance since it allows to obtain further quantitative information on placental tissue in vivo, being helpful in the prenatal management of pregnancies complicated by FGR, even in early gestational ages.

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GU245-SD-THB6

Size of Kidney Stones in Computed Tomography: Influence of Acquisition and Image Reconstruction Parameters

Thursday, Dec. 5 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #6

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PURPOSE

Computed tomography (CT), preferably conducted using low-dose techniques, is the imaging modality of choice in suspected urolithiasis. Information obtained from CT include presence, location and size of stones while the latter frequently determines need for treatment. While there appears consensus regarding size measurements conducted on axial plane, the influence of other factors possibly impairing accurate measurement including radiation dose, reconstruction algorithm (RA) and kernel is unknown.

METHOD AND MATERIALS

Fifty stones of different composition, shape, etc. were collected and imaged in a 3D-printed, semi-anthropomorphic phantom. Stone size was measured manually with a digital caliper (Man-M). Stones were then imaged with 2 and 10 mGy using a spectral detector CT. Images were reconstructed using filtered back projection, hybrid-iterative and model-based iterative RA (FBP, HIR, MBIR) with soft, routine and sharp kernels. All stones underwent semi-automatic, threshold-based segmentation and consecutive analysis using an in-house developed software allowing for automated computation of maximum diameter. Statistics were conducted using ANOVA ± correction for multiple comparisons.

RESULTS

Average stone size was 10.0±3.2 mm (4.3-20.6 mm). Overall, stone size as compared to manual measurements was overestimated in CT (8.6 vs 10.0 mm, p<=0.05); however, showed a good correlation (p<=0.05, R2=0.683). Radiation dose did not influence measurement error (p<=0.05), while MBIR tended to underestimate size (e.g. FBP/MBIR: 10.3/9.7mm, p<=0.05). Segmentations using sharp image kernels did show closest agreement with Man-M as compared to soft kernels (8.6 vs 9.7/10.2, both p<=0.05). Differences within single stones were as high as 40% (e.g. Man-M: 7.3 mm, largest/smallest CT-based: 6.8/11.5 mm).

CONCLUSION

CT-based measurements tend to overestimate stone size as compared to manual measurements. They can be conducted irrespective of radiation dose; however, reconstruction algorithms and kernels may have relevant impact on size measurements. Differences between manual and CT-based measurements can be minimized by utilization of model-based iterative reconstruction algorithms with a sharp kernel.

CLINICAL RELEVANCE/APPLICATION

If using CT-based measurements of kidney stone size for clinical decision making, image reconstruction parameters need to be considered as they may greatly influence stone size in CT.

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HP227-SD-THB1

The Art of Imaging Methods - Using Micro-CT to Uncover the Secrets of Ancient Ivory Manikins

Thursday, Dec. 5 12:45PM - 1:15PM Room: HP Community, Learning Center Station #1

Participants
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PURPOSE

Ivory anatomical manikins, allowing the extraction of individual organs, are thought to have been carved in Germany in the late 16th or 17th century. While these manikins may have been used for the study of medical anatomy, little is known about their origin. Our institution holds the largest collection of these manikins (22 out of 180 known manikins worldwide). This study aims is to utilize micro-computer tomography (mCT) scanning to investigate the composition of these anatomical manikins. In particular, we hope to determine the ivory type, appreciate repairs and alterations (like pins and screws) that are not visualized by the naked eye, and allow more precise estimations of their age.

METHOD AND MATERIALS

Complete mCT scans of all 22 manikins were performed on an XT H 225 ST Nikon Micro-CT scanner at 150-200 kV with an average exposure time of 267 msec and a slice thickness of 40-80 micrometers. Comparison mCT images of whale bone, deer antler, mammoth/elephant ivory, and rhinoceros horn were extracted from the existing literature. Axial mCT slices of all 22 manikins were evaluated to determine the ivory/bone composition/source, as well as materials other than ivory/bone, such as repairs and pins used in hinging mechanisms.

RESULTS

Twenty out of 22 manikins were made from ivory alone, one figurine was made of antler material and one figurine contained both ivory and whale bone (Figure 1). Metallic components (pins, linings) were found in four manikins and fibers (e. g. 'umbilical cords', Figure 1) were found in two manikins. Eleven manikins contained hinging mechanisms or internal repairs with ivory pins. Trade routes are being analyzed by archeologists to narrow down the time period in which these manikins may have been produced.

CONCLUSION

mCT can be used to identify the different components of fragile archeological manikins. This may enable archeologists to draw conclusions concerning their origins, and further make 3D-renderings and subsequent 3D-prints possible.

CLINICAL RELEVANCE/APPLICATION

Medical imaging methods can benefit arts and archeology significantly by revealing the composition of fragile historical pieces, allowing better understanding of object age, and making these pieces more readily accessible to 3D-printing.

IN023-EC-THB

Tips and Tricks on Basic Programming Tools for Radiologists to Handle DICOM Data

Thursday, Dec. 5 12:45PM - 1:15PM Room: IN Community, Learning Center Custom Application Computer Demonstration

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TEACHING POINTS

• In the era of artificial intelligence, it is beneficial for radiologists to learn some basic programming tools to organise and curate DICOM data. • There are numerous user-friendly simple tools available, that can be used in their clinical and research practice. • DCM4CHE and DCMTK are open-source tools that can be used for the following: a. Extracting images from PACS systems, using filters like study date, modality etc. b. Data sorting, Data modification and analysis. c. Converting Dicom (DCM) images to Jpeg or Pdf. d. Transferring Data to PACS or any other viewer. • Python is one of the easier programming languages which a radiologist, without much programming background, can learn and start using for manipulating DICOM data. Some python modules to use radiology are: a. Pydicom b. Matplotlib c. Pynetdicom3 d. tqdm

TABLE OF CONTENTS/OUTLINE

• Why a radiologist should learn Basic programming tools. • About DCM Toolkit & how to install • Multiple Functions of DCM Toolkit & how to use them. • What is Python? How to Install Python. • What is pip? How to install python modules using pip. • Use of Python to modify Dicom's Metadata.

IN034-EC-THB

Integrated Research Platform for Prostate Cancer

Thursday, Dec. 5 12:45PM - 1:15PM Room: IN Community, Learning Center Custom Application Computer Demonstration

Participants
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William Hsu, PhD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, Siemens AG

Conclusion

Our integrated diagnostics research repository can be used to build probabilistic population atlases and can help improve the performance of lesion detection and classification of aggressive tumors.

Background

Multiparametric MRI (mpMRI) currently detects less than half of all and less than two thirds of clinically significant prostate cancer foci. We have developed a platform that integrates data from various clinical systems into an electronic repository that enables us to match and compare prostate diagnostic imaging findings with biopsy and whole mount (WM) findings. This platform facilitates artificial intelligence and research initiatives that may help increase precision, accuracy and granularity of MRI as a diagnostic tool for prostate cancer detection.

Evaluation

The platform consists of (Figure 1): 1. A scalable database schema that enables lesion-level tracking over time and across diagnostic modalities while accommodating growth of data sources and patient records; 2. Live connections with electronic medical record systems that update database records; 3. Dashboards and data entry interfaces that enable visualization and validation; 4. Programming interfaces that transform data into formats that can be easily consumed by researchers and artificial intelligence systems; 5. Natural Language Processing services that extract structured information from free text documents; 6. Cybersecurity and patient de-identification infrastructure; and 7. Standard Operating Procedures that govern the extraction, storage and distribution of data for research.

Discussion

Our research platform hosts clinical, imaging and pathology data for 701 patients, including 932 lesions (593 index lesions) detected on MRI and 1414 lesions identified in WM specimens. The matching algorithm detected 750 true positives (where imaging and pathology targets match), 188 false positives (where radiology targets were not confirmed by pathology) and 695 false negatives (where targets not detected on MRI were identified by pathology). There are 220 patients with WM annotations and 313 patients with MRI annotations. The database indexes 140 distinct data elements (e.g. PSA, Ktrans, kep).

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IN208-SD-THB1

Mimicking Radiologists to Improve the Robustness of Deep-Learning Based Automatic Liver Segmentation

Thursday, Dec. 5 12:45PM - 1:15PM Room: IN Community, Learning Center Station #1

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PURPOSE

Radiologists delineating organ contours on a CT slice typically consider a couple of neighboring slices while taking into account the whole in-plane context in order to distinguish the organ boundary from surrounding structures. We present a new 3D deep-learning model that mimics the way radiologists interpret images on the example of liver segmentation. To evaluate its performance, the model is compared with a standard 3D neural network.

METHOD AND MATERIALS

The baseline model employs a 3D u-net architecture that puts equal focus on each spatial dimension. The model performs segmentation on images resampled to 1 mm isotropic voxel size based on context information encompassing image patches of 92x92 voxels from 92 consecutive slices. To mimic how radiologists perform organ segmentation, we designed an anisotropic segmentation network (Anisotropic-net) that considers fewer slices (44) while enlarging the analyzed image patch size to 188x188 voxels.Both models were trained on 160 manually annotated CT scans from two hospitals. For evaluation, a dataset comprising 826 CTs from one clinic acquired with different protocols was used. The results of both models were scored manually by a human expert using automatically generated screenshots containing cross-sections in axial, coronal, and sagittal orientation. Results of each model were scored in a randomized order in two separate sessions (6 weeks apart) to prevent recall bias. The following scoring system was employed: 1=no corrections necessary, 2=minor corrections required, 3=major corrections required.

RESULTS

634 cases segmented by the Anisotropic-net were scored by the human expert with 1, while only 516 received this score for the 3D u-net. The 3D u-net required minor/major corrections in 123/187 cases and the Anisotropic-net only in 93/99 cases.

CONCLUSION

The Anisotropic-net mimicking the way radiologists interpret images shows a substantial segmentation quality improvement when compared to a standard 3D u-net. More extensive validation of the Anisotropic-net approach is planned.

CLINICAL RELEVANCE/APPLICATION

Liver segmentation plays a key role in many clinical workflows. Robust and automatic liver segmentation would allow for shorter segmentation times and reduction of observer subjectivity.

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IN245-SD-THB2

A Pilot Study of a New Technique for the 3D Reconstruction of the Incisional Hernia

Thursday, Dec. 5 12:45PM - 1:15PM Room: IN Community, Learning Center Station #2

Participants
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PURPOSE

To evaluate incisional hernias accurately with a new 3D reconstruction technology in order to provide more information to surgeons to make intuitive and accurate judgments about the incisional hernia so as to minimize the perioperative complications and recurrence rate.

METHOD AND MATERIALS

This was a pilot study using a new technique of 3D reconstruction based on CT scans to measure abdominal wall defect, herniary area, herniary volume, abdominal cavity volume and the volume of transverse, oblique and recti muscles in 3 patients with incisional hernias.

RESULTS

The 3D reconstruction software in this pilot study made reproducible automated segmentation of the bony skeleton, skin, and outer abdominal wall. The hernia sac, abdominal muscles and the anatomic relationship between hernia sac and surrounding organs were clearly shown in the 3D reconstruction images. Moreover, the herniary diameter, area, volume and the volume of transverse, oblique and recti muscles could be measured through 3D reconstruction images in the 3 patients. Surgeons can also freely combine, rotate, scale, move the 3d reconstruction mode, modify the name and transparency of the 3d reconstruction model and observe the internal structure of the tissue and the size, shape and location of the lesion from multiple angles, so as to make intuitive and accurate judgments.

CONCLUSION

The herniary diameter, area, volume and the volume of transverse, oblique and recti muscles can be accurately calculated through this 3D reconstruction technology. In this pilot study, we firstly calculated the volume of transverse, oblique and recti muscles, which could reflect the condition of abdominal muscles and be conductive to the choice of the way hernia repair. Three-dimensional vision of the abdomen through this technology can objectively and quantitatively evaluate the situation of ventral hernia, providing a more realistic means for diagnosis and treatment of diseases.

CLINICAL RELEVANCE/APPLICATION

3D CT reconstruction technology in incisional hernia could provide more information about the incisional hernia to surgeons to minimize the perioperative complications and recurrence rate.

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IN272-SD-THB3

A Radiomics Approach for Early Detection of Tumor Response to MDSC-Directed Immunotherapies

Thursday, Dec. 5 12:45PM - 1:15PM Room: IN Community, Learning Center Station #3

Participants
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PURPOSE

Due to variable and often delayed tumor response, there is a need to develop novel, non-invasive techniques for early detection of efficacy to immune-directed therapies. Myeloid-derived suppressor cells (MDSCs), a component of tumor microenvironment (TME), play a central role in treatment resistance and disease relapse. In this pre-clinical study, we investigated a radiomics approach for early detection of response to MDSC-directed immunotherapy.

METHOD AND MATERIALS

Studies were performed in a humanized mouse model of neuroblastoma (NB). Animals were randomized to three groups (n=10/group): 1) Tumor cells (*T group*); 2) Tumor cells+MDSCs (*T+M group*), 3) Tumor cells+MDSCs+Immunotherapy (*Therapy group*). For Therapy group, MDSC-directed natural killer cells were administered 9 days prior to CT. Contrast-enhanced delayed CT (CT leak) was performed 4 days after injection of a liposomal-iodine (Lip-I) contrast agent. Immediately after, a second dose of Lip-I was administered for CT angiography (CTA). MDSC burden in tumors was determined post-mortem by flow cytometry. Tumors were segmented in CT images and radiomic analysis was performed using an open-source software (PyRadiomics). A Wilcoxon statistical test was used for the selection of radiomic features.

RESULTS

CT-derived tumor volumes did not significantly differ between Therapy and non-Therapy (T+M) group. Radiomic analysis identified 16 features based on CT leak datasets and 17 features based on CTA datasets that differentiated ($p<0.05$) Therapy and non-Therapy group (T+M). Analysis of difference between radiomic features derived from CT leak and CTA datasets identified 29 features that separated ($p<0.05$) Therapy and non-Therapy group (T+M). Furthermore, 7 of 29 features differentiated tumor only (T) from MDSC-containing tumor (T+M) group. First order radiomic features exhibited highest statistical power for differentiating treated from non-treated groups, suggesting markedly different texture of tumor architecture post-immunotherapy. Flow cytometry confirmed depletion of tumor MDSCs in Therapy group.

CONCLUSION

Texture-based radiomics features detected early tumor changes in response to MDSC-directed immunotherapies.

CLINICAL RELEVANCE/APPLICATION

Radiomics may enable early detection of efficacy to immune-directed therapies in solid tumors.

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MI214-SD-THB1

Fe3+@PolyDOPA-b-Polysarcosine, a T1-Weighted MRI Contrast Agent via Controlled NTA Polymerization

Thursday, Dec. 5 12:45PM - 1:15PM Room: MI Community, Learning Center Station #1

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PURPOSE

To assess the applicability of novel PDOPA-b-polysarcosine nanoparticles (PDOPA-b-PSar) as high-relaxivity T1 magnetic resonance imaging (MRI) contrast agent for tumor diagnosis.

METHOD AND MATERIALS

PDOPA-b-PSar were synthesized via the sequential copolymerization of sarcosine-N-thiocarboxyanhydride (Sar-NTA) and 3,4-dihydroxy-L-phenylalanine NTA (DOPA-NTA) containing unprotected phenolic hydroxyl groups. Fe3+@PDOPA-b-PSar micellar nanoparticles were prepared on the basis of strong chelation between iron (III) cations and catechol groups. T1 relaxivity (r1) measurements were performed at 3.0-T MR field strengths. Cell proliferation and apoptosis were evaluated in vitro. T1-weighted dynamic contrast-enhanced MRI was performed in vivo in tumor-bearing mice that were intravenously injected with PDOPA-b-PSar.

RESULTS

The longitudinal relaxivity of Fe3+@PDOPA10-b- PSar50 is higher than that of commercial Gd3+-based compounds (r1 =5.6 mM-1 s-1). In vivo MRI of Fe3+@polyDOPA-b-polysarcosine-treated tumor-bearing mice revealed strong signal enhancement of the tumor area because of enhanced permeability and retention. In vivo analysis also indicated that the maximum contrast-to-noise ratio of the tumors in the T1-weighted imaging mode increased up to 6.46±1.3,and reduced to 3.45±0.44,4h and 24h after the injection of Fe3+@PDOPA-b-PSar ,respectively. Cytotoxicity assay showed that Fe3+@PDOPA-b- PSar had relatively low cytotoxicity and high biocompatibility in NIH 3T3 cells.

CONCLUSION

Fe3+-polypept(o)ides nanoparticles are novel, Gd-free, nontoxic T1-weighted MRI contrast agents with the potential to replace traditional Gd3+ compounds. These unique properties of Fe3+@PDOPA-b-PSar make them highly efficient for tumor-targeted MRI in vivo, possibly improving tumor diagnosis and enabling more accurate tumor therapy.

CLINICAL RELEVANCE/APPLICATION

Fe3+-polypept(o)ides nanoparticles may replace traditional Gd3+ compounds as a T1-weighted MRI contrast agents to improve tumor diagnosis and accurate tumor therapy.

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MI218-SD-THB2

CT Radiomic Features Predicting Epidermal Growth Factor Receptor Mutation Status of Exon 19 and Exon 21 in Lung Adenocarcinoma

Thursday, Dec. 5 12:45PM - 1:15PM Room: MI Community, Learning Center Station #2

FDA Discussions may include off-label uses.

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PURPOSE

To assess the CT radiomic features in predicting the exon 19 deletion(Del19) and exon 21 (L858R) mutations in lung adenocarcinoma patients for choosing the best targeted therapies.

METHOD AND MATERIALS

The study was approved by the Institutional Review Committee and gave up informed consent. 148 lung adenocarcinoma patients (61 males and 87 females; mean age 61.5 ±9.57 years) were involved in this study, which were confirmed by pathological examination from July 2017 to December 2018. All patients had undergone chest CT (contrast-enhanced CT, thickness 0.63mm) examination before operation. The data of EGFR gene mutation sites, clinical features and CT imaging were collected and analyzed retrospectively. Radiomics software which implemented in a client server application of the manufacturer (syngoVia, Research Frontier, Siemens Healthcare, Germany) was used to post-process and extract radiomic features. For each tumor, 848 radiomic features were extracted. Multivariate logistic regression analysis was used to establish the classifiers to predict the mutation type exon Del19 and L858R with the selected features, which were filtered by univariate analysis.

RESULTS

Univariate analysis showed a statistically significant correlation between patient age and exon 21 (L858R) mutation with $p = 0.039$. 31 of 848 imaging radiomic features were proved that have statistically associations with exon 21 (L858R) ($p<0.05$). The top 10 most relevant features were involved to establish the logistic regression models. In model selection, two and eight features were applied to build classifiers by the min-BIC and min-AIC criteria respectively. The performances of logistic regression classifiers with radiomic features obtained the area under curve (AUC) of 0.78 and 0.75 with min-AIC and min-BIC selected respectively. The AUCs were improved to 0.79 and 0.72 by adding patient age into the model establishment. The sensitivity and specificity were 73.5% and 72% at the best diagnostic decision point.

CONCLUSION

CT radiomic features of lung adenocarcinoma combined with clinical variables could better predict the mutation types of EGRF gene. Radiological characteristics might have potential alternative biomarkers for differentiating the exon Del19 and 21 (L858R) mutations.

CLINICAL RELEVANCE/APPLICATION

Radiomic features had potential to use noninvasive method to identify genetic mutation types, which leaded to the better individualized treatments for patients.

MK008-EB-THB

Hands Up! Systemic Diseases with Characteristic Imaging Findings in the Hand

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Hardcopy Backboard

Participants
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TEACHING POINTS

1) Systemic diseases can involve several organ systems and have characteristic imaging findings in the hand.2) It is important to be familiar with these imaging findings in order to diagnose these systemic diseases.

TABLE OF CONTENTS/OUTLINE

Background A systemic disease is any disorder that affects multiple organ systems and the hands can be the initial presenting site. Recognition of these hand findings on imaging, including those discovered incidentally, will aid in early diagnosis and prevent unnecessary workup. Imaging considerations:Hand findings can be well evaluated on radiography; however, CT and MRI can also be helpful. It important to have a systematic approach by evaluating for abnormalities of the joint space, bones, and soft tissues. The bones can be further assess for congenital deformities and periostitis. Systemic diseases with hand findings:Arthritis (osteoarthritis, psoriatic, rheumatoid, gout), Neoplastic (multiple enchondromatosis, hypertrophic pulmonary osteoarthropathy, acromegaly, thalassemia), Inflammatory/Autoimmune disorders (SLE, scleroderma, sarcoidosis, dermatomyositis), Congenital (Marfan's, Down's, Hadju Cheney, Turner), Metabolic Bone Disorders (hemochromatosis, hyperparathyroidism, osteoporosis, renal osteodystrophy, tumoral calcinosis, mucopolysaccharidosis), Infectious (tuberculous).

MK343-ED-THB10

Piriformis Muscle Variants: Not Always the Culprit!

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #10

Awards
Certificate of Merit

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TEACHING POINTS

* Determine the major anatomical variations of the piriformis muscle and sciatic nerve * Exemplify with mri exams most of the variations and findings associated with deep gluteal pain syndrome

TABLE OF CONTENTS/OUTLINE

* Introduction of the topic from the epidemiology to anatomical variants of the piriformis muscle * Clinical picture and findings of images compatible with the pain syndrome * Didactic illustration of muscle-tendinous relationships and neural pathway, including Beaton and Anson classification * Cases to consolidate the knowledge * Conclusions * Bibliographical references

MK344-ED-THB9

Elusive Complications in Hip Arthroplasty - Dare to Spot It: Imaging Features of Uncommon Postoperative Complications

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #9

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TEACHING POINTS

Total hip arthroplasty (THA) is most frequently performed for advanced osteoarthritis (OA) of the hip, with >1 million estimated procedures undertaken worldwide annually. The incidence of complications is low, but due to the frequency of the procedure, they are quite commonly seen images in daily radiology practice and require accurate interpretation for early necessary intervention by the surgeon. Modern Total Hip Arthroplasty (THA) systems are modular, with a variety of newer bearings and coating surfaces making it more challenging to identify early complications. This exhibit will serve as a primer for radiologists about what to look for in immediate postoperative evaluation, clearly elaborate normal and abnormal findings on follow up evaluation and what not to miss while looking for elusive complications in follow up imaging studies .

TABLE OF CONTENTS/OUTLINE

Brief review of various types of hip implants and it's imaging features . Normal / Acceptable radiological anatomy of artificial hips. Radio-opacity, artifacts in different material types. Abnormal Imaging findings in common and rare elusive complications at follow up visits.

MK345-ED-THB11

Spaces and Interfaces: An Approach to Tendon Pathology in MR Imaging of the Hand and Wrist

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #11

Awards
Cum Laude

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TEACHING POINTS

1. Review the normal and abnormal appearance of tendons in the hand and wrist on MRI2. Present the anatomy and pathology of tendons in the context of fibro-osseous interfaces and soft tissue spaces4. Review the pathology that occurs at these interfaces and spaces through MRI examples

TABLE OF CONTENTS/OUTLINE

1. MRI appearance of normal and abnormal tendons in the hand and wrist2. Anatomy of Interfaces2.1. First extensor compartment fibro-osseous tunnel2.2. First extensor compartment crosses over the second extensor compartment2.3. Third extensor compartment crosses over the second extensor compartment2.4. Sixth extensor compartment fibro-osseous tunnel2.5. Flexor carpi radialis fibro-osseous tunnel2.6. Flexor tendons in the hand fibro-osseous tunnel3. Pathology and Pathomechanics of Interfaces3.1. Fibro-osseous tunnel - tendinosis, tears, tenosynovitis, subluxation, dislocation, and bowstringing3.2. Crossing tendons - intersection syndromes4. Anatomy of Spaces4.1. Deep dorsal space (subaponeurotic)4.2. Fourth extensor compartment "space"4.3. Palmar bursae - radial bursa, ulnar bursa, and intermediate bursa4.4. Deep palmar spaces - thenar space, midpalmar space5. Pathology and Pathophysiology of Spaces - allow spread of tenosynovial processes (infectious, inflammatory, or neoplastic) throughout the hand and wrist

MK346-ED-THB7

Bone Injury Patterns and Pseudofractures of the Knee: Are You Familiar with Them?

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #7

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TEACHING POINTS

The purpose of this study is: To review the imaging appearance of typical trauma contusion patterns, avulsion fractures and pseudofractures of the knee, using radiographs and MRI. • To review the anatomy of the knee and discuss the relations of bone injuries with trauma mechanism and soft tissue damage. To instigate people to test their knowledge about the topic, using a quiz format.

TABLE OF CONTENTS/OUTLINE

The knee has typical bone contusion patterns and avulsion fractures, with well-known relation to trauma mechanism and soft tissue injury. Identifying avulsion fractures on radiographs, although sometimes difficult, may predict the underlying soft-tissue abnormality and lead to proper treatment, and thus avoiding chronic instability. Identifying typical bone injury patterns on MRI also increases the diagnostic confidence for associated lesions. The most typical avulsion fractures include Segond fracture, reverse Segond fracture, Osgood-Schlatter disease, Sinding-Larsen-Johansson syndrome, arcuate complex avulsion and avulsion of the anterior and posterior cruciate ligaments. The radiologist also plays a role identifying common anatomical variants of the knee which may mimic fractures causing unnecessary treatment, including patella dorsal defect, bipartite patella, variations in femoral condyle ossification, cyamella and meniscal ossicle.

MK347-ED-THB8

Left Foot, Right Foot, Feet, Feet, Feet: Imaging Evaluation of Ankle and Foot Instrumentation and Reconstruction

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #8

Awards
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TEACHING POINTS

To review and understand current concepts in foot and ankle reconstruction and the orthopedic hardware utilized. To review the radiographic evaluation of foot and ankle malalignment. To become familiar with the prostheses and instrumentation utilized, and understand the physiology of the corrective surgical techniques. To review normal post-operative imaging findings.

TABLE OF CONTENTS/OUTLINE

Review the radiographic evaluation of foot and ankle malalignment including: Hindfoot varus/valgus Pes planovalgus Pes cavovarus Hallux Valgus Hammertoes/claw toes Illustrate examples of procedures performed for end-stage osteoarthritis or malalignment reconstruction. Explain the physiology goals and the instrumentation utilized: Ankle / Hindfoot Arthroplasty Arthrodesis Talar replacement Calcaneal Osteotomy Midfoot Arthrodesis Navicular replacement Tendon transfer Forefoot Arthroplasty Hammertoe repair Bunionectomy Arthrodesis Review the expected normal postoperative appearances of hindfoot and forefoot reconstruction, and illustrate examples of hardware failure

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MK348-SD-THB4

Comparison of the Clinical Value of Two MR Metal Artifact Reduction Sequences in Patients with Malignant Bone Tumor after Joint Replacement

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #4

MK

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PURPOSE

To compare the image quality and diagnostic value of two metal artifacts reduction sequences in patients with malignant bone tumor after joint replacement.

METHOD AND MATERIALS

MR scans with syngo-WARP sequences and simple parameter adjustment sequences were performed on 3 prosthesis phantoms and patients with malignant bone tumor after joint replacement. The artifact area of the prosthesis was measured on the largest plane of the artifact in each sequences of MR images , and the MR image quality of patients in each sequences is evaluated. Wilcoxon signed rank test was used to evaluate the differences of image quality between syngo-WARP sequences and simple parameter adjusted sequences. The sensitivity, specificity, and consistency rate of syngo WARP sequences were compared with simple parameter adjusted sequences in diagnosing local recurrence of malignant bone tumors. The Kappa test was used to assess the consistency of syngo WARP and simple parameter adjusted sequences with pathology in diagnosing recurrence, respectively.

RESULTS

The artifact areas of the 3 prosthesis phantoms were all larger in the simple parameter adjusted sequences than the syngo-WARP sequences. MR scans with syngo WARP sequences were performed for 94 patients, and simple parameter adjusted sequences for 60 patients. There was no statistical difference in the image quality of the coronal T1WI (P=0.642) and coronal STIR (P=0.337) between the two sequences. However, the image quality of transverse STIR in the syngo-WARP sequences was better (P=0.004). The sensitivity, specificity, coincidence rate and Kappa value in diagnosing local recurrence of malignant bone tumors were 93.9%, 91.8%, 92.6%, and 0.840 for syngo WARP sequences, and 94.7%, 85.4%, 88.3% and 0.748 for simple parameter adjusted sequences.

CONCLUSION

Syngo-WARP sequences can reduce metal artifact more effectively than simple parameter adjusted sequences, and have higher specificity, coincidence rate and Kappa value in diagnosing local recurrence of malignant bone tumors after joint replacement.

CLINICAL RELEVANCE/APPLICATION

Syngo-WARP sequences can reduce metal artifact more effectively than simple parameter adjusted sequences, and have higher specificity, coincidence rate and Kappa value in diagnosing local recurrence of malignant bone tumors after joint replacement.

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MK376-SD-THB1

Intracortical Bone Mineral Density Correlates Well with Quantitative Susceptibility Mapping (QSM) Obtained from Cones Ultrashort Echo Time Magnetic Resonance Imaging (UTE-MRI)

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #1

Participants
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PURPOSE

To implement Cones 3D ultrashort echo time MRI (UTE-MRI) for ex vivo quantitative susceptibility mapping (QSM) and to investigate the correlations of QSM with intracortical bone mineral density (BMD).

METHOD AND MATERIALS

9 tibial midshaft cortical bone specimens (61±15 yo) were embedded in 1% weight/volume agarose gel and then scanned on a clinical 3T MRI scanner (MR750, GE) using an eight-channel T/R knee coil for QSM measurement. The scans involved Cones 3D UTE-MRI sequences with the following TEs: 0.032, 0.2, 0.4, 1.2, 1.8, 2.4 ms. Other scanning parameters were as follows: bandwidth=83.3kHz, flip angle=10°, TR=30ms, matrix size=256×256x30, voxel size=0.5×0.5×2 mm3. A complex (magnitude and phase) 4D matrix was generated from the 6 single echo acquisitions. The preliminary field map and R2* were estimated using an iterative decomposition of water and fat with echo symmetry and least-squares estimation algorithm(1). Then, the inhomogeneity field map was obtained by fitting the complex 4D matrix to an R2* signal model-based iterative least-squares estimation with a multi-peak model(2). Specifically, the Projection onto Dipole Fields (PDF) algorithm was used to remove the background from the frequency shift and phase map(3). Specimens were scanned later using a Skyscan 1076 (Kontich, Belgium) µCT at 9 µm3 voxel size to measure bone porosity and BMD. Pearson's correlation coefficients were calculated between QSM and µCT measures.

RESULTS

Figs. 1a, b illustrate the Cones UTE-MRI QSM map and one representative µCT slice, respectively, of a representative tibial bone specimen. Figs. 1c, d illustrate the bone porosity and BMD maps, respectively. QSM showed significantly ($p<0.01$) strong correlations with BMD ($R=-0.70$). Scatter plots and linear regressions of QSM on BMD and bone porosity are shown in Figs. 1e,f, respectively.

CONCLUSION

Cones 3D UTE-MRI previously demonstrated a faster scanning process. The significant strong QSM-BMD correlations highlighted the Cones 3D UTE-MRI QSM technique as a useful method to assess intracortical BMD.

CLINICAL RELEVANCE/APPLICATION

A UTE-MRI-based QSM technique which correlates well with the intracortical BMD may be useful in future clinical bone studies while avoiding ionizing radiation.

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MK377-SD-THB2

Role of Whole-Body Diffusion-Weighted Imaging in Evaluation of Multiple Myeloma

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #2

FDA Discussions may include off-label uses.

Participants
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PURPOSE

Accurate assessment of plasma cell infiltration of the bone marrow supports diagnosis and monitors treatment response in patients with multiple myeloma (MM). This study retrospectively investigated whole-body diffusion-weighted imaging (WB-DWI) in the evaluation of bone marrow infiltration in MM.

METHOD AND MATERIALS

Patients with MM who underwent WB-DWI between January 2016 and October 2018 were enrolled. Patients received high dose chemotherapy with autologous stem cell transplantation after an induction regimen. Treatment response was assessed by the National Comprehensive Cancer Network guidelines. WB-DWI was performed to measure the apparent diffusion coefficient (ADC) values. The degree of bone marrow infiltration was assessed by bone marrow biopsy within three days of WB-DWI.

RESULTS

Sixty-eight patients with MM who underwent WB-DWI after treatment were included in the study. Their mean age was 56.91 ±8.57 years and 67.6% were male. Durie-Salmon stage was IIA to IIIB. There was a negative correlation between the ADC value and the degree of bone marrow infiltration in the right ilium and this was statistically significant ($r=-0.829$, $P<0.001$). Eleven patients also underwent WB-DWI before starting treatment and 10 (91%) had complete response or very good partial response; their ADC values after treatment were significantly higher than those before treatment ($P=0.004$).

CONCLUSION

The ADC value was negatively correlated with the degree of bone marrow infiltration in the right ilium. In 11 patients also monitored before treatment the ADC values of the largest lesion were shown to increase after treatment.

CLINICAL RELEVANCE/APPLICATION

(Dealing with whole-body diffusion-weighted imaging) 'WB-DWI is important to patients with multiple myeloma in evaluation of intramedullary lesions.'

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MK378-SD-THB3

Clinical Utility and Economic Impact of Screening Follow-Up Upper Extremity Radiographs in Children with Uncomplicated Distal Radius Fractures

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #3

Participants
Deborah D. Brahee, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Ethan A. Smith, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The distal radius is one of the most common sites for pediatric fractures. Fractures that involve the physis have a theoretical risk for development of a physeal bridge with subsequent growth disturbance. Delayed radiographs are sometimes obtained in asymptomatic children with prior distal radius fractures to evaluate for development of a physeal bridge. The purpose of this study was to investigate the clinical utility and economic impact of obtaining routine delayed radiographs in asymptomatic patients with uncomplicated distal radius fractures.

METHOD AND MATERIALS

IRB approval was obtained. Radiology records were searched retrospectively between January 1, 2016 and January 1, 2018 to identify patients with a documented acute Salter-Harris type 2 (SH2) fracture of the distal radius and delayed wrist radiography at 3 to 6 months after the injury. Exclusion criteria included prior distal radius surgery, suspicion for a physeal bridge based on clinical symptoms, additional wrist trauma or history of infection. Radiography was correlated with MRI and clinical data as a reference standard for the presence of a distal radius physeal bridge. The financial cost associated with follow-up imaging was determined based on standard charges associated with wrist/forearm radiography, wrist MRI, and orthopedic clinical follow up.

RESULTS

A total of 381 children with SH2 fractures of the distal radius and delayed radiographs were identified. Four children were excluded due to clinical symptoms or surgery to the same wrist, for a total population of 377. Five patients (1.3%) were found to have a distal radius physeal bridge on delayed radiographs. Based on routine institutional charges for the delayed radiographs and orthopedic visit, total billed charges for the 377 patients would be approximately $245,804. This equates to approximately $49,161 in billed charges per identified physeal bridge. Only 3 of the 5 cases with a physeal bridge went on to surgical treatment. The billed charges per identified physeal bridge, requiring surgery, equates to approximately $81,935.

CONCLUSION

In asymptomatic children, with uncomplicated SH2 fractures of the distal radius, detection of a physeal bridge on delayed radiographs is rare. Although it is common clinical practice, the financial burden of routine delayed follow up in asymptomatic patients is an important consideration.

CLINICAL RELEVANCE/APPLICATION

Need for follow-up radiography in wrist fracture.

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MK395-SD-THB6

Self-Improving AI-Assisted Semiautomated Musculoskeletal MR Image Segmentation

Thursday, Dec. 5 12:45PM - 1:15PM Room: MK Community, Learning Center Station #6

FDA Discussions may include off-label uses.

Participants
Paul Anton Reymond Prakash Sathiadoss, MBBS, Ottawa, ON (*Presenter*) Nothing to Disclose
Leonid Chepelev, MD,PhD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Elisha Pruner, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
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Dimitrios Mitsouras, PhD, Ottawa, MA (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;
Adnan M. Sheikh, MD, Ottawa, ON (*Abstract Co-Author*) Speaker, Siemens AG

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PURPOSE

Organ segmentation is crucial for the development of anatomical models used to facilitate complex therapy planning, interdisciplinary communication, and patient-physician interactions. It can aid quantitative imaging in the assessment of early cartilage damage. Current segmentation approaches are relatively time-consuming, limiting clinical throughput and adoption of advanced visualization and 3D printing. Emergent AI-assisted segmentation methods do not currently have a built-in capacity to capitalize on AI self-improvement after deployment, limiting improvement or extension across organ systems.

METHOD AND MATERIALS

We demonstrate AI-boosted software for MR-based patellofemoral compartment cartilage segmentation. We trained 2D V-Net CNN on 15872 3T CUBE and SPACE PDFS 0.3mm axial and sagittal manually MSK radiologist-segmented knee images from 31 patients with normal and abnormal cartilage (75% training, 20% validation, 5% testing). Resultant CNN-based initial segmentation was presented in an interactive Unity engine-based GUI with advanced segmentation tools, developed in house. Following manual correction, cases are added to a dataset for CNN retraining at regular intervals. We compared randomly ordered cartilage segmentation times using existing and proposed approaches for 20 patients segmented by two experts. Dice and agreement coefficients were used to evaluate our segmentation accuracy against manual standard.

RESULTS

Our method results in a significantly shorter segmentation time, 12.9+/-9.2 min compared to manual 139.5+/-46.0 min ($p << 0.001$). This improvement results in minimal segmentation disagreement, with a mean dice coefficient of 0.90 (0.79 - 0.94), which is not significantly different from the inter-observer variability using manual segmentation ($p=0.18$). Additional cases submitted for CNN retraining resulted in modest and variable segmentation time and accuracy gains.

CONCLUSION

We present accessible, self-improving AI-boosted software to dramatically facilitate segmentation without significant accuracy loss, using patellofemoral cartilage as an example, given the previous relative paucity of AI studies of its anatomy.

CLINICAL RELEVANCE/APPLICATION

Self-improving AI-assisted software developed here can be applied to any organ system/modality to boost segmentation throughput. This facilitates the adoption of advanced visualization & 3D modeling

MS229-ED-THB1

Advantages and Pitfalls in the Imaging with Human 7T MRI Scanner

Thursday, Dec. 5 12:45PM - 1:15PM Room: MS Community, Learning Center Station #1

Participants

Koji Fujimoto, MD, PhD, Kyoto, Japan (*Presenter*) Nothing to Disclose
Tomohisa Okada, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Research Grant, Siemens AG
Thuy Dinh Ha Duy, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
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Ravi T. Seethamraju, PhD, Malden, MA (*Abstract Co-Author*) Employee, Siemens AG Stockholder, Siemens AG
John Grinstead, PhD, Portland, OR (*Abstract Co-Author*) Employee, Siemens AG
Tadashi Isa, Kyoto, Japan (*Abstract Co-Author*) Research Grant, Siemens AG

TEACHING POINTS

To understand the characteristics of imaging with the ultra-high-field MRI scanner To understand advantages and potential pitfalls in the imaging with human 7T MRI scanner To understand the examples of current research topics using human 7T MRI scanner

TABLE OF CONTENTS/OUTLINE

MR physics at 7T Changes in T1/T2/T2* Changes in the RF wavelength Changes in the chemical shift Advantages at 7T Increased SNR --> high-res TOF-MRA within basal ganglia Increased SNR + increased susceptibility --> high-res 2D T2*WI Pitfalls at 7T Decreased wavelength --> B1+ inhomogeneity --> image inhomogeneity --> Decreased signal at the right lower temporal lobe --> Image inhomogeneity in TSE sequences (FLAIR, SPACE, etc.) Increased SAR --> T2SPACE done with lower FA No body coil for 7T --> RF pulse is always local, we always need a TX coil Current research topics MP2RAGE : can overcome the problem of B1+ inhomogeneity MRF : can overcome the problem of B1+ inhomogeneity Task fMRI / rs-fMRI Future research topics Parallel Transmission (pTx) Na imaging

NM141-ED-THB6

Beyond Pulmonary Embolism (PE): A Pictorial Review of the Mimickers of PE and Incidental Findings on Ventilation/Perfusion (V/Q) Scintigraphy

Thursday, Dec. 5 12:45PM - 1:15PM Room: NM Community, Learning Center Station #6

Awards
Identified for RadioGraphics

Participants
Ryan T. Downey, MD, Omaha, NE (*Presenter*) Nothing to Disclose
Neil J. Hansen, MD, Bennington, NE (*Abstract Co-Author*) Nothing to Disclose
Craig M. Johnson, MD, Omaha, NE (*Abstract Co-Author*) Nothing to Disclose
Jorge D. Oldan, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of the this exhibit is: 1. To review potential mimickers of PE on VQ scintigraphy 2. To review common and uncommon incidental findings on VQ scintigraphy

TABLE OF CONTENTS/OUTLINE

Principles of VQ scintigraphy Mimickers of PE on VQ scintigraphy -Parenchymal disease -Mediastinal mass/lymphadenopathy -Congenital abnormalities Incidental findings -Parenchymal disease -Cardiovascular disease -Extrathoracic abnormalities Representative examples with CT correlation Summary

Printed on: 10/29/20

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NM227-SD-THB1

Correlation of the Prognostic Value between Deauville and RECIL Therapy Response Scales in Hodgkin's Lymphoma

Thursday, Dec. 5 12:45PM - 1:15PM Room: NM Community, Learning Center Station #1

Participants
Erika S. Fajardo, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
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Luis Felipe Alva Lopez, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the Correlation of the prognostic value between Deauville and RECIL therapy response scales in Hodgkin lymphoma.

METHOD AND MATERIALS

A cross-sectional, analytical, retrospective study was carried out to evaluate the Correlation of the prognostic value between Deauville and RECIL therapy response scales, in patients diagnosed with Hodgkin's lymphoma, treated between 2009 and 2015; who had been evaluated with 18F-FDG PET/CT at baseline, interim and end-of-treatment. 206 patients, with qualitative information on response to treatment were selected. Information was processed with the SPSS Statistics v.22 program, displaying Pearson's Chi square test and Cohen's Kappa index, to determine the proportion of the concordance observed among the qualitative variants with significance of 95% and $p < 0.05$.

RESULTS

The complete response assessment of Deauville / RECIL scales at the end of treatment were similar ($X2 = 432.6$ and $p = 0.0000$); with a final concordance between studies was 94.65%. Additionally it was found that, the relationship RECIL Interim / final was ($X2 = 0.35$ and $p = 0.000$) and Deauville Interim / final was ($X2 = 263$ and $p = 0.000$).

CONCLUSION

The scale of RECIL is as reliable as the DEUVILLE scale for assessment of the response during and at the end of treatment in patients with Hodgkin lymphoma.

CLINICAL RELEVANCE/APPLICATION

18FDG-PET/CT has become a valuable tool in the staging and monitoring of patients with lymphoma, providing a continuous scale to refine the threshold of adequate / inadequate response in specific clinical situations and the optimization of treatment in the patient with Hodgkin´s Lymphoma.

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NM228-SD-THB2

Association between 18F-FDG Uptake Heterogeneity and p16-Expression in Patients with Oropharyngeal Squamous Cell Carcinoma

Thursday, Dec. 5 12:45PM - 1:15PM Room: NM Community, Learning Center Station #2

Participants
Katsuya Mitamura, Kita, Japan (*Presenter*) Nothing to Disclose
Yuka Yamamoto, MD, PhD, Kita-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Hanae A. Okuda, MD, Kita-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The new classification provides guidelines for p16 testing in oropharyngeal squamous cell carcinoma (OPSCC) and moderate staining intensity is classified as p16 positivity and plausible human papillomavirus (HPV) related etiology. The purpose of this study was to evaluate association between 18F-FDG (FDG) uptake heterogeneity using texture indices and p16-expression in patients with OPSCC, in comparison with the conventional PET parameters.

METHOD AND MATERIALS

FDG PET/CT was performed in 25 patients with newly diagnosed OPSCC. The 4 conventional parameters [SUVmax, SUVpeak, metabolic tumor volume (MTV) and total legion glycolysis (TLG)] and 4 texture parameters [skewness, kurtosis, entropy, and uniformity] were measured. The presence of p16-expression in tumor specimens was examined by immunohistochemistry and compared with PET parameters.

RESULTS

All tumors showed focally increased FDG uptake. No significant differences in all 4 conventional parameters were noted between p16-positve tumors and p16-negative tumors. Two of 4 texture indices [entropy ($p<0.03$) and uniformity ($p<0.05$)] significantly differed between p16-positve tumors and p16-negative tumors.

CONCLUSION

These preliminary results indicate that texture indices reflecting heterogeneity on FDG PET/CT images seem to be useful for assessment of p16-expression in patients with OPSCC.

CLINICAL RELEVANCE/APPLICATION

Texture indices reflecting heterogeneity on FDG PET/CT images seem to be useful for assessment of p16-expression in patients with OPSCC.

NM229-SD-THB3

Usefulness of Combined Analysis Using Both FDG-PET and Diffusion MRI in Predicting Overall Survival in Invasive Ductal Pancreatic Cancer

Thursday, Dec. 5 12:45PM - 1:15PM Room: NM Community, Learning Center Station #3

Participants
Shigeki Nagamachi, MD, PhD, Fukuoka , Japan (*Presenter*) Nothing to Disclose
Masanari Nonokuma, Fukuoka , Japan (*Abstract Co-Author*) Nothing to Disclose
Youichi Mizutani, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
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Toshinori Hirai, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Research Grant, Bayer AG
Kengo Yoshimitsu, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Both Total lesion glycolysis (TLG) calculated by FDG-PET and apparent diffusion coefficient (ADC) calculated by diffusion MRI are useful for predicting overall survival (OS) in invasive ductal pancreas cancer. However, few researches predicting OS of invasive ductal pancreas cancer using combined analysis FDG-PET and diffusion MRI have been reported. We investigated whether combined analysis using both FDG-PET and diffusion MRI can predict OS of invasive ductal pancreas cancer in this study.

METHOD AND MATERIALS

Fifty-two pancreatic cancer patients (27 females and 25 males, mean age 67.7) were enrolled in the retrospective analyses. Although the stages were various (III 18, IV 34), all cases were undertaken surgical treatment and post-operative chemo-therapy. Both pre-operative FDG-PET and MRI images were analyzed retrospectively. The values of TLG were calculated by multiplication of the SUV mean value and total volumes more than 40% of SUVmax using FDG-PET/CT. The values of ADC mean were measured on ADC map under the condition b value 1000 on the 3T MRI. We divided all patients into the three groups according to the value of TLG and ADCmean obtained in pre-therapy examinations. The cut-off values of each examinations were 50g and 1200 s/mm2 respectively. We compared the OS among three group, namely the patient group with both high TLG and low ADC mean (Both index severe) (n=9), the patients group with either high TLG or low ADCmean (One index severe)(n=25) and the patient group with both moderate value TLG and ADCmean (Both index moderate) (n=18).

RESULTS

The mean value of OS was significantly shorter in the both index severe group compared with that in the one index severe group (595.0 vs. 1342.4 days). However, the mean value of OS in the both index moderate group was 1240.7 days and it did not show any statistical significance compared with other two groups. Regarding other clinical parameters including pathological stages, there was no statistical significance.

CONCLUSION

Although single image abnormality did not influence on the OS, severe abnormalities of both TLG and ADCmean in the pre-operative PET and MRI significantly shortened OS of invasive ductal pancreas cancer.

CLINICAL RELEVANCE/APPLICATION

In planning treatment of invasive ductal pancreas cancer, both TLG by FDG-PET and ADCmean by MRI should be analyzed before pre-therapy in order to predict OS.

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NM238-SD-THB4

Clinical Utility of 18FDG-PET/CT in Treatment Response Assessment and Follow-Up of Lung Tumors Treated with Stereotactic Body Radiotherapy

Thursday, Dec. 5 12:45PM - 1:15PM Room: NM Community, Learning Center Station #4

Participants
Jose Luis Vercher Conejero, Lhospitalet de Llobregat (Barcelona) , Spain (*Presenter*) Nothing to Disclose
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PURPOSE

Stereotactic body radiation therapy (SBRT) is a relatively new treatment modality whose main indications are inoperable non-small-cell lung cancer and oligometastases to liver and lung. The aim of this study was to evaluate the usefulness of 18FDG-PET/CT in monitoring treatment response and in the follow-up of patients with pulmonary lesions treated with stereotactic body radiotherapy (SBRT).

METHOD AND MATERIALS

We retrospectively studied 91 patients who received SBRT for stage I lung cancer or isolated pulmonary metastases from other tumors. The final analysis excluded 52/91 patients because an initial follow-up PET was not available or additional therapies were administered. We included 39 patients with pulmonary tumor lesions: 32/39 lung cancer and 7/39 colorectal metastases. PET/CT was performed <1 month prior SBRT, and after SBRT at 3 timepoints: <6, 6-18 and> 18 months. The clinical evaluation of the response was classified as stable disease (SD), including partial or complete metabolic response or progression (PD).

RESULTS

Primary lung tumors were adenocarcinomas (22) and squamous carcinoma (10), and adenocarcinomas (7) for colorectal cancer, presenting a baseline-SUVmax average of 6.9, 10.8 and 6.5 g/ml, respectively. SBRT dose ranged 34-60 Gy.The majority of patients (76%) with SD already had a decrease in metabolic activity within the early evaluation without a significant reduction in size. Low diffuse metabolic uptake was observed in most patients due to inflammatory changes. 6 patients had PD by PET and CT, 3 in early evaluation, 2 in intermediate and 1 >18 months.

CONCLUSION

The response evaluation with PET/CT is more reliable than that observed only with CT in the follow-up of lung lesions treated with SBRT. The morphological changes induced by SBRT can show a consolidation or a mass-like appearance making the diagnosis complicated. However, it is important to keep in mind that diffuse hypermetabolism after SBRT may persist beyond 18 months after treatment without definitive evidence of recurrence. In our study, PET correlated with the clinical response and may be useful in predicting the response to SBRT and further research to determine optimal management is needed.

CLINICAL RELEVANCE/APPLICATION

Considering the increasing use of SBRT for the treatment of pulmonary lesions, tools for the early detection of local failure are needed to allow the timely rescue of surgery.

NM239-SD-THB5

18F FDG as a Prognostic Imaging Biomarker in the Rra of LIRADS Diagnosis of Hepatocellular Carcinoma (HCC)

Thursday, Dec. 5 12:45PM - 1:15PM Room: NM Community, Learning Center Station #5

Participants
Munazza Anis, MD, Richmond, VA (*Presenter*) Nothing to Disclose
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Binu John, MD, MPH, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

1. Understand status of 18F FDG PET/CT imaging in the diagnosis of hepatocellular carcinoma (HCC) in the era of LIRADS 2. Understand the bio;logy of 18F FDG uptake in the diagnosis of HCC 3, Review data supporting the role of 18F FDG as a prosgnostic imaging biomarker following cross sectional imaging LIRADS diagnosis of HCC

TABLE OF CONTENTS/OUTLINE

1. Introduction: Role of 18 F FDG in the diagnosis of HCC in comparison with LIRADS vs the biological phenotype information 2. 18F FDG uptake quantification in HCC to predict microvascular metastases and distant metastases 3. Cases 4. Role of 18 F FDG in evaluating recurrence after ablative therapies 5. Cases 6. Conclusion

NR361-ED-THB7

What's the Buzz? An Imaging Approach to Tinnitus

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #7

Participants
Louise Bisolo, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Hugo Tames, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos Toyama, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Regina L. Gomes, PhD, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos Jorge da Silva, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To define tinnitus and which type needs imaging approach. To be able to select the best imaging method for the diagnosis. To identify the possible causes of secondary tinnitus and the role of the imaging on its evaluation.

TABLE OF CONTENTS/OUTLINE

1. Introduction - Describing and classifying tinnitus. - A brief discussion about the pathophysiology. - Clinical findings and what method to choose to better evaluate tinnitus. 2. Findings on pulsatile tinnitus. Common and uncommon causes of secondary pulsatile tinnitus unrelated with vessel abnormalities - Glomus jugulotympanicum - Glomus tympanicum - Others Common and uncommon causes of vascular pulsatile tinnitus - Jugular bulb variants - Arterial variants - Dural arteriovenous fistula - Arteriovenous malformation - Others 4. Findings on non-pulsatile tinnitus. Common and uncommon causes of non-pulsatile tinnitus. - Vestibular schwannoma - Cochlear schwannoma - Meningioma - Endolymphatic sac tumor - Vascular loops - Otospongiosis - Ménière disease - Others 5. Take-home messages

NR362-ED-THB8

Gyriform Imaging Pattern: What's Wrong with the Cerebral Cortex?

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #8

Participants
Santiago Medrano, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Laia P. Desmeules, MBBS, Barcelona, Spain (*Presenter*) Nothing to Disclose
Maria Pumar, MBBS, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Sofia Gonzalez-Ortiz, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
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TEACHING POINTS

Illustrate the radiological findings in different imaging techniques that show a gyriform cortical alteration and approximate the pathophysiological mechanisms. To know the spectrum of diseases that can manifest in neuroimaging as a cortical alteration with a gyriform pattern.

TABLE OF CONTENTS/OUTLINE

Radiological findings in gyriform cortical pattern (edema, calcification, contrast enhancement or diffusion alteration) and their relation to their pathophysiological mechanism. Diseases that are frequently shown by this pattern and their specific radiological characteristics. Summary table in order to establish a correct differential diagnosis against this radiological findings.

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NR363-ED-THB9

Autoimmune Encephalitis: Not Always Limbic

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #9

Participants
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TEACHING POINTS

The purpose of this exhibit is:1. To briefly review the history, pathogenesis and diagnostic criteria for autoimmune encephalitis. 2. To illustrate a series of autoimmune encephalitis cases with clinical and imaging extra-limbic presentations.

TABLE OF CONTENTS/OUTLINE

Definition of autoimmune encephalitis (AIE)Epidemiology PhysiopathologyHistory and discoveriesDiagnostic criteriaSeries of AIE cases - Limbic - Basal Ganglia - Diencephalic - Brainstem - Cerebellar - Encephalomyelitis Summary

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NR391-SD-THB1

Ultra-High-Resolution Dynamic CT to Evaluate Pituitary Adenomas: Comparison with Dynamic MRI

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #1

Participants
Akio Hiwatashi, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Osamu Togao, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazufumi Kikuchi, MD,PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Daichi Momosaka, MD, Higashi-ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshitomo Kikuchi, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare dynamic ultra-high-resolution CT using a detector row width of 0.25 mm and a 1024 × 1024 matrix with dynamic MR to evaluate pituitary adenomas.

METHOD AND MATERIALS

This retrospective study included 23 patients (13 females and 10 males; age range 27-72-year-old; median 57 year) with pituitary adenomas (16 non-functioning, 3 prolactin-producing, 3 adrenocorticotrophic hormone-producing, and 1 growth hormone-producing). All patients underwent dynamic CT (Aquilion Precision; Canon) and 3-T MR imaging (Ingenia; Philips). The imaging parameters for dynamic CT were as follows: 120 kV, 400 mA, slice collimation = 160 × 0.25 mm, contrast material; Iopamidol 300 mg I/mL, 100ml, injection rate = 5 ml/s, acquired at 0, 30, 45, 60, 90 secs after injection, CTDI = 55.9 mGy/rot, DLP = 223.4 mGycm/rot, total DLP = 1117 mGycm. The imaging parameters for MR imaging were as follows: TR/TE = 350/12 msec, FOV = 150 × 150 mm, voxel size = 0.39 × 0.39 × 2 mm3, contrast material; Gadobutrol, 0.05 ml/kg, injection rate = 1 ml/s followed by saline flush, acquired at every 20 sec after injection until 2 min. CT values and signal intensity on the normal appearing anterior lobe, pituitary adenoma and the left temporal white matter were measured. The areas under the curve (AUCs) of the values compared to white matter were calculated. Relative AUC (rAUC) was subsequently calculated for each lesion, as rAUC = AUCadenoma/AUCanterior lobe. Statistical analyses were performed with Wilcoxon signed-rank test.

RESULTS

There were no statistically significant differences in the AUCs of the anterior lobes (CT: 199.40 ± 62.14, MR: 172.25 ± 40.19; P = 0.13) and the adenomas (CT: 137.42 ± 44.95, MR: 151.53 ± 27.28; P = 0.08) based on CT and MR. rAUC on CT (0.69 ± 0.19) was significantly less than that on MR (0.93 ± 0.21; P = 0.0014). There were no statistically significant differences in these values among tumor subtypes.

CONCLUSION

Dynamic ultra-high-resolution CT might better discriminate pituitary adenomas from the normal appearing anterior lobe than dynamic MRI.

CLINICAL RELEVANCE/APPLICATION

With dynamic ultra-high-resolution CT, we could better discriminate pituitary adenomas from the normal appearing anterior lobe of the pituitary gland than with 3-T MRI.

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NR392-SD-THB2

Utility of Susceptibility Weighted Imaging (SWI) in Diagnosing Colloid Cyst

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #2

Participants
Rashmi S. Thakkar, MD, Cabin John, MD (*Presenter*) Nothing to Disclose
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PURPOSE

Colloid cysts are relatively rare intracranial lesions located in the rostral aspect of third ventricle. They may produce acute hydrocephalus, brain herniation and death. On conventional MR imaging the appearance of colloid cyst varies depending on its internal composition and can be isointense to adjacent brain parenchyma on T1 and T2 weighted sequence. As a result, it can be sometimes missed. However, on SWI, colloid cysts can be identified as a well-defined mildly hyperintense rounded lesion with a characteristic hypointense rim. We define this appearance of colloid cysts on SWI as the 'Black Rim Sign'. The purpose of this study is to assess the utility of SWI for the accurate diagnosis of colloid cyst.

METHOD AND MATERIALS

IInstitutional review board approved retrospective study was performed on cases from January 2012 - September 2018. Two fellowship trained neuroradiologists were blinded to cases and controls, and individually interpreted 100 brain MRI scans (19 cases and 81 control) for the presence of colloid cyst based on the 'Black Rim Sign' on SWI. Out of 19 cases, 9 were pathology proven colloid cysts.

RESULTS

Sample consisted of 43% males and 57% females, average age was 51.8 + 17.7. Sensitivity, specificity and accuracy for reader 1 was 94.8%, 98.8% and 98% and for reader 2 was 89.5%, 100% and 98% respectively. Positive predictive value and negative predictive value for reader 1 was 94.7% and 98.8% and for reader 2 was 100% and 97.6% respectively. Interrater correlation between the two readers was good with kappa of 0.93.

CONCLUSION

The 'Black Rim Sign' on SWI is a novel and accurate diagnostic tool for the diagnosis of colloid cyst. This can be especially useful in cases where the conventional MR imaging is indeterminate.

CLINICAL RELEVANCE/APPLICATION

Colloid cyst on conventional MR can be missed if it is isointense to adjacent brain. However, on SWI it can be identified as a mildly hyperintense lesion with a characteristic hypointense rim in the region of the foramen of Monro.

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NR393-SD-THB3

The Effects of Sound Therapy on Resting-State Functional Brain Networks in Patients with Tinnitus: A Graph-Theoretical-Based Study

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #3

Participants
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PURPOSE

Tinnitus is considered to be triggered by aberrant neural activity in the brain. We hypothesized that sound therapy, as a commonly used tinnitus treatment method, would alter the functional connectivity (FC) of brain regions in tinnitus models.

METHOD AND MATERIALS

In this study, resting-state functional magnetic resonance imaging data were collected from 27 tinnitus patients before and after 12 weeks of sound therapy. Twenty-seven matched healthy controls were also longitudinally scanned at the 12-week time point. Functional connectivity strength (FCS), a graph-theoretical-based analytic method, was applied to analyze the FC features in the whole brain.

RESULTS

The interaction effect between the two groups and two scans on FCS was observed in the bilateral thalamus and left anterior cingulate cortex (ACC). The FCS values in the bilateral thalamus were significantly higher in tinnitus patients at baseline and decreased to relatively normal range after sound therapy compared with healthy controls. Conversely, the FCS values in the left ACC were within normal range but increased after treatment. Importantly, significant correlations observed between the FCS changes in the right thalamus, the FC of the right thalamus-right inferior frontal gyrus, and symptomatic improvement suggest that the right thalamus connectivity may act as an objective indicator of the clinical response to sound therapy.

CONCLUSION

These findings provided evidence that sound therapy may modulate intrinsic network connectivity by altering the gating function of the thalamus as well as enhancing the tinnitus canceling system, adding to our understanding of the neurological mechanism of sound therapy.

CLINICAL RELEVANCE/APPLICATION

This study demonstrated that sound therapy may modulate intrinsic network connectivity by altering the gating function of the thalamus as well as by the enhancing tinnitus-canceling system. Understanding the neural mechanisms of sound therapy is pivotal for better management of tinnitus and sheds light on the neurological mechanism of tinnitus treatment.

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NR415-SD-THB4

A Machine-Learning Based Top 10 List: Extracranial Determinants of Cerebral White Matter Lesion Volume

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #4

Participants
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PURPOSE

High white matter lesion (WML) volume of the brain is associated with an increased risk of stroke, worse outcome after stroke as well as an increased incidence or earlier onset of dementia. Regarding the plethora of potentially interrelated factors influencing the development of cerebral WML, drawing a clear picture of the most powerful determinants of WML is challenging. Considering that traditional confounder-adjusted regression models have limitations in datasets with large numbers of variables, a machine-learning approach might be suited to overcome these challenges. The aim of this study was to identify the variables with the biggest effect size on WML volume using machine-learning algorithms.

METHOD AND MATERIALS

400 subjects of the KORA study cohort underwent 3T-MRI. WML were manually segmented on 3D-FLAIR-images. 90 extracranial parameters including measures of diabetes, blood pressure, adipose tissue, medication intake, sociodemographics, anthropometrics, behaviour, somatic/depressive symptoms and sleep were collected in a standardized method. To identify relevant predictor covariates associated with WML volume penalized zero-inflated negative binomial regression models based on elastic Net (EN) regularization were calculated.

RESULTS

The final study population consisted of 370 participants (58% male; age: 55.7 ± 9.1 years). WML were found in 236 participants with a mean volume of 2797.45 ± 7392.12 mm3. The EN model was evaluated on 1000 data splits. The ten variables most often selected were in descending order: age, controlled hypertension, HbA1c, widowed marital status, prediabetes, antiplatelet medication, hypertension unawareness of participants with hypertension, NSAID medication, physical activity less than 2h/week, alcohol consumption 1g-20g/day.

CONCLUSION

In this reference population without prior cardiocerebrovascular disease, a systematic machine-learning based analysis of 90 extracranial parameters showed that besides age and hypertension prediabetes might play an important role in the development of WML, and identified HbA1c as a quantitative determinant of WML.

CLINICAL RELEVANCE/APPLICATION

This systematic analysis of 90 extracranial WML determinants has the potential to inform the development of prevention strategies and monitor early treatment strategies of WML-associated morbidity.

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NR416-SD-THB5

Artificial Intelligence-Based Cochlea Segmentation and Analysis on Clinical High-Resolution CT Images: Towards Automatic Patient-Specific Measurements for Surgical Planning

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #5

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PURPOSE

To develop a method to automatically segment and measure the human cochlea in clinical CT images for personalized implant planning.

METHOD AND MATERIALS

108 CT temporal bone scans from as many different patients were acquired with two ultra-high resolution CT scanners (voxel size 0.25x0.25 mm, Aquilion ONE Precision and Proteus, Canon Medical Systems). An Artificial Intelligence (AI) algorithm for automated cochlea detection, segmentation, and analysis was developed and applied to this data set. Measurements performed were cochlea length, width, height, basal radius, volume, and cochlear duct length. The algorithm uses deep learning, through the combination of multiscale residual architectures for cochlea detection, an encoder-decoder network for segmentation, and another residual network for measurements. The system was trained and validated using extensive data augmentation on 48 scans, and tested on the remaining. Testing was performed against manual annotation (in terms of Dice similarity) and manual measurements, which were performed on all scans under the supervision of an experienced head-and-neck radiologist.

RESULTS

Automatic segmentation resulted in a Dice similarity of 0.93±0.03 against manual annotation. Measurements resulted in an average absolute error of 0.014±0.002 ml (9%) for the volume, 0.46±0.05 mm (5%) for the length, 0.065±0.021 mm (1%) for the width, 0.56±0.71 mm (8%) for the height, 0.10±0.02 mm (5%) for the basal diameter, and 1.93±0.22 mm (6%) for the cochlear duct length. The size of the cochlea varied broadly among the patients in our dataset, ranging between 0.10-0.28 ml (volume), 7.3-9.8 mm (length), 5.4-7.1 mm (width), 5.3-10.1 mm (height), 1.4-2.5 mm (basal diameter), and 27.7-38.3 mm (cochlear duct length).

CONCLUSION

The developed AI system could segment and measure the cochlea with satisfying accuracy, and highlighted a high variability in cochlea size across different patients. This could suggest that the current use of a single-size cochlear implant electrode may not be suitable for an optimized surgical outcome.

CLINICAL RELEVANCE/APPLICATION

Performing patient-specific pre-operative cochlea CT-based measurements could be helpful to positively affect the outcome of cochlear surgery in terms of intracochlear trauma and loss of residual hearing.

NR417-SD-THB6

Develop Recommendations for Follow-Up Carotid Ultrasound Surveillance of Patients with <60% Carotid Stenosis

Thursday, Dec. 5 12:45PM - 1:15PM Room: NR Community, Learning Center Station #6

Participants
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PURPOSE

Develop recommendations for follow-up carotid ultrasound surveillance of patients with <60% carotid stenosis.

METHOD AND MATERIALS

This retrospective observational cohort study includes 2957 patients who were seen between August 1998 and March 2015 in a total of 4440 visits; 8880 observations were analyzed. Primary outcome was defined as progression of carotid stenosis: baseline stenosis of 0%-39% progressed to 40%-59% on subsequent examination, baseline stenosis of 0%-39% progressed to >=60%, or baseline of 40%-59% progressed to >=60%. Medications taken and comorbidities were analyzed. Progression risk was estimated using Cox proportional hazard ratios and progression speed with the Kaplan-Meier method.

RESULTS

More than 10% of patients progressed in the 40%-59% baseline group within 12 months, as opposed to 78 months for the 0%-39% baseline group. Patients who progressed had a higher proportion of peripheral vascular disease, ischemic heart disease, and active smoking compared to those who did not. While there were statistically significant correlations between medication classes and comorbidities, none of the medications studied appeared to slow carotid stenosis progression. The survival analysis showed a significant difference in progression of carotid stenosis depending on the level of carotid stenosis at baseline. Estimated survival for 10% progression was 73 months for 0%-39% stenosis and 11 months for 40%-59%.

CONCLUSION

: For patients with a 0%-39% carotid stenosis, follow-up examination should be performed at 6-year intervals. For patients with 40%-59% carotid stenosis, follow-up should be obtained annually to identify those who progress to a level requiring intervention.

CLINICAL RELEVANCE/APPLICATION

As a result of this outcome study, patients can now be appropriately advised when to receive follow up examinations when they are identified as having a minor stenosis of less than 59% on a carotid ultrasound examination. Patients with a minor stenosis of <59% should be followed with carotid ultrasound at significantly different intervals based on the degree of stenosis. : Patients with minor carotid stenosis should appropriately be followed with ultrasound at different intervals (independent of comorbidities and medications): 0%-39% stenosis at 6-year intervals and 40%-59% stenosis at yearly intervals to identify progression.

PD186-ED-THB7

360 Degrees of Pediatric Biliary Disease: Multimodality Imaging Review

Thursday, Dec. 5 12:45PM - 1:15PM Room: PD Community, Learning Center Station #7

Participants
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TEACHING POINTS

To be familar with standard and novel imaging techniques to evaluate biliary tree anatomy and function To understand which imaging studies to do when in the assessment of pediatric biliary disease at different ages To recognize different manifestations of pediatric biliary disease across modalities

TABLE OF CONTENTS/OUTLINE

OUTLINE1. IMAGING TECHNIQUES:Standard and novel imaging techniques, such as ultrasound and magnetic resonance elastography, used in evaluation of bile ducts will be reviewed, defining their anatomical and functional roles, and advantages and disadvantages, specific to the pediatric population. (Table 1)2. PEDIATRIC BILIARY DISEASES:Case-based imaging algorithms will be used to illustrate the spectrum of biliary disorders encountered in infants, children and adolescents, including congenital, genetic, inflammatory, neoplastic and traumatic conditions. (Table 2) What test to use when, with key imaging findings and clinicopathologic correlation, will be considered at different time points from initial presentation, to monitoring disease progression or treatment response, guiding diagnostic or therapeutic procedures, and assessing treatment complications including liver transplantation where pertinent to the biliary tree. Diagnostic mimics, grading systems and template reporting will also be discussed.

PD227-SD-THB1

To Evaluate the Role of 18F-FDG PET/CT versus Conventional Imaging for Initial Staging and Follow-Up of Pediatric Sarcomas

Thursday, Dec. 5 12:45PM - 1:15PM Room: PD Community, Learning Center Station #1

Participants
Sikandar M. Shaikh, DMRD, Hyderabad, India (*Presenter*) Nothing to Disclose

PURPOSE

The purpose of this study was to compare the diagnostic performance of 18F-FDG PET/CT and conventional imaging for staging and follow-up of pediatric osteosarcoma and skeletal Ewing sarcoma.

METHOD AND MATERIALS

We evaluated the sensitivity, specificity, and accuracy of PET/CT and other conventional imaging (CT, MRI, bone scanning) modalities for sites of disease and number of lesions. Diagnostic benefit, defined as better characterization of lesions, was evaluated on a per-scan basis, comparing PET/CT and conventional imaging.

RESULTS

A total of 103 lesions were characterized by imaging in 31 patients (10, osteosarcoma; 21, Ewing sarcoma). For osteosarcoma patients PET/CT was available only at follow-up, where it proved more accurate than conventional imaging for the detection of bone lesions (accuracy, 95% vs 67% for CT and 86% for MRI) and complementary to CT in evaluating lung nodules (sensitivity, 84% vs 94%; specificity, 79% vs 71%) with diagnostic benefit in 18% of examinations. In patients with Ewing sarcoma, PET/CT tended to perform better during follow-up than at initial staging (accuracy, 85% vs 69%). For lung findings, PET/CT was more specific than CT but was less sensitive. The diagnostic benefit of PET/CT was greater at staging (28%) than during followup (9%). On a per-patient basis, PET/CT provided diagnostic benefit in 11 of 22 patients with Ewing sarcoma and four of 10 patients with osteosarcoma at least once during clinical management.

CONCLUSION

FDG PET/CT provides diagnostic benefit in Ewing sarcoma and osteosarcoma, with the exception of small lung nodules. Prospective studies are needed to define the best imaging algorithm and combination of tests in the staging and follow-up of patients with pediatric bone sarcoma.

CLINICAL RELEVANCE/APPLICATION

Thus PET-CT has better relevance as compared to the other imaging modalities.

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PD228-SD-THB2

Survival Prediction Model of Children with Hepatoblastoma-Based on PRETEXT System

Thursday, Dec. 5 12:45PM - 1:15PM Room: PD Community, Learning Center Station #2

Participants
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PURPOSE

To identify clinical and imaging predictors of outcome in pediatric patients with hepatoblastoma.

METHOD AND MATERIALS

A total 84 patients (mean age, 2.9 ± 3.5 years) were retrospectively identified between 1998 and 2017 in our tertiary referring center. Eligible criteria were patients who (1) diagnosed with hepatoblastoma, (2) were younger than 18 years old, and (3) had initial cross-sectional imaging (CT or MRI) at the time of diagnosis.Clinical variables including age and serum alpha fetoprotein (AFP) level at the initial diagnosis and imaging variables of PRETEXT (PRE-Treatment EXTent of tumor) staging system including groups (I-IV) and annotation factors (V, P, E, F, R, C, N, M) were evaluated. Event-free survival (EFS) (i.e. time from diagnosis to first relapse, progression, second malignancy, or death for any reason), which was the primary outcome of this study, was analyzed. Univariable and multivariable Cox proportional hazards analysis were used to analyze the effect of clinical and radiologic variables. C-index was measured to quantify the model's discriminatory performance.

RESULTS

Univariable Cox proportional hazards analysis revealed that age group, and PRETEXT annotation factor of P, F, and M were significant predictors of EFS. On multivariable Cox proportional hazard analysis, the PRETEXT annotation factor of F (multifocality of tumor) was the strongest predictor (HR 2.908, 95% CI of 1.061-7.972, p=0.038) in predicting EFS. The PRETEXT annotation factor of M (distant metastasis) showed borderline significance in predicting EFS (HR 2.416, 95% CI of 0.918-6.354, p=0.074). The prediction model based on F and M (F+M model) showed good performance to predict EFS (C statistics, 0.734; 95% CI of 0.612-0.854).

CONCLUSION

PRETEXT annotation factor of F was most powerful prognostic factor for predicting EFS in pediatric patients with hepatoblastoma. The F+M model driven from our multivariable model showed high discrimination ability of risk prediction for EFS.

CLINICAL RELEVANCE/APPLICATION

Prediction model consisted of F(multifocality) and M(distant metastasis) help to identify tumors with high risk and is recommended to use in patients with hepatoblastoma of pret-reatment stage to predict outcome.

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PD229-SD-THB3

Usefulness of Cardiac T1 and T2 Mapping in Pediatric Patients with Myocarditis: Do We Need Gadolinium?

Thursday, Dec. 5 12:45PM - 1:15PM Room: PD Community, Learning Center Station #3

Participants
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PURPOSE

Early diagnosis of myocarditis decreases risk of progression. Cardiac MRI is basic for non-invasive diagnosis, especially in children. Lake Luise criteria show wide range of sensitivity (Se) and specificity (Sp) T1 and T2 mapping are quantitative sequences, not based on gadolinium, for detection of myocardial inflammation. There are few studies about their use in pediatric population. Objectives: • To evaluate T1 mapping value to diagnose acute myocarditis in children, to differentiate clinical patterns and to detect exacerbations • To use topographic maps and incremental native T1 thresholds to detect fibrosis-necrosis, and compare it with LGE • To evaluate additional value of T2 mapping and extracellular volume (ECV)

METHOD AND MATERIALS

Prospective study (2017-19)with 9 acute and 5 chronic myocarditis, 2 exacerbations and 5 controls. MRI was performed on Avanto 1.5 Tesla.

RESULTS

Absolute values of native T1-maps in interventricular septum and free wall of left ventricle were higher in acute than chronic myocarditis ($p<0.01$) or controls ($p<0.001$) and no differences were found between chronic myocarditis and clinical exacerbations. T1 mapping offer area under curve (AUC) of 0.86 in septum and 0.94 in free wall to differentiate acute myocarditis from the other cases, with a Se of 77.8% and Sp of 83.3% for a cut-off of 1.050ms. Combination of T1 and T2 mapping raised SP to 100%. ECV didn't offer additional value. Cut-off of 1.100ms in septum differentiated cases presented with cardiac insufficiency from infarct-like (AUC 100%) Se of T1 mapping (88.9%) was higher than qualitative LGE (44.4%), $p<0.001$.

CONCLUSION

• T1 mapping is a novel tool for diagnosis and prognosis of myocarditis in children, with high Se and Sp and additional value of T2 mapping. • Inflammatory changes in interventricular septum are more intense in infarct like myocarditis. • Topographic T1 maps and incremental T1 thresholds determine severity of acute myocarditis and correlates with areas of fibrosis and/or necrosis in a better way than LGE. • Cardiac MRI sequences based on gadolinium (LGE and ECV) don't offer additional value in diagnosis of myocarditis. • Diagnostic criteria should be redefined to include T1 and T2 mapping sequences.

CLINICAL RELEVANCE/APPLICATION

Diagnostic criteria should be redefined to include T1 and T2 mapping since they offer higher sensitivity than classical cardiac MRI sequences like LGE, without need of gadolinium.

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PD241-SD-THB4

CT-Based Radiomics Signature: A Potential Non-Invasive Biomarker for Predicting MYCN Amplification in Neuroblastomas in Children

Thursday, Dec. 5 12:45PM - 1:15PM Room: PD Community, Learning Center Station #4

Participants
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PURPOSE

To develop a CT-based radiomics signature and evaluate its capability for predicting the MYCN-amplification (MNA) in neuroblastomas (NBs) in children.

METHOD AND MATERIALS

This retrospective study included 77 children with histopathological-confirmed neuroblastomas (39 in training group and 38 in test group). Clinical information were recorded for each child.Children underwent MYCN gene detection and contrast-enhanced CT before treatment. Region of interest (ROI) was manually delineated in pre-contrast phase, arterial phase, and venous phase with five slices of primary tumor, and 396 CT-based radiomics features were extracted from each phase respectively. The synthetic minority oversampling technique (SMOTE) was used to balance the sample number in training group (MNA vs non-MNA, 7 vs 32). Four radiomics signatures were built by the least absolute shrinkage and selection operator (LASSO) logistic regression model based on the 3 phases and combined phase, respectively. The receiver operating characteristics curve (ROC) analysis and 10-fold aross validation were conducted to evaluate the predictive performance of them. The developed radiomics signature was further validated for its predictability in the test group.

RESULTS

All of four CT-based radiomics signatures were developed as an independent predictor for MNA in NBs. The best predicting performance of MNA was from the combination of pre- and post-phases. The sensitivity, specificity, accuracy and area under the curve of training group were 96.4%, 100%, 98.0%, and 1.00, while 93.8%, 100%, 94.9%, and 0.98 in the test group,respectively.

CONCLUSION

The proposed CT-based radiomic signature can potentially help in predicting MNA in pretreated NBs in children. Combination of images in the pre- and post-contrast phase can serve as a better non-invasive biomaker for the identification of MNA.

CLINICAL RELEVANCE/APPLICATION

This study is designed to developing a CT-based radiomics signature and evaluating its capability for predicting the MYCN-amplification (MNA) in neuroblastomas (NBs) in children. The proposed CT-based radiomic signature can potentially serve as a non-invasive biomaker for the identification of MNA.

PD242-SD-THB5

Utility of Non-Contrast Doppler Sonography in Diagnosing Vesicoureteral Reflux in Children: Report from a Developing Country

Thursday, Dec. 5 12:45PM - 1:15PM Room: PD Community, Learning Center Station #5

Participants
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PURPOSE

Voiding cystourethrography (VCUG), radionuclide cystography and contrast-enhanced voiding urosonography are the main diagnostic methods when vesicoueretral reflux (VUR) is suspected. Many children with VUR, however, need relatively long-term follow-ups that put them at risk of radiation by VCUG and cystography. Contrast agents required for urosonography, on the other hand, are expensive and/or inaccessible especially in developing countries with limited resources. This study aimed to evaluate the diagnostic value of non-contrast Doppler sonography in detecting VUR in children.

METHOD AND MATERIALS

After being approved by the Ethics Committee of our university (No. 89/3-9/2), a total of 77 children (mean age, 41.9 months; range, 2 to 124 months) who were referred for VCUG underwent non-contrast Doppler sonography using Ultrasonix OP equipped with 5-14 and 2-5 MHz probes by an experienced radiologist. Saline instilled into the bladder through the indwelling catheter and the ureterovesical junctions were examined by color Doppler sonography. VCUG was considered the standard method of choice.

RESULTS

VCUG detected VUR on 47 sides. Color Doppler sonography showed VUR on 14 sides, yielding true positive results in 14 sides, true negative results in 60 sides and false negative results in 33 sides. There was no false positive findings. Sensitivity, specificity, positive predictive value and negative predictive value of color Doppler sonography were 30% (95%confidence interval, 17.3%-44.9%), 100%, 100% and 64.5% (95%CI, 53.9%-74.2%), respectively.

CONCLUSION

Non-contrast Doppler sonography is a specific but not sensitive modality in detecting VUR in clinically suspected children.

CLINICAL RELEVANCE/APPLICATION

Despite its high specificity, superb safety profile, high availability and inexpensiveness, non-contrast Doppler sonography will miss many symptomatic children with VUR even in experienced hands.

PH138-ED-THB8

Know Your Dark Horse in Imaging: Acquisition and Physics Behind Dual-Energy CT and Its Application in Cardiac Imaging

Thursday, Dec. 5 12:45PM - 1:15PM Room: PH Community, Learning Center Station #8

Participants
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TEACHING POINTS

1. To educate the reader about the different acquisition techniques of dual energy CT.2. To describe the physics behind dual energy CT and understanding its basis on material decomposition 3. To discuss the applications of dual energy CT in cardiac imaging4. To be aware of pitfalls that could occur during dual energy CT.

TABLE OF CONTENTS/OUTLINE

108 CT coronary angiogram studies were done using dual energy CT performed in 2018-2019. Prospective review revealed various applications of DECT including in patients with suspected instent restenosis, high calcium score, stress and rest perfusion, assessment of myocardial infarction and viability will be discussed. We also discuss the various acquisition techniques in dual energy CT, physics behind it. Pitfalls which occur due to display Settings and Noise of Color-Coded Iodine maps, image noise on virtual monoenergetic images will also be discussed.

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PH209-SD-THB1

Construction and Pre-Evaluation of an In-House Cylindrical Ionization Chamber Fabricated from Indigenous Materials

Thursday, Dec. 5 12:45PM - 1:15PM Room: PH Community, Learning Center Station #1

Participants
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PURPOSE

The objectives of this study were to construct a very robust in-house cylindrical ionization chamber from locally available materials to minimise cost, and to assess the suitability of the constructed ionization chamber (IC) to be used for radiation metrologies appropriate with the detector in a clinical setting

METHOD AND MATERIALS

The entire body of the constructed IC was composed of Perspex (PMMA). Within the sensitive volume of the IC, the Perspex wall was made conductive by lining it with a piece of paper smeared with Graphite. The central electrode of the chamber was made of Alumimium rod, which formed part of strands of wires within a piece of scrapped Alumimium twisted cable obtained from the country's main electricity provider. The in-house IC was made waterproof by passing the triaxial cable connecting its various electrodes through a plastic tube which once served as a drainage tube of a urine bag. This connection was done such that the chamber was vented to the environment. The completed in-house IC was evaluated for: polarity effect, ion recombination, ion collection efficiency, stability, dose linearity, stem effect, leakage current, and angular, dose rate and energy dependences.

RESULTS

Although the pre-evaluation results confirmed that the in-house IC satisfied the stipulated international standards for ICs, there were the need to enhance stem effect and leakage current characteristics of the IC. The in-house IC was found to have an absorbed dose to water calibration coefficient of 4.475 x 107 Gy/C (uncertainty of 1.6%) for cobalt 60 through a cross calibration with a commercial 0.6 cc cylindrical IC with traceability to the Germany National Dosimetry Laboratory. Using a Jaffé diagram, the in-house IC was also found to have recombination correction factor of 1.0078 when operated at the calibration voltage of + 400 V. In terms of beam quality correction factors for megavoltage beams, the in-house IC was found to exhibit characteristics similar to those of Scanditronix-Wellhofer IC 70 Farmer type IC.

CONCLUSION

The use of the constructed in-house IC for beam output calibration in external beam radiotherapy is recommended.

CLINICAL RELEVANCE/APPLICATION

The study would be of interest to readers in the areas of reference dosimetry, design and construction of dosimeters. This study would also be of great significance to developing countries and other places with less endowed Radiotherapy Oncology institutions.

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PH223-SD-THB2

Evaluation of Patient Radiation Dose Values Recorded During Fluoroscopically-Guided Neuro-Endovascular Procedures

Thursday, Dec. 5 12:45PM - 1:15PM Room: PH Community, Learning Center Station #2

Participants
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PURPOSE

This study compares patient radiation doses between fluoroscopically-guided neuro-endovascular procedures. Peak skin dose is compared to dose area product and cumulative air kerma to determine correlations between these variables.

METHOD AND MATERIALS

The peak skin dose (PSD), cumulative air kerma (CAK), and dose area product (DAP) were retrospectively collected for 301 neuro-endovascular procedures from the Canon real-time Dose Tracking System (DTS). The procedures were categorized as cerebral angiography (207), aneurysm treatment (30), arteriovenous malformation (AVM) treatment (13), stenosis treatment (34), or thrombectomy (17). Cerebral angiographies were classified as diagnostic and the others interventional.

RESULTS

There was no significant difference in body mass index (BMI) of patients between procedure types. Cerebral angiography had a mean PSD (286 mGy) 3.4 times lower than the interventional procedures with individual procedure PSD's being: aneurysm treatment (1274 mGy), AVM treatment (1212 mGy), stenosis treatment (337 mGy), and thrombectomy (921 mGy). Eight interventional cases had a PSD above the 2000 mGy threshold for skin erythema: 5 aneurysm treatments, 2 AVM treatments, and 1 thrombectomy. The mean PSD, CAK, and DAP of the diagnostic procedures were significantly different from the interventional procedures ($p < 0.001$). However, the mean PSD and DAP of cerebral angiography, although lower, were not significantly different from stenosis treatment ($p = 0.117$ and $p = 0.139$). Regression analysis revealed a positive association, but with considerable dispersion of the data about the regression line between PSD and CAK ($R = 0.962$, mean absolute residuals = 88.8 mGy) and between PSD and DAP ($R = 0.869$, mean absolute residuals = 158.9 mGy) in the overall sample population.

CONCLUSION

Radiation exposure to patients during neuroendovascular procedures varies depending on the type of procedure. Cerebral angiography resulted in significantly lower radiation exposure than interventional procedures. PSD is important to assess the risk for skin injury and should be determined independently since, as seen from the magnitude of the residuals, it cannot be accurately estimated from CAK or DAP values.

CLINICAL RELEVANCE/APPLICATION

This presentation provides an insight into the magnitude of dose for neuroendovascular procedures which can place patients at risk for deterministic and stochastic radiation effects.

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PH224-SD-THB3

A Brief Answer to the Concerns About Neutron Contamination in 18-MV Spatially Fractionated Radiation Therapy

Thursday, Dec. 5 12:45PM - 1:15PM Room: PH Community, Learning Center Station #3

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PURPOSE

Despite the advantages of Spatially Fractionated Radiation Therapy (SFRT), there are concerns about photo-neutron production in 18-MV SFRT, especially when high-Z materials such as lead, cerrobend or brass are used for constructing the grid blocks. To have a better understanding about these concerns, the Monte Carlo (MC) calculations were carried out and the photo-neutron production was compared between two treatment modalities: 20-Gy single fraction SFRT and 40-Gy Conventional Fractionated Radiation Therapy (CFRT) in 20 fractions.

METHOD AND MATERIALS

The MCNPX 2.7.0 code was used to simulate photo-neutron production in the gantry head of an 18-MV LINAC (Varian 2100 CD). The tally f4 was used to estimate the total neutron fluence at the isocenter (Φn). SFRT plans were generated in different field sizes with a grid block on the LINAC tray. Each plan was calculated with a grid made of different materials (lead, cerrobend and brass). In the corresponding CFRT plans, same field sizes were used without a grid. Additionally, Neutron Equivalent Dose (NDE) to an 8 cm spherical tumor inside the liver of a MIRD anthropomorphic phantom was compared between CFRT and SFRT (brass grid only). In all MC calculations, the relative error was kept within 3%.

RESULTS

The values of Φn in the CFRT plans were found to be 4.56, 5.02, 5.18 and 5.11 (108 n/cm2) for 10 × 10, 15 × 15, 20 × 20 and 25 × 25 cm2 fields, respectively. In the corresponding SFRT plan using a brass grid, they were 1.2, 1.46, 1.68 and 1.81 (108 n/cm2). The Φn increased to 1.82, 2.37, 2.94 and 3.43 (108 n/cm2) when a lead grid was used instead. The Φn in SFRT with a cerrobend grid was 1.82, 2.31, 2.86 and 3.28 (108 n/cm2). The NDE to the tumor for the SFRT plan (brass grid) and CFRT plans was found to be 11.9 and 38.4 mSv, respectively.

CONCLUSION

In contrast with common concerns about 18-MV SFRT, this study showed that the neutron contamination during SFRT is less pronounced than CFRT. The Φn and NDE of SFRT are 33-74 % and 31% (brass grid) of CFRT. Brass is the preferred material for grid blocks due to its lower cross-section for (γ, n) reaction. This study will continue on the simulations of neutron dose to critical organs.

CLINICAL RELEVANCE/APPLICATION

(dealing with secondary neutron dose) Neutron contamination in 18 MV SFRT (GRID therapy) is less pronounced than conventional fractionated radiation therapy.

PH225-SD-THB4

Automated Segmentation of Cardiac Structures for Pre-Operative Training and Planning of Congenital Heart Surgery

Thursday, Dec. 5 12:45PM - 1:15PM Room: PH Community, Learning Center Station #4

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PURPOSE

To evaluate accuracies of automated 3D segmentation for the pre-operative training and planning of congenital heart surgery, via 3D U-Net with deep convolutional neural net (CNN).

METHOD AND MATERIALS

Pre-operative planning underwent for thirty-six patients with congenital heart disease, who were scanned by dual source mode of multi-detector CT (Somatom® Definition, Siemens) with submillimeter slice thickness. Myocardial structures including four chambers and lumen of vessels were manually segmented from enhanced CT images, under the supervision of an expert cardiac radiologist. Collected 36 pairs of CT images and 3D segmentation mask for myocardial structures were used to train 3D-Unet and 3-fold cross-validation were performed to evaluate the accuracy of the automatic segmentation method. Region of interest of congenital heart in CT images was standardized as 256 by 256 by 128 in 3D volume, and Dice similarity coefficient (DSC) was used to evaluate accuracy of the semantic segmentation method.

RESULTS

The automated semantic segmentation in 36 enrolled patients (Age 16.5±10.4 months, 19 male, and 17 female) showed considerable DSC accuracies (91.3% in 1st fold, 91.4% in 2nd fold, 92.5% in 3rd fold; 91.7% in average) compared to the ground truths via professional radiologist. In general, a manual segmentation task took around 7-9 hours. However, with the sematic segmentation which took around 10 sec, correction of automated segmentation result took around 1-2 hours for an expert radiographer.

CONCLUSION

The possible way to the full automation of myocardial structure segmentation, even for the congenital heart disease, was evaluated, which could be applied in real clinical workflow for more fast segmentation.

CLINICAL RELEVANCE/APPLICATION

Proposed automatic segmentation method of myocardial structures using 3D U-Net may help the radiologist's efforts for preoperative surgical planning and training, which could provide congenital heart disease patient more stable and effective surgical care.

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PH245-SD-THB6

The Impact of Radiation Dose on the Measurement Accuracy of Nodule Volume and Long Diameter Using Deep Learning-Based Computer-Aided Diagnostic System: A Phantom Study

Thursday, Dec. 5 12:45PM - 1:15PM Room: PH Community, Learning Center Station #6

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PURPOSE

To investigate the impact of radiation dose on the measurement accuracy of nodule volume and long diameter with a deep learning-based computer aided diagnostic system (DL-CAD) using an anthropomorphic chest phantom.

METHOD AND MATERIALS

An anthropomorphic chest phantom consisting of realistic pulmonary vessels (LUNGMAN, KYOTO KAGAKU, Kyoto, Japan) was used to simulate chest CT imaging. The chest phantom contains 8 spherical lung nodules of different diameters (6 mm, 8 mm, 10 mm, 12 mm) and densities (solid and ground glass nodules) and were scanned on a 256-slice CT (Revolution, GE Healthcare) with the following parameters:120 kVp, Noise Index=12, pre-ASIR-V was adjusted to 0%, 40%, 80% and 100% to modulate the tube current. Images were reconstructed with lung kernel and post-ASIR-V of 80%. Absolute percentage error (APE) of the diameter and volume of the lung nodules was used to describe the accuracy of measurement. The diameter APE was calculated as APEd =| Dm-Drs| / Drs×100, and the volume APE was calculated as APEv = | Vm-Vrs| / Vrs×100, where Dm, Drs represent the true and measured long diameter and Vm, Vrs represent the true and measured volume. One-way ANOVA and LSD-t test were used to compare APEd and APEv of nodules with different sizes and densities.

RESULTS

Effective radiation dose of different scans with 0%, 40%, 80%, 100% pre-ASIR-V were 9.68mSv, 3.78mSv, 0.82mSv and 0.23mSv respectively ($p<0.01$). For both nodule diameter and volume measurement, APEd and APEv for 0%, 40%, 80%, 100% pre-ASIR-V scans increased significantly ($p<0.05$) as the effective dose decreased, there was a significant difference between each scan for both APED and APEv ($p<0.05$) (Table 1 and Fig. 1-3).

CONCLUSION

The radiation dose impact the measurement accuracy of nodule volume and long diameter with DL-CAD.

CLINICAL RELEVANCE/APPLICATION

Radiation dose impact the measurement accuracy of volume and long diameter measurement accuracy with DL-CAD. Attention should be paid when DL-CAD was used to lung cancer screening or follow-up.

PH246-SD-THB7

Assessment of Texture Feature Reproducibility in Dual-Energy Computed Tomography Virtual Monoenergetic Images

Thursday, Dec. 5 12:45PM - 1:15PM Room: PH Community, Learning Center Station #7

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PURPOSE

To explore the reproducibility of radiomic texture features across virtual monenergitic images generated from dual-energy CT (DECT) acquisitions used in clinical practice and clinical trials at our institution.

METHOD AND MATERIALS

A phantom containing liver and lung texture modules was scanned in triplicate with a clinical dual source DECT scanner. Three fixed volumes of interest (VOIs) were drawn in mixed images (weighted images of low (90kV) and high (150kV) energy acquisitions) and monoenergetic images at 8 different energy levels (40,50,60,70,80,100,120,140 keV) to compare four Harlick texture features (energy, entropy, contrast, and homogeneity). Percentage difference of texture values from the mixed image was calculated for each VOI and keV level.

RESULTS

For VOIs placed in the lung portion of the phantom, texture value difference from mixed the image was on average 10% (range:1-17%) for energy, 4% (range:0.5-8%) for contrast, 3% (range:0.3-6%) for correlation, and 1% (range:0.1-2%) for homogeneity. In liver these values included 7% (range: 0.4-16%) for energy, 11% (range: 0.4-39%) for contrast, 10%(range: 2-29%) for correlation, and 2%(range: 0.3-6%) for homogeneity.

CONCLUSION

All four texture features reviewed showed variance across monoenergetic images of DECT.

CLINICAL RELEVANCE/APPLICATION

Defining imaging device characteristics and their effect on imaging features with an empirical manner is a critical step for utilization of radiomics in the precision medicine era.

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QI008-EB-THB

Pushing Limits: Are We Scanning Too Far?

Thursday, Dec. 5 12:45PM - 1:15PM Room: QR Community, Learning Center Hardcopy Backboard

Participants
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PURPOSE

CT-related x-ray doses are a public health concern with epidemiological evidence of a small increase in cancer risk. ALARA mandates that any radiation dose, no matter how small, without a direct benefit, should be avoided. There has been significant effort to reduce radiation dose in CT by adjusting parameters including number of scan phases, tube voltage and current, scan pitch, and applying iterative reconstruction techniques. Dose reduction protocols in chest CT primarily include limiting tube current and increasing pitch. However, the most basic facet of imaging seems to be overlooked when one reviews the existent practice standards aimed to reduce CT dose. Dose is directly proportional to the scan length, which can and should be reduced to the area of anatomic interest. Studies have shown that in almost every CT, the imaged volume is larger than the actual volume of interest, with an associated linear increase in dose.Historically, oncologic chest CTs were extended inferiorly to include the adrenal glands. Additionally, many CTAs extend the field of view to include the abdominal aorta. Since there are no mandated anatomic landmarks on the scout tomogram, it is left to the technician's discretion to determine the field of view. This has led to a "creep" phenomenon where many CTs extend far into the abdomen, providing extra radiation at the patient's expense.To address this concern, we introduced new practice standards to ensure patient safety by setting exact anatomic limits to chest CTs. The purpose of our study was to implement a lasting intervention to decrease unnecessary radiation dose by reduction of scan length. In this way we can assure a comparable, safe radiation dose to every patient without inter-technician variability. We planned to regularly reassess the intervention to ensure that the effect persists.

METHODS

In September 2018, we created a task force to implement anatomic guidelines for CT chest exams. In collaboration with the chest division leadership, we trained radiologists, technical supervisors, and technicians to set the superior and inferior margins as the lung apices on the frontal scout view and the posterior costophrenic sulci on the lateral scout view, respectively. Technical supervisors provide daily support and assist technicians to enforce the new anatomic guidelines. There is continuous feedback from the physicians using our Radiology Information System which provides a messaging mechanism to alert technical staff about scan deficiencies at the time of interpretation.The primary outcome assessed is the radiation dose of our most common chest CT applications - routine non-contrast chest and contrast-enhanced pulmonary embolism protocol. Performance indicators are the dose-length product (DLP) and CT dose index (CTDIvol) values which are mined from every exam using the DoseMonitor software. The ACR instituted guidelines in 2014 to include only the lung parenchyma on lung cancer screening examinations which were implemented in our institution. These studies therefore served as negative controls.A quality management team, including a statistician, was formed to regularly analyze the outcome metrics in an ongoing basis. To assess the statistical significance of the dose reduction, we used linear regression models with the log-transformed CTDIvol and DLP as the response, pre and post time periods as the explanatory variable, and age, gender, and weight as covariates.

RESULTS

We reviewed CTDIvol and DLP values for 3110 routine chest CTs prior to and 3109 routine chest CTs after our intervention, for 1629 PE studies prior to and 1831 PE studies after our intervention, and 688 lung cancer screening studies prior to and 612 lung cancer screening studies after our intervention (Table 1). We found a statistically significant reduction in DLP in both the routine non-contrast (4.76%, P-val=1.1e-5) and pulmonary embolism protocol (5.8%, P-val=3.4e-7) chest CTs. As expected, there was no statistically significant reduction in CTDIvol or DLP in the lung cancer screening studies. There was a marginal reduction in CTDIvol in the routine chest CTs (1.93%, P-val=0.03). Creation of smoothing lines showed no evidence of return to pre-intervention dose levels for several months post-intervention.

CONCLUSION

Radiation dose is directly proportional to anatomic scan coverage. Using strict anatomic guidelines to only scan from the lung apices to the posterior costophrenic sulci, we were able to significantly reduce radiation dose to the patient for routine and pulmonary embolism protocol chest CTs. Further research will focus on the impact of better anatomic guidelines on incidental findings which may cause downstream imaging and expenses. Our aim is to further standardize scan lengths for other body regions in our institution and justify more exact global practice guidelines for routine CT imaging which are similar to those already instated for lung cancer screening studies.

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QI130-ED-THB1

Verification of Operational Database for MRI and Evaluation Analysis on Tasks for Safety Management

Thursday, Dec. 5 12:45PM - 1:15PM Room: QR Community, Learning Center Station #1

Participants
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PURPOSE

The environment surrounding medical care is constantly changing. While MRI imaging continues to innovate rapidly (with various applications being researched and developed) as the magnetic field of devices increases, there are very few examples that systematically evaluate the safety of the examination. In this research, the tasks of MRI examination are systematized and classified according to the evaluation items. We investigate which components are important in the safety management.

METHODS

We examine the important tasks in MRI Examination by the following methods.1. Draw Activity Diagram using Unified Modeling LanguageUML is a unified modeling language for object-oriented analysis and design.2. Create evaluation items using brainstorming and Assign evaluation items to the tasks from Activity Diagram.3. Perform ISM (Interpretive Structural Modeling) analysis on the components related to medical safety and Evaluate the relevance and impact of each componentsThe ISM method to which graph theory is applied is one of the structural modeling methods proposed by J.N.Warfield. In addition, it is possible to correct the contradiction of recognition based on human empirical judgment, to clarify the problem more objectively, and to create a directed graph by pairwise comparison of components. The generated model can be interpreted and examined for more objective problem solving and is applied in many fields.

RESULTS

1. In the Activity Diagram, there were 72 items in the MRI examination.2. As a result of brainstorming, the work of MRI Examination could be classified into quality control, safety management and image management. There were 30 components classified as safety management.3. In the MR, the components related to safety management were "confirmation of patient identification", "confirmation concerning the contrast examination" and "confirmation of the order contents and patient condition" and these components were affecting other work.

CONCLUSION

We could identify components related to medical safety and clarify the degree of influence of the items in the Activity Diagram. We were also able to systematize the work of the radiographers by drawing business flows. This raised the awareness of medical staff for safety in our hospital has increased.

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QI131-ED-THB2

Sustained Increases in The Quality of Imaging Histories Provided by Ordering Providers Resulting from Cross-functional Collaboration and Systems Design

Thursday, Dec. 5 12:45PM - 1:15PM Room: QR Community, Learning Center Station #2

Participants
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PURPOSE

Providing a complete imaging history supports high quality, accurate and efficient interpretations by radiologists. Many imaging orders submitted to radiology departments are missing key components of a complete imaging history. This can result in the radiologist having an unclear understanding of the clinical scenario requiring imaging and the question the ordering provider is seeking to have answered, potentially resulting in missed diagnoses and/or recommendations for additional unnecessary imaging. The purpose of this quality improvement project was to create sustained improvement in the frequency of complete imaging histories provided with imaging examinations submitted directly by ordering providers. A secondary outcome was to increase the amount of information submitted by ordering providers with imaging examinations.

METHODS

A cross-functional team of radiologists, primary care providers, physician assistants, a primary care supervisor, a process improvement expert, and an analyst collaborated to improve the quality of imaging histories. The team defined the components of a complete imaging history and tested the definition. Data was obtained and consecutive meetings allowed for iterative improvement cycles improving the standardized definition of a complete imaging history. Audits were regularly performed using consensus, and the project team regularly evaluated performance. The final components of the definition of a complete imaging history included: 'What happened?', 'When did it happen?', 'Where to focus?' and [what are you] 'Concerned for?' These prompts were subsequently inserted into the electronic physician order entry process and performance was monitored for an additional 18 months. The average number of complete imaging history components provided was analyzed via a u type control chart. Subset analysis was performed by each history question and by ordering provider.

RESULTS

10,236 orders were placed by providers in the study clinic from March 13, 2017, to December 16, 2018. 1,593 (15.6%) of all provided imaging histories were scored. 16.0% (72/449) of orders scored in the baseline period contained all four history components, which increased to 55.0% (928/1688, an absolute increase of +39.0%, a relative increase of +243.8%, P<0.0001) in the subsequent periods. Figure 1 demonstrates an average of 2.1 history components were provided during the baseline period, which increased to 3.1 (+47.6%) in subsequent periods. This average was sustained for more than a year, from May 29, 2017, through December 16, 2018. Figure 2 demonstrates that the frequency of orders placed with four complete history items increased from 16% at baseline, and was sustained throughout the project (64% during the implementation phase and 49% during the sustainability phase). It further demonstrates that at baseline, 11% of orders had one complete history component provided, which decreased to 0 to 2% during implementation and sustainability, respectively. All providers experienced a higher average number of components provided after the intervention, ranging from +1.5 to +0.3 more history components provided after the intervention. For 5 of 16 providers, this change was statistically significant in a per provider subset analysis. Table 1 provides examples of histories provided before and after the intervention. After the intervention, more details were provided, such as specific anatomic sites of concern, more complete medical history information, specific clinical exam findings, and suspected diagnoses, to support the interpreting radiologist in providing an accurate and clinically relevant interpretation. While sustained improvements were observed for each history component, some questions were more commonly submitted than others. Providers tended to more frequently provide information about 'What happened?' and 'Where to focus?' than 'When did it happen?' and [what are you] 'Concerned for?' (Figure 3). The average number of characters providers entered in the imaging histories they submitted increased from 45.4 characters per order during the baseline period to 75.4 (+66.1%, P<0.0001) after the intervention (Figure 4).

CONCLUSION

By collaborating with ordering providers and a collaborative cross-functional team, we created a standardized definition of an imaging history and engineered our systems to include supportive prompts into the order entry interface that were designed by and for ordering providers. By designing systems to support consistent, high-quality care and the provision of complete histories, we were able to hardwire excellence and sustained improvement.

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QI132-ED-THB3

Creating a Community Standard and Promoting Artificial Intelligence Research in Multiple Sclerosis: A Pre- and Post-Intervention Assessment of the Frequency of Common Data Element (CDE) Reporting

Thursday, Dec. 5 12:45PM - 1:15PM Room: QR Community, Learning Center Station #3

Participants
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PURPOSE

This retrospective study was performed as part of a quality assurance initiative to evaluate the completeness of neuroradiology reports for the evaluation of multiple sclerosis (MS) for MRI examinations. The RSNA-ASNR-ACR Common Data Elements (CDE) Neuroradiology Working group has produced reporting templates in an effort to promote best-practice reporting, standardize reports, and facilitate research such as artificial intelligence and machine learning. We hypothesize there are aspects of MS that are not reported consistently, and that intervening with structured templates will increase the frequency with which they are reported. By comparing the reporting frequency of CDE before and after the introduction of the reporting templates, we can assess for improvements in reporting consistency.

METHODS

The PACS was queried for all MRI spine exams performed 7/1/2017-5/1/2018. Reports were excluded in the settings of non-MS pathology (degenerative spine disease, osteomyelitis, metastatic disease, etc). Reports were reviewed for the explicit inclusion of each of the reporting fields in the RSNA-ASNR-ACR CDE MRI Multiple Sclerosis Spine template. Following the introduction of CDE templates to the neuroradiology department on 1/1/2019, the PACS was queried for all MRI Spine exams performed 1/1/2019-4/6/2019. Again, reports were reviewed for the explicit inclusion of each of the reporting fields in the RSNA-ASNR-ACR CDE MRI Multiple Sclerosis template. The primary outcome was the change in reporting of CDE fields before and after the formal introduction of the CDE template, along with the percentage of the 11 CDE fields explicitly reported in each report. The secondary outcome was the adoption rate of CDE templates (these templates do not automatically populate for each report, and must be inserted when indicated).

RESULTS

From the pre-intervention study period, 49 reports were reviewed. Of the 49 reports, the most frequently reported Common Data Elements were: cervical or thoracic location (95.9%), enhancement (93.8%), and lesion span (22.4%). The least consistently reported CDE were: lesion number (0%), T1-appearance (0%), and cord edema (0%). The post-intervention study period included 25 reports during template creation and initial implementation. Of the 25 reports, 15 reports used the Common Data Element template (60% adoption rate). The most frequently reported Common Data Elements were: enhancement (96%), cervical or thoracic location (92%), and largest lesion identified (76%). Additionally, the pre-intervention CDE's that had been reported least frequently showed post-intervention improvement, as follows: lesion number (36%), T-1 appearance (52%), and cord edema (56%).Reporting of all of the Common Data Elements increased across all fields following the intervention of introducing formal CDE templates, except in the case of location (96% pre-intervention and 92% post-intervention).

CONCLUSION

While the overall core concepts of normal anatomy may be conveyed in reports, major concepts in multiple sclerosis evaluation may not be explicitly reported. Although reports including very broad general statements and lacking a description of the pathology may quicken reporting as well as information consumption by ordering physicians, this practice could potentially leave some ambiguity. In addition to hindering quality assurance checks, the use of natural language processing and machine learning is also hindered by the use of broad general statements. The RSNA-ASNR-ACR CDE reporting templates provide a starting point for best-practice reporting. Based on the results of this study, a formal introduction of CDE templates into a neuroradiology section leads to a dramatic increase in the frequency by which these disease-specific common data elements are reported. This may have a beneficial impact on patient care by leading to the development of community standards to report disease-specific findings for multiple sclerosis and many other major illnesses. Such community standards could increase the clarity of the reports, decrease the risk of omitting findings, and lead to improved data curation for research purposes including deep learning algorithms. CDE templates also guide trainees' review of pertinent positives/negatives for specific disease entities, holding a great potential educational value.

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QI133-ED-THB5

Rapid On-site Evaluation of Ultrasound Guided Fine Needle Aspiration Thyroid Nodule Biopsy: Does it Have a Role in the Reduction of Non-diagnostic Sample Rate?

Thursday, Dec. 5 12:45PM - 1:15PM Room: QR Community, Learning Center Station #5

Participants
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PURPOSE

Thyroid nodules are one of the most common incidental findings. Criteria for following and managing those nodules have been under continuous development and update. When tissue sampling is required, ultrasound guided fine needle aspiration (US-FNA) represents an easy and effective way of getting the needed tissue with minimal risk. Despite the use of ultrasound to guide our choice for biopsy site, obtaining inadequate sample for diagnosis can be a frustrating consequence of this procedure, mainly due to obtaining few or no cells. This can result in repeating the procedure which subsequently contributes towards increasing cost and patient anxiety. The use of on-site cytological evaluation of fine-needle aspiration biopsy specimens can help in the determination of adequacy of specimens and even providing a specific preliminary diagnosis. In our study, we evaluated the impact of implementation of an on-site assessment of thyroid FNA biopsy performed under ultrasound guidance on overall sample adequecy and rebiopsy rate. Our aim was to detect the effect of rapid on site evaluation on the success of obtaining adequate diagnostic samples and decreasing rebiopsy rate.

METHODS

After co-ordination with our pathology department, We implemented an on-site immediate cytological evaluation of the adequacy of the obtained sample starting in 2017 at our institution. We then performed a retrospective analysis of the overall adequacy of samples obtained before and after the rapid on site evaluation. Patients who had ultrasound guided FNA of thyroid nodules performed at our institution from mid 2017 till the end of 2018 were identified. The adequacy of the sample and the performance of on-site cytological exam for each case was recorded. The relationship between adequacy and performance of on-site cytological evaluation was examined with the chi-square test and Fischer's exact test. Two subsets of these data were analyzed in a similar fashion, which included cases with a maximum nodule size of less than or equal to 3 cm (maximum diameter) and less than or equal to 2 cm. SAS Version 9.4. was used for analysis.

RESULTS

355 patients with 443 nodules were reviewed. On-site cytological exam was performed in 60 cases (17%) with 65 nodules. 12.3% of nodules biopsied with on-site cytology performed had inadequate sample, compared to 15.2% when it was not performed (RR =0.8, p = 0.839). However in nodules less than or equal 2 cm in maximum dimension the risk of obtainining non-diagnostic sample decreased significantly, nearly no samples were labeled as inadequate compared to 15.5% of cases without on-site ctyological exam performed (p = 0.034).

CONCLUSION

FNA biopsy of thyroid nodules is one of the most commonly performed procedures. Inadequate sample is frustrating for the patient, results in rebiopsy, and increases cost. Performing rapid on-site cytological exam, particularily in nodules less than 2 cm resulted in reduction of the incidence of obtaining inadequate sample. In our experience, this has led to improving the quality and safety of patient care.

QI134-ED-THB4

RadPath: Automated Radiology-Pathology Notification System Improves Breast Procedure Addendum Turnaround Time

Thursday, Dec. 5 12:45PM - 1:15PM Room: QR Community, Learning Center Station #4

Participants
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Ross W. Filice, MD, Washington, DC (*Abstract Co-Author*) Co-founder, DexNote LLC; Research Grant, NVIDIA Corporation; Advisor, BunkerHill Health, Inc

PURPOSE

Radiologists perform a variety of image-guided procedures in practice. Histopathological results are particularly scrutinized in breast imaging for radiologic-pathologic concordance, which is addended to the final reports. Expeditious notification and documentation of these results is important for patients and referring clinicians as well as for quality assurance purposes. We have a user-friendly, automated, semi-intelligent radiology-pathology correlation system (RadPath) for all radiology reports and procedures in our enterprise and have recently initiated automated email notifications of results. These emails link the user directly to the RadPath system, present the radiology and pathology reports, and allow direct launch of images aiding radiology-pathology concordance assessment. Our hypothesis is that these notifications result in improved turnaround time for documentation of pathology results on breast imaging procedures resulting in more timely radiologic-pathologic concordance.

METHODS

IRB exemption was obtained. We searched our RadPath system for pathology matches corresponding to image-guided breast interventions at our flagship academic site during a 3 month period before and after the initiation of our notification system. To test our hypothesis, we analyzed turnaround time from finalized report to finalized addendum based on automatically generated report timestamps for these breast procedures. We excluded reports that had been addended less than 2 days after the final reports as our pathology results are not returned that quickly; this was felt to be reasonable exclusion of addenda not related to pathology concordance documentation.

RESULTS

A total of 44 image-guided breast biopsies were performed in the 3 month period prior to the initiation of notifications with a mean turnaround time of 10.1 days from finalized report to finalized addendum. A total of 38 image-guided breast biopsies were performed during the 3 month period after initiation with a decreased mean turnaround time of 7.2 days. A two-sample unequal variance t-test showed this to be a statistically significant decrease with a p value of 0.045.

CONCLUSION

We have shown a statistically significant decrease in turnaround time from procedure report finalization to pathology addendum in image-guided breast biopsies following initiation of the RadPath notification system. This is important for radiologists performing these procedures as timely notification and documentation of pathology results and establishment of radiologic-pathologic concordance is crucial for patient care and quality assurance. We believe patient and referring clinician satisfaction will also be improved and that this pattern will hold true across our enterprise. We plan to explore both of these hypotheses and also extend our analysis across our entire enterprise as future directions.

RO215-SD-THB1

Outcomes After Treatment for Recurrence in Patients with Locally Advanced Cervical Cancer Treated with Radiotherapy

Thursday, Dec. 5 12:45PM - 1:15PM Room: RO Community, Learning Center Station #1

Participants
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PURPOSE

It is necessary to determine the candidates for curative intent salvage treatment for recurrence of cervical cancer after definitive concurrent chemoradiotherapy (CCRT) or radiotherapy (RT) alone. In this study, we evaluated the survival outcomes of cervical cancer patients who showed recurrence after definitive CCRT/RT.

METHOD AND MATERIALS

From April 2006 to December 2012, 166 patients with cervical cancer were treated with definitive CCRT/RT in our hospital. They received RT, combining external beam RT (total median dose, 50.4 Gy) and HDR intracavitary brachytherapy (median dose per fraction, 6 Gy; median fraction, 4). Among them, 61 patients who relapsed and had more than 12 months follow-up, reviewed in this retrospective study. The primary outcome was overall survival (OS). OS was calculated from diagnosis of recurrence to death.

RESULTS

The median age at the diagnosis of the first recurrence was 66 years old (28 to 85). The median time from primary treatment to recurrence was 11.1 months (1.9 to 70.7 months). Of the 61 patients with recurrences, combined recurrence (31%) was most common, follow by local only (26%), distant only (18%) and extra-regional only (16%). The median follow-up after the diagnosis of the first recurrence was 15.5 months (2.1 to 72.4). Patients with extra-regional only recurrence had longer OS than those with other recurrence pattern (60% vs 30% at 2-year; $p = 0.016$). Seven patients with extra-regional only recurrence and one with pulmonary metastasis only were received definitive salvage treatment including RT (median 50.4 Gy; 44 to 60 Gy) or surgery (partial resection). Remaining 35 and 18 patients received mainly chemotherapy and best supportive care, respectively. The difference in the OS rate between patients treated with aggressive therapy and those treated with mainly chemotherapy was statistically significant (69% vs 32% at 2-year; $p = 0.006$).

CONCLUSION

In cervical cancer patients treated with CCRT/RT, the definitive salvage treatment seemed to be useful for recurrence in limited regions, especially extra-regional only recurrence.

CLINICAL RELEVANCE/APPLICATION

It seemed that the limited recurrence lesions from cervical cancer after CCRT/RT should be treated aggressively.

UR194-ED-THB7

A Guide to Imaging in Pancreas and Kidney Transplants

Thursday, Dec. 5 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #7

Awards
Certificate of Merit

Participants
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TEACHING POINTS

1. Review indications and surgical techniques of simultaneous pancreas-kidney (SPK) transplants and solitary renal transplants 2. Review multimodal imaging of normal pancreas and renal grafts as well as vascular and non-vascular complications that can help timely diagnosis and appropriate management. 3. Present structured templates in pancreas and renal transplants that can help communicate relevant findings related to the surgical team.

TABLE OF CONTENTS/OUTLINE

Overview of indications, surgical techniques in SPK transplant and independent renal transplant with schematic illustrations. Role of various imaging modalities in post-transplant evaluation. Review multimodal imaging in normal pancreas and renal transplant along with complications with representative examples, as follows. Pancreas Transplant complications.Vascular: arterial stenosis and occlusion, venous thrombosis, arteriovenous fistula. Parenchymal: inflammation, necrosis. Perigraft hematoma, abscess, pseudocyst. Renal Transplant complications. Vascular: arterial/ venous stenosis, thrombosis, pseudoaneurysm and arteriovenous fistula. Parenchymal: Rejection, infarcts, acute tubular necrosis, pyelonephritis, abscess, neoplasm. Perigraft hematoma/collection, urinoma, lymphocele. Present structured reporting template for pancreas and kidney transplant evaluation.

UR195-ED-THB8

MR Imaging of Penile Neoplasms: Not That Hard

Thursday, Dec. 5 12:45PM - 1:15PM Room: GU/UR Community, Learning Center Station #8

Participants
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TEACHING POINTS

1. Understand treatment of penile neoplasms has radically evolved with organ-sparing surgeries and locoregional therapies. EUA 2018 guidelines recommend MRI when organ sparing surgery is considered. 2. Appreciate changes in TNM staging which is crucial for accurate MR interpretation to avoid overtreatment to avoid devastating physical and psychological consequences.

TABLE OF CONTENTS/OUTLINE

MRI correlates of normal anatomical structures and surgical planes Perfecting Penile MR - Optimal patient, coil and penile positioning - 2D or 3D T2-weighted MRI? Is Gadolinium necessary? Diffusion weighted imaging which b-values to use? The concept of multi-parametric penile MRI. Intracavernosal prostaglandin injection - does it have added value? Nodal staging, is there a role for SPIO agents? Special emphasis on updated 8th TNM classification. What has changed since the 7th edition and how does it affect imaging? Examples of T1, T2, T3 and T4 cancers including challenging cases and tips and tricks Beyond T-staging: Extent of resection planning; Identification of Satellite nodules; Grading (G1 - G3) of tumor - How can quantitative ADC help avoid incorrect biopsy grading due to undersampling? Radiomics and future Imaging appearances post-surgery, radiotherapy, recurrence Miscellaneous neoplasms - metastases, sarcomas, glomus tumor and mimics

VI144-ED-THB9

Complications of an Ileal Conduit after Radical Cystectomy: Interventional Radiologic Management

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #9

Awards
Identified for RadioGraphics

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TEACHING POINTS

1. Describe surgical techniques for and anatomy of an ileal conduit as urinary diversion following radical cystectomy. 2. Describe early and late complications related to an ileal conduit following radical cystectomy and their diagnostic work-up. 3. Discuss interventional radiologic management of complications related to an ileal conduit.

TABLE OF CONTENTS/OUTLINE

1. Overview of current indications of an ileal conduit as urinary diversion following radical cystectomy 2. Surgical techniques for and anatomy of an ileal conduit 3. Early and late complications of an ileal conduit following radical cystectomy and their diagnostic work-up (urine leak, postoperative fluid collections, pyelonephritis, uretero-ileal anastomotic stricture, stomal stenosis, conduit stenosis, urolithiasis etc) 4. Current interventional management of complications of an ileal conduit 5. Limitations of interventional radiologic management of complications of an ileal conduit and procedure-related complications

VI221-SD-THB1

Particle Embolization for Treatment of Acute Lower Gastrointestinal Hemorrhage is Associated with Higher Rates of Ischemic Bowel Complications: A Single-Center Retrospective Analysis

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #1

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PURPOSE

Coil embolization has emerged as the standard embolic agent for the endovascular management of lower GI bleeding, with particle embolization having theoretically higher risk of bowel ischemia and perforation but without supporting data. The purpose of this study was to analyze outcomes after particle embolization for the management of lower GI bleeding.

METHOD AND MATERIALS

This study received IRB approval and a waiver for informed consent. Between 2004 and 2018, a total of 582 mesenteric angiograms were performed for the indication of lower GI bleeding. Of these procedures, embolization was performed for active extravasation using only microcoils in 127 procedures in 114 patients and using particles in 81 procedures in 56 patients. In general, particles were used when microcoils alone were deemed inadequate. A case-control comparison was performed by matching cases employing PVA particles versus microcoils alone, based on age, gender, and year. Clinical success was defined as no additional intervention to treat recurrent bleed and no readmission for lower GI bleed within 30 days. Patients with less than 30 days of follow up were excluded.

RESULTS

Analysis was performed on 33 matched patients in each group. Average age was 67.8 years in the particles group and 68.0 years in the coils group. Mean follow up was 3.1 years after embolization. Clinical success was 54% in the particles group and 71% in the coils group (P=0.15). Four patients (12%) in the particles group had bowel infarction requiring surgery within 30 days after embolization, versus none in the coils group (P=0.11). Multiple embolizations in the same admission approached significance as a risk factor for bowel ischemia within 30 days (P=0.07). One patient developed a bowel stricture 283 days after embolization using particles (embolized twice).

CONCLUSION

Particle embolization may have lower rates of clinical success and higher rates of ischemic bowel compared to coil embolization, although there is selection bias between groups given utilization criteria as well as limited sample size. Multiple embolizations in the same admission may increase risk of ischemic bowel as well.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that particle embolization may have a higher risk for clinically significant bowel ischemia, which may be relevant for choosing embolization material.

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VI222-SD-THB2

A Comparison between Laparoscopic and Open Surgery Following Self-Expandable Metallic Stent Placement for Malignant Colorectal Obstruction and an Assessment of Long-Term Oncological Outcomes

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #2

Participants
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Gyoo Sik Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the outcomes between single stage laparoscopic surgery and open surgery following self-expandable metallic stent (SEMS) placement in patients with malignant colorectal obstruction and to evaluate the long-term oncological outcomes of SEMS placement.

METHOD AND MATERIALS

This retrospective study included 46 patients (28 men and 18 women; mean age, 67.2 years ± 10.3) who underwent SEMS placement followed by laparoscopic resection (LS group, n=31) or open surgery (OS group, n=15) for malignant colorectal obstruction between January 2009 and January 2018. The outcomes of surgery were analyzed and compared. After a mean follow-up of 38.9 months ± 31.2, recurrence-free and overall survival were estimated by using the Kaplan-Meier method, and prognostic factors were evaluated by using the Cox proportional hazard regression model.

RESULTS

Stent placement was successful in all patients. No procedure related complications occurred. Complete expansion of the stent occurred and bowel obstruction resolved within 2 days after SEMS placement. The mean interval between SEMS placement and surgery was 11.0 days ± 6.8 (range, 3-42 days). Primary anastomosis was possible in all patients. The mean operation time in the LS group was significantly shorter than in the OS group (P = .014). The mean postoperative hospital stay was significantly shorter in the LS group than in the OS group (P = .001). Bowel perforation was detected in six patients (13.0%). During the follow-up, ten patients (21.7%) developed a recurrence: five of the six patients with bowel perforation developed a recurrence. Bowel perforation did not have an effect on overall survival (P = .893), but had a significant effect on recurrence-free survival (P = .010).

CONCLUSION

Laparoscopic surgery following SEMS placement results in a faster recovery than open surgery for malignant colorectal obstruction. Stent-related bowel perforation is a significant predictive factor for tumor recurrence.

CLINICAL RELEVANCE/APPLICATION

Laparoscopic surgery following SEMS placement results in a faster recovery than open surgery for malignant colorectal obstruction. Stent-related bowel perforation is a significant predictive factor for tumor recurrence.

VI223-SD-THB3

The Clinical Characteristics and Drug Resistance of Pyogenic Liver Abscess Caused By Extended-Spectrum Beta-Lactamase-Producing Klebsiella Pneumoniae

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #3

Participants
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PURPOSE

The proportion of extended-spectrum beta-lactamase-producing(ESBL+) is increasing year by year and has multiple drug resistance in clinically Klebsiella Pneumoniae(KP) infection.KP has become the primary pathogen of pyogenic liver abscess(PLA).This study analyzed the incidence of ESBL+KP induced liver abscess in our hospital in the past 4 years,compared the clinical features and drug resistance of patients with liver abscess caused by ESBL+ and ESBL-KP, and explored the clinical risk factors of infection ESBL+.

METHOD AND MATERIALS

We retrospectively collected medical records of 122 inpatients with liver abscess from January2015 to January 2019(including 16 cases of PLA caused by ESBL+KP and 106 cases of PLA caused by ESBL- KP) The clinical characteristics and bacterial drug resistance of the two groups were compared and analyzed,and the independent risk factors of ESBL+ KP were further investigated by Logistic multivariate analysis.

RESULTS

In ESBL+ patients,the proportion of history of biliary disorders and malignancy was significantly higher than ESBL- group.(75% vs 30.2%;p<0.05);(50% vs 12.3%;p<0.05).ESBL+ patients were associated with pulmonary infection(87.5% vs 67.9%;p<0.05), and had a higher recurrence rate (43.8%vs 9.84%;p<0.001).Multivariate analysis indicated that history of biliary disorders(odds ratio,4.145;95%confidence interval,1.139-15.085;P=0.026) and history of malignancy (odds ratio,4.282;95%confidence interval,1.227-14.939;P=0.023) were independent risk factors for the infect of ESBL+ .Both groups were sensitive to carbapenem antibiotics.However,the resistance rate of the ESBL+ group to the compound sulfamethoxazole (59% vs 4.9%;P<0.001) and aztreonam(68.8% vs 0.8%;P<0.001) was significantly higher than that of the ESBL- group.

CONCLUSION

The proportion of ESBL+ in KPLA in not high,but the clinical symptoms of these patients are serious.A history of biliary disorders or malignancy is an independent risk factor for ESBL+ infection.ESBL+ has a high resistance rate to non-carbapenem-based antibiotics.

CLINICAL RELEVANCE/APPLICATION

The mainstay of treatment remains antibiotic in combination with adequate aspiration or drainage.In the course of treatment,it is recommended to use carbapenem antibiotics in order to improve the treatment effect if the conventional antibiotics is not effectively.Be alert to ESBL+ ,especially patients with liver abscess who have a history of biliary tract diseases or malignant tumors.

VI249-SD-THB5

Radiologic and Clinical Factors Predicting Survival Following Hepatic Arterial Infusion Chemotherapy in Advanced Hepatocellular Carcinoma

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #5

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PURPOSE

To analyze radiologic and clinical factors predicting overall survival (OS) in patients with advanced hepatocellular carcinoma (HCC) treated with hepatic arterial infusion chemotherapy (HAIC).

METHOD AND MATERIALS

Between Jan 1998 to Dec 2018, 251 Barcelona Clinic Liver Cancer stage C advanced HCC patients (219 men and 32 females; mean age 53±9.8 years) were treated with high-dose HAIC (5-FU, 500 mg/m2 for 3 consecutive days and cisplatin, 60 mg/m2 on day 2). We retrospectively collected clinical data and assessed following radiologic features: macroscopic growth pattern of the tumor, arterial enhancement pattern of HCC, extent of portal vein and hepatic vein tumor thrombus, presence of extrahepatic metastasis, size of the tumor, response to the 1st session of the treatment evaluated by mRECIST, and the direction of the portal venous flow studied during the chemoport implantation. Survival curve calculation and prognostic factor analysis were performed by Kaplan-Meier method and Cox proportional hazard model.

RESULTS

During the mean follow-up period of 7.3 months (median, 4.4 months; range, 1-60 months), 181 (72.1%) patients died. The mean OS was 11.3 months and the median OS was 5.4 months. Objective response rate (% of patients with complete response plus partial response) and disease control rate (objective response rate plus % of patients with stable disease) were 15% and 50%, respectively. Infiltrative tumor growth and rim-like arterial enhancement pattern were pre-treatment radiologic features negatively affected the OS (both $p < 0.05$). Response to the 1st HAIC session was significantly associated with OS, with better response showing prolonged survival. Higher level of AST, larger size of the tumor, presence of hepatic vein tumor thrombus, bile duct invasion by the tumor, and higher CTP score all negatively affected the OS (all $p < 0.05$).

CONCLUSION

HAIC is a feasible treatment option for an advanced HCC. Baseline imaging features regarding tumor growth pattern and arterial enhancement profile as well as radiologic response to the 1st therapeutic session can be used to predict OS after HAIC.

CLINICAL RELEVANCE/APPLICATION

Pre-/post-therapeutic radiologic features of the target tumor and clinical factors may help predict survival in advanced HCC patients treated with HAIC.

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VI250-SD-THB6

Day-Clinic High-Intensity Focused Ultrasound (HIFU) Focal Therapy to Primary Treatment of Localized Prostate Cancer: Initial Experience of 37 Patients

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #6

Participants
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PURPOSE

To demonstrate the safety and feasibility of HIFU focal therapy (FT) in a day-clinic setting, as a primary option of treatment of Gleason 6 or 7 (ISUP 1, 2 and 3) prostate cancers (pCa) comproved by fusion MRI-transrectal ultrasound (TRUS) fusion biopsies, in a prospective study of initial 30 patients. HIFU is a non-invasive, single shot, radiation-free therapy that use real-time image guidance, directs focused beam of ultrasound waves to thermally ablate a selected portion of prostate gland.

METHOD AND MATERIALS

A single-center prospective analysis of initial 37 patients with unilateral prostate cancer candidates for FT (hemi-gland or super-focal ablation) as the primary treatment option from August 2018 to March 2019. All patients were re-evaluated by MRI and fusion prostate biopsy and only patients with unilateral disease (high volume Gleason 6 or Gleason 7), prostatic volume less than 50 cc and mild lower urinary tract symptoms were included.

RESULTS

Thirty-seven patients were enrolled as candidates for FT based on biopsy results. Seven were excluded and underwent radical treatment due to a Gleason upgrading and 4 due to a concomitant transurethral resection of the prostate (TURP), totalizing 26 patients in our analyses. Mean prostatic volume, age, PSA and region of interest volume were: 44.7 cc, 65.1 years, 6.09 ng/dl and 0.97cm; respectively. Pre-procedure MRI showed 5.2% of patients with PIRADS 2, 15.78% with PIRADS 3, 68.42% with PIRADS 4 and 10.52% with PIRADS 5. The biopsy showed 6 patients with unilateral ISUP 1, 14 patients unilateral ISUP 2 and 6 patients with ISUP 3. Hemi-gland ablation was performed in 20 patients and super-focal ablation in 6 patients. All patients were discharged between 2 and 4 hours after the procedure. Urethral catheter was kept for 7 days. Two patients had refractory urinary retention treated with TURP. None of the patients had urinary incontinence, worsening of erectile function, bleeding, infectious complications or rectal fistulae.

CONCLUSION

In conclusion, day clinic HIFU FT is safe and feasible as a primary option for localized and low/intermediate risk pCa, with potential clinical impact.

CLINICAL RELEVANCE/APPLICATION

High-intensity focused ultrasound in a day-clinic setting is a feasible technique that has the potential to provide an alternative to radical surgery or radiation-therapy with fewer complications and similar oncological outcomes in selected patients.

VI251-SD-THB7

Power of Lipiodol-Enhancement in CT-Guided Biopsies of Unspecified Suspect Intrahepatic Lesions: Improvement of Accuracy and Safeness

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #7

Participants
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PURPOSE

To evaluate the power of Lipiodol in improving the rate of successful biopsies of suspect intrahepatic lesion which is often challenging in native CT-scans. Lipiodol, commonly applied in angiography for tumor embolization, might improve the success rate.

METHOD AND MATERIALS

Six-hundred-seven patients (men: 358, women: 259) with unclear suspect liver lesions were retrospectively evaluated. All patients received a CT-guided liver biopsy and results were histopathological analysed. Successful punctuations were defined by positive pathological findings. Data were ascertain regarding the use of contrast media, lipiodol or common intravenous contrast, or native performance. Lesion hitting rate and influencing factors like lesion size or liver cirrhosis were insulated. Procedure was performed with the same 128-multislice CT-scanner. Correlation was calculated according to Spearman-Rho, results compared using Wilcoxon-Man-Whitney t-test and Chi-square-test. $P<0.05$ was considered as statistically significant.

RESULTS

Lesion hitting rate was significantly higher using Lipiodol (78.6%) compared to native biopsy (73.2%) or the use of intravenous contrast agent (65.2%) ($p=0.038$). For lesions with a size <20mm, the benefit regarding the hitting rate was even higher for Lipiodol (71.2% vs 47.7% vs. 65.5%) ($p=0.021$). For patients with an existing liver cirrhosis in comparison of all three groups were seen. ($p=0.97$). No major complications occurred during the interventions.

CONCLUSION

Pre-puncture marking using Lipiodol in angiography increases the lesion hitting rate significantly, especially for small suspect liver lesions (<20mm), combines with a lower rate of re-biopsy and a higher safeness for the patient.

CLINICAL RELEVANCE/APPLICATION

Pre-puncture marking of unclear intrahepatic lesions using Lipiodol increases the hitting rate and safeness of liver biopsies and is recommended for hardly detectable liver lesions in CT.

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VI252-SD-THB8

Evaluation of Blood Pressure Variations on CTA Geometries of Abdominal Aortic Aneurysms and CTA Protocol Recommendations on Blood Pressure Measurements for Maintaining Mechanical Simulation Viability

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #8

Participants
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PURPOSE

To assess in patients with known abdominal aortic aneurysm (AAA) undergoing clinically indicated CTA imaging the influence of blood pressure (BP) measurements for vessel diameter measurements and mechanical simulations.

METHOD AND MATERIALS

50 adult patients with known AAA underwent a contrast enhanced CT of the abdomen on a 3rd generation dual source CT (SOMATOM Force, Siemens Healthcare). BP measurements were taken upon admission as per standard protocol and during imaging, as well as at home on subsequent days at the same time of day. The mean and largest differences in mean arterial pressure (MAP) were measured. The impact of these differences on the vessel diameter/volume was then analytically estimated using an idealized cylinder geometry and stiffness parameters for young (1.14 MPa) and adult aorta (2.21 MPa). Finite element analysis (FEA) was used on the actual aneurysm geometry with the largest MAP difference to model the changes predicted by the analytic estimate.

RESULTS

The relative difference in MAP between the imaging and home setting was 10.8% (9.1mmHg), with a maximum of 23.7% (31.2mmHg), which results in an aneurysmal difference in diameter of 1 - 2.2% (3.6 - 8.2% for the maximum MAP difference).Comparing MAP during the imaging process to the measurements at hospital admission, the average relative difference was 10.6% (9.4mmHg), with a maximum of 29.5% (27.7mmHg). The resulting difference in the aneurysmal diameter/volume is 0.8-2.4% (2.5-7.9% for the maximum MAP difference). Simulation in aorta with stiffer wall properties, such as in older patients, show a 50% reduction of maximum wall displacement in the aneurysmatic section of the aorta, when compared to the more flaccid aorta in younger patients (1.5 mm vs. 3 mm, $p<0.001$).

CONCLUSION

AAA-geometry derived from CTA used for diameter measurements and mechanical simulations such as FEA are sensitive to BP differences and age. A dedicated age and gender dependent AAA-simulation is warranted for rupture risk-simulation.

CLINICAL RELEVANCE/APPLICATION

There are pronounced differences in blood pressure during the CTA imaging process and the home setting and hospital admission. Aortic aneurysm diameters can be affected by these variations.

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VI253-SD-THB4

Retrospective Multivariate Study of the Clinical Outcomes in Patients Affected by Different Grades of Varicocele Treated using Different Endovascular Approaches

Thursday, Dec. 5 12:45PM - 1:15PM Room: VI Community, Learning Center Station #4

Participants
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PURPOSE

The aim of this study is to assess the clinical outcomes of patients affected by different grades of varicocele treated by retrograde scleroembolization.

METHOD AND MATERIALS

210 patients, mean age 32 years, with left varicocele and infertility were treated. Study inclusion criteria were: grade II or III left varicocele according to Dubin classification, infertility and US diagnosis of varicocele. All the patients were divided into 2 groups according to the diameter of the left spermatic vein with a cut-off of 6mm. Group 1 (128 out of 210 patients) underwent scleroembolization using 3% Polidocanol. Group 2 (82 out of 210 patients) underwent scleroembolization using 3% Polidocanol and coiling. Median follow-up time was 3 months. Clinical examination, semen specimen and Doppler US examination were compared to follow-up data.

RESULTS

208 patients were successfully treated. 2 patients presented intraprocedural spermatic vein rupture. Color-Doppler US examination showed an optimal resolution of reflux in testicular veins (mean value: pre-treatment 7.1 cm/s; post-treatment 1.9 cm/s). 63% of patients showed a complete resolution of varicocele. Three months follow-up semen analysis in all the patients showed an improvement in sperm motility (mean value: pre-treatment 31%; post-treatment 42%) and sperm count (mean value: 3.6 million sperm cells per ml pre-treatment; 20.9 million sperm cells per ml post-treatment).

CONCLUSION

varicocele embolization is minimally invasive and technically feasible procedure that improves semen quality with a high successful rate of varicocele resolution. No differences were observed in clinical follow-up among the two groups of patients.

CLINICAL RELEVANCE/APPLICATION

Two different approaches for the varicocele embolization such sclerosing agent(Polidocanol 3%) and coiling are both safe and effective. Also an improvement in patients semen quality was observed.