

AUR 2018 Research Paper Abstracts

Research papers are oral educational or scientific presentations that are 8 minutes in length, followed by a 2-minute discussion period. Presenting author is identified by institution name, city, and state (or country if not United States or Canada). Presentations by trainees (medical students, residents, or 1st-year fellows) are noted in [blue](#).

Wednesday, May 9, 2018

1:00–2:30 PM

SS01: Clinical: Musculoskeletal, Neuroradiology

Location: Colonial

Moderator: Mark E. Mullins, MD, PhD

MK NR

(SS01-01) 1:00–1:10 PM

Comparing Lesion Detection and Observer Performance of Infratentorial Multiple Sclerosis Lesions Between T2-Weighted Spin-Echo, 2D-FLAIR, and 3D-FLAIR Sequences

Kevin Y. Wang, MD, *Baylor College of Medicine, Houston, TX*; Tomas E. Uribe Acosta, MD; Christie M. Lincoln, MBBS

PURPOSE: Three-dimensional fluid attenuation inversion recovery (3D-FLAIR) increases overall white matter lesion detection in multiple sclerosis (MS), but evidence remains conflicting on 3D-FLAIR's capability of improving 2D-FLAIR's poorer infratentorial lesion detection when compared to T2-weighted spin-echo (T2SE). This study aims to compare the infratentorial lesion detection performance, observer performance, and signal and contrast properties between T2SE, 2D-FLAIR, and 3D-FLAIR.

METHOD AND MATERIALS: A total of 116 brain MRIs from patients with clinically definite MS and with single slab 3D-, 2D-FLAIR, T2SE sequences from the same scan were retrospectively reviewed. Two board-certified radiologists counted all infratentorial lesions on the 3 sequences. The averages of the individual lesion counts per sequence of both readers were calculated. Contrast-to-noise ratios (CNRs) and signal-to-noise (SNRs) of the lesion, white matter (WM), and grey matter (GM) were measured on same lesion across the 3 sequences for 18 random MRIs. Wilcoxon signed-rank test was used for pairwise comparisons of average lesion count, CNR, SNR, and adjusted for three pairwise comparisons using Bonferroni correction. Hence, a $p < 0.017$ was considered statistically significant. Interobserver agreement was evaluated using the intraclass correlation coefficient (ICC).

RESULTS: The highest lesion count per scan was scored on 3D-FLAIR (mean of 3.6), and was statistically significantly higher than those on T2SE (mean of 2.8, $p < 0.001$) and 2D-FLAIR (mean of 2.4, $p < 0.001$). Difference in lesion count between T2SE and 2D-FLAIR was not statistically significant ($p = 0.085$). SNRs of the lesion, WM, and GM on 3D-FLAIR was statistically significantly higher compared to 2D-FLAIR ($p < 0.001$ to 0.012). No other statistically significant differences were noted in SNR or CNR between the sequences. ICC was highest for T2SE (0.81), followed by 2D- (0.72), then 3D-FLAIR (0.71).

CONCLUSION: The higher infratentorial lesion detection on 3D-FLAIR may address the poor infratentorial lesion detection seen on 2D-FLAIR while still maintaining the advantage of enhanced detection of lesions adjacent to the cerebrospinal fluid when compared to T2SE.

(SS01-02) 1:10–1:20 PM

Risk Threshold Algorithm for Thyroid Nodule Management Demonstrates Superior Diagnostic Performance to SRU and ATA Management Guidelines

Toshimasa J. Clark, MD, *University of Colorado Denver, Aurora, CO*; Kristin McKinney, MD; Nayana U. Patel, MD (*toshimasa.clark@ucdenver.edu*)

PURPOSE: Society of Radiologists in Ultrasound (SRU) and American Thyroid Association (ATA) guidelines are often used to determine which thyroid nodules to biopsy. With these guidelines the decision of whether to pursue fine needle aspiration (FNA) is largely due to size. We evaluate the diagnostic performance of the SRU and ATA management guidelines as compared to a Risk Threshold Algorithm that determines whether FNA is indicated by comparing calculated malignancy risk of a nodule to a predetermined risk of malignancy.

METHOD AND MATERIALS: IRB approved, retrospective study of pathology records for all thyroid FNA performed at our institution over a set time period. 50 sequential benign and 50 sequential definite papillary thyroid carcinoma cases were derived and included if pathology data existed and a pre-surgery ultrasound was available. A radiologist recorded patient demographics and verified measurements and imaging characteristics: solidity, regular or marked hypoechogenicity, microlobulated or vague margins, microcalcification, macrocalcification, taller than wide morphology, vascularity, and growth ($\geq 50\%$ volume change). SRU, ATA, and a malignancy risk model were implemented and applied to each nodule. Condition positivity is cytology of definite papillary thyroid carcinoma. Test positivity is SRU or ATA algorithms recommending FNA, and calculated malignancy risk greater than 10–50% thresholds. Diagnostic performance of each test was derived.

RESULTS: 44 benign nodules and 46 papillary thyroid carcinomas were analyzed. Sensitivity and specificity of the SRU guidelines was 74% and 18%; 85% and 5% for ATA. Sensitivity and specificity of the Risk Threshold algorithm with a threshold of 10% (i.e., nodules with 10% or greater calculated malignancy risk would be recommended for FNA) was 89% and 48%; 85% and 59% for a 20% threshold; 80% and 61% for 30%; 76% and 80% for 40%; 74% and 80% for 50%.

CONCLUSION: Using a Risk Threshold Algorithm that recommends FNA if a nodule's calculated risk of malignancy is greater than 20% has the potential to equal the sensitivity of current practice while drastically increasing specificity.

AUR Trainee Prize: 1st Place

(SS01-03) 1:20–1:30 PM

5-Minute Brain MRI in Children with Headaches: Reducing the Need for Sedation

Anna V. Trofimova, MD, PhD, *Emory University, Atlanta, GA*; Nadja Kadom, MD (*atrofjim@emory.edu*)

PURPOSE: To evaluate the effects of 5-minute brain MRI (5-min MRI) on the procedural sedation use and assess its diagnostic quality.

METHOD AND MATERIALS: The study was performed at a pediatric hospital where 5-min MRI was offered as an alternative to standard brain MRI with sedation for children with headaches. We retrospectively searched for studies with indications "headache" or "migraine" and performed per 5-min MRI protocol from April, 1 till August 14, 2017. Patients 9 years and older were excluded. For included patients we reviewed medical records to determine if MRI was scheduled and completed with sedation. An on-line survey with 5-min MRI and a list

* Faculty financial disclosures are located in the Faculty Index.

of 29 diagnosis most commonly seen in children with headaches was distributed to 19 neuroradiologists and 8 community radiologists in order to evaluate quality of the protocol.

RESULTS: 461 brain MRI were done in children with headaches during the study period. 53 patients were under the age of 8. 5-min MRI was used in 22 patients and allowed to convert MRI scheduled with sedation to a non-sedated exam in 18 patients. In 4 cases MRI was completed with sedation. 82% (18/22) of eligible patients were converted to a non-sedated MRI - 3.9% of the entire cohort. In the on-line survey 91% of radiologists were confident that the quality of 5-min MRI was good to diagnose stroke, hemorrhage, hydrocephalus, contusion, arachnoid cyst, Chiari malformation, sinus disease, adenoid enlargement. 73% agreed that it was good to diagnose ADEM, low intracranial pressure, mass ≥ 3 mm and 64% - aqueductal stenosis, vasculitis and vascular malformation ≥ 3 mm. The respondents were less confident in diagnosing sinus thrombosis (45%); encephalitis, signs of HIV, carotid/vertebral artery dissection (27%). 72-100% were not sure they could diagnose Lyme disease, mitochondrial disorder or meningitis without additional information/contrast.

CONCLUSION: 5-min brain MRI allowed to decrease MRI sedation rate by 82% in the target cohort. The image quality of this protocol was good, but may not meet quality standards for certain imaging findings and its use is limited to patients with headaches only, when the probability of structural abnormalities is low.

AUR Memorial Award

(SS01-04) 1:30–1:40 PM

Abstract was not available at printing deadline. Please visit the online program.

(SS01-05) 1:40–1:50 PM

Chasing the Gold Standard: The Efficacy of Biopsy in the Diagnosis and Treatment of Suspected Vertebral Osteomyelitis

LeAnn M. Shannon, MD, *Vanderbilt University Medical Center, Nashville, TN*; Cari L. Motuzas, MD (*leann.m.shannon@vanderbilt.edu*)

PURPOSE: Biopsy remains the gold standard for diagnosis of vertebral osteomyelitis; however, studies involving the efficacy of this standard are often limited by low sample size and varying biopsy techniques across radiologists at the multiple hospitals used to shore up their numbers. The purpose of this study is to add to the limited dataset available on vertebral biopsies with respect to their utility in the diagnosis and treatment of suspected osteomyelitis.

METHOD AND MATERIALS: A retrospective chart review was performed to assess the usefulness of vertebral biopsy in the treatment of suspected osteomyelitis. All spine biopsies performed at Vanderbilt University Medical Center dating back to January 2012 were reviewed. Inclusion criteria included vertebral biopsies of patients with suspected osteomyelitis/discitis. Those presenting with vertebral masses and known or suspected malignancies were excluded. Data was then collected pertaining to if the patient was febrile on presentation, vertebral level of biopsy, prior administration of antibiotics, culture results, complications, and eventual treatment course.

RESULTS: Data collection is still underway. Preliminary data from 53 spine biopsies yielded 25 that met inclusion criteria. Of those 25, 22 were lumbar, two thoracic, and one cervical. Only two biopsies (8%) yielded positive culture results, one of which was staph epidermidis, likely a contaminant. Six biopsies were completed after the administration of antibiotics, with this subset's only positive culture being the likely contaminant. Two biopsies were complicated by severe patient discomfort and reattempted at a later date under general anesthesia, neither of which yielded a positive result. Regardless of biopsy results, patients were all treated with lengthy courses of antibiotics for suspected osteomyelitis.

CONCLUSION: Despite vertebral biopsy being the gold standard for diagnosis of osteomyelitis, this study's preliminary data shows only 8% of

biopsies yielding a positive result, with the remainder of patients having no change in treatment course despite undergoing an invasive procedure.

(SS01-06) 1:50–2:00 PM

Efficacy of 3D Printed Models on Resident Learning and Understanding of Common Acetabular Fractures

Maunil P. Sheth, MD, *Temple University Hospital, Philadelphia, PA*; Ian W. Sullivan, DO; Jafar Hussain, MD; Stephen Ling, MD; Sayed Ali, MD; Omer A. Awan, MD (*shethmaunil@gmail.com*)

PURPOSE: The conceptualization of acetabular fractures can present a daunting challenge to radiology residents. 3D models have been shown to aid in the spatial perception of complicated anatomy and may help residents grasp the elaborate classification systems for these anatomically complex fractures. Prior studies have explored the utility of 3D printed models for surgical planning in various settings. To our knowledge, no study has evaluated their efficacy in radiology resident training.

METHOD AND MATERIALS: Following IRB approval, 22 radiology residents were randomized and stratified by PG-year into two groups of 11 residents. Both groups received separate identical presentations on the 5 most common acetabular fractures given by a MSK trained radiologist. Residents in the experimental group received 3D printed models of the five most common fracture types with which to interact during the presentation, while the control group did not. Both groups received a pretest and a follow up posttest one week later.

RESULTS: A 2 sample t-test was performed to determine if statistically significant differences between the pretest and posttest scores of the experimental and control groups existed. There was no statistically significant difference in scores on the pre-test, which confirmed successful randomization. There was a statistically significant difference ($p < 0.05$) on the post-test scores between the experimental and control groups.

CONCLUSION: 3D printed models show promise as an effective educational tool for resident learning with respect to acetabular fractures, improving short term understanding of complex anatomy and classification systems.

(SS01-07) 2:00–2:10 PM

Value of Shoulder MRI in Cancer Patients Presenting with Shoulder-Related Symptoms

Bilal Mujtaba, MD, *Bellaire, TX*; Gaurav Syngal; Kevin McEney, MD (*BMujtaba@amdanderson.org*)

PURPOSE: In cancer patients more than 65-years-old presenting with shoulder-related complaints, clinicians usually utilize MRI of the shoulder to detect de-novo metastasis. However the diagnostic yield of MRI in those patients is not known. In this project, we evaluate the diagnostic yield from MRI of the shoulder requested for cancer patients more than 65-years-old presenting with shoulder-related symptoms.

METHOD AND MATERIALS: We retrospectively reviewed 306 consecutive shoulder MRI scans that were performed at our institution for cancer patients more than 65-years-old who presented with shoulder-related symptoms. Patient's primary diagnosis, symptoms, and previous imaging data was collected. Patients with primary shoulder tumors were excluded.

RESULTS: Of 306 patients, 20 were excluded because they had primary tumor of the shoulder. For the rest of the 286 patients, MRI showed internal derangement in 162 (57%) patients. 46 (16%) patients had metastatic disease to the shoulder. Of these, 29 (63%) were initially suspected on other imaging modalities. Of the whole population, MRI of the shoulder showed de-novo metastasis in 17 (5.9%) patients. In this group, 13 (76%) patients had documented metastatic disease in other anatomical locations. In patients without known prior metastatic disease, 4 (2%) patients had newly detected shoulder metastasis as the cause of their symptomatology.

CONCLUSION: MRI of the shoulder plays a role in validation of suspected shoulder metastasis seen on other imaging modalities. However, MRI of the shoulder has a low diagnostic yield for the initial detection of de-novo shoulder metastasis in cancer patients greater than 65-years-old.

* Faculty financial disclosures are located in the Faculty Index.

(SS01-08) 2:10–2:20 PM
Eliminating Unnecessary Dose: Ditch That Coned Lateral!

Donna Magid, MD, MEd, *Johns Hopkins Medicine, Baltimore, MD*
(dmagid@jhmi.edu)

PURPOSE: Low back pain remains a common cause of adult disability and medical expenses. The American College of Radiology Appropriateness Criteria outline 'What to request when' for LBP scenarios but generically list 'XR lumbar spine' without specifying 2 vs. 3 views. While there have been suggestions dating back to 1979 that the 3rd, coned lateral, view could be eliminated in over 90% of studies, the 3-view lumbar exam continues to prevail. Routinely eliminating this 3rd view may produce significant radiation dose reduction to marrow and gonads.

METHOD AND MATERIALS: 150 3-or-more view LS exams across multiple Out Patient Spine Clinics were assessed to determine when the 3rd coned view improved or contributed to diagnostic interpretation. All interpretations were performed the senior MSK Radiologist. Each image was assessed prior to reviewing prior images and before scrutinizing available clinical information. Only 2 judgments were made: 1) Was the coned image significantly technically better at depicting the lumbar-sacral area; and 2) If better, did that influence the dictated interpretation of that study.

RESULTS: Only 17 studies had coned views contributing to a slightly better-visualized lumbosacral region image than the frontal/full lateral alone. Only 3 coned views enhanced diagnostic certainty compared to the long lateral alone. 147 coned views were redundant. We discovered the order-entry system was the problem: if not specified by clinicians, technologists assumed 3 views was the default. As of Oct. 2017, our order-entry format will be changed throughout our system to make 2 views the default.

CONCLUSION: While coned centered radiographs over any area of interest general may enhance detail, in the lumbar spine they add little but significant dose. The practice persists mostly because of image-requisition order-entry systems and habit, rather than specific goal-directed clinician request. The current emphasis on high-value imaging and on dose awareness should make this an ideal time to finally eliminate this extremely low-yield, high-dose coned view from the routine requisition. The ubiquity of the clinical problem makes this a small tweak with a potentially huge positive individual and population impact.

(SS01-09) 2:20–2:30 PM
Readability of Musculoskeletal MRI Reports: Will Patients Understand?

Paul H. Yi, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; John Harringa; Sean Golden; Mark A. Kliever, MD
(pyi10@jhmi.edu)

PURPOSE: Although radiology reports have traditionally been written for referring clinical providers, the advent of online medical records has resulted in patients increasingly reading their radiology reports. This trend has raised concerns about patients' ability to comprehend these complex medical documents. The purpose of this study was thus to assess the readability of knee and shoulder MRI reports.

METHOD AND MATERIALS: We reviewed 77 consecutive knee and shoulder MRI reports from a single academic center. Each article was assessed for readability using 5 quantitative readability scales: the Flesch-Kincaid (FK) grade level, Flesch Reading Ease, Gunning-Fog Index, Coleman-Liau Index, and the Simple Measure of Gobbledygook (SMOG). The number of reports with readability \leq the 8th grade level (average reading ability of US adults) and the 6th grade level (NIH-recommended level for patient education materials) were determined.

RESULTS: The mean readability grade level of the MRI reports was greater than the 12th grade reading level for all readability scales; there was no significant difference between knee and shoulder MRIs. No reports were written at or below the 8th grade level.

CONCLUSION: Musculoskeletal MRI knee and shoulder reports are written at a level too high for the average patient to adequately under-

stand. Although radiology reports traditionally written for referring clinical providers, consideration should be made to the patients who will likely read these reports in the current landscape of online health records.

Wednesday, May 9, 2018
1:00–2:30 PM

SS02: Clinical: Abdominal, Interventional Radiology, Nuclear Medicine, Women's Imaging
Location: Augusta
Moderator: Bhasker R. Koppula, MBBS

BR IR NM

(SS02-01) 1:00–1:10 PM
F-18 FDG PET/CT for Primary Head and Neck Carcinomas: Is it Worthwhile to Scan the Abdomen and Pelvis?

Eduardo R. Estades Romero, Jr, MD, *Christiana Care Health System, Newark, DE*; Reza J. Daugherty, MD; Hung Q. Dam, MD; Timothy Manzone; Erin Grady, MD (estadesmd@gmail.com)

PURPOSE: The typical field of view of a standard body F-18 FDG PET/CT study starts at the base of the skull and extends to the mid-thighs (neck, chest, abdomen and pelvis). However, we have observed a trend that some referring providers order limited field of view PET/CT scans of the neck and chest only and do not include the abdomen and pelvis (A&P) for head and neck (H&N) carcinomas. This study sought to identify how often imaging of the A&P detects suspicious metastatic disease or clinically significant incidental findings in patients with primary H&N carcinomas.

METHOD AND MATERIALS: We retrospectively reviewed the medical records of all patients who had PET/CT scans performed in 2014 for H&N carcinomas. The review consisted of evaluation of the patient's primary diagnosis, PET/CT results, and pathology reports. Patients with PET/CT scans that did not image the A&P or without biopsy proven primary H&N carcinoma were excluded.

RESULTS: A total of 198 PET/CT scans were performed for H&N carcinoma in 2014. 29/148 (14.6%) of patients were excluded because A&P was not imaged. Suspected metastases or clinically significant incidental findings were revealed in the A&P in 18/169 (10.7%) of the remaining patients. PET/CT detected suspected metastatic lesions in the A&P in 5/169 (3.0%) patients: 1/5 (20.0%) patients had a lesion only on PET, 0/20 (0%) were found only on CT, and 4/5 (80%) were present on both PET and CT. PET/CT identified clinically significant incidental findings in the A&P in 13/169 (7.7%) patients: 6/13 (46.2%) patients had findings present only on PET, 1/13 (7.6%) had findings only on CT, and 6/13 (46.2%) had findings apparent on both PET and CT.

CONCLUSION: For patients with known H&N carcinoma, including the A&P when performing F-18 FDG PET/CT results in the detection of suspected metastases or clinically significant incidental findings in 10.7% of patients. Therefore, limited PET/CT scans of the neck and chest only should not be routinely ordered for these patients.

(SS02-02) 1:10–1:20 PM
Clinical Implication of Provocative Cholescintigraphy

Qiong Han, MD, PhD; Kavya Sudanagunta, MD, *University of Kentucky, Lexington, KY*; Ravi Jayavarapu, MD; M. Elizabeth Oates, MD (qiong.han@uky.edu)

PURPOSE: Provocative cholecystokinin (CCK) cholescintigraphy protocols employing a technetium-99m (^{99m}Tc) iminodiacetic acid (IDA) analog evaluate functional acalculous gallbladder conditions. At our institution, a nuclear technologist worksheet (NTW) is used to record the patient's pain status/character during the CCK infusion. The radiologist correlates the objective gallbladder ejection fraction (GBEF) with the subjective symptomatology, determining concordance vs. discordance,

* Faculty financial disclosures are located in the Faculty Index.

potentially uncovering the underlying pathophysiology. This study focuses on the clinical implications of provocative CCK cholescintigraphy with this combined subjective/objective approach.

METHOD AND MATERIALS: The NTW was redesigned in December 2016. An IRB-approved, retrospective search of our PACS yielded 84 hepatobiliary scans from 1/1/2017 to 6/30/2017. Of the 84, 36 were excluded due to confounding conditions; 48 were included in this study.

RESULTS: Included patients ranged in age from 7 to 70 years; 73% were female, 27% male. Patient medical records were reviewed for their post-scan clinical course. Two outcomes were observed: cholecystectomy vs. medical management. Eleven (22.9%) underwent surgery; the rest (77.1%) were treated medically. Both cohorts were analyzed against their demographic information (e.g., age and gender), symptoms during CCK infusion, recorded GBEF (normal > 35%), and concordance/discordance. The baseline demographic characteristics of both cohorts were similar ($p > 0.05$). Logistic regression of GBEF however showed a statistically significant difference between the two cohorts ($p < 0.01$).

CONCLUSION: Despite the significant difference in GBEF between the two cohorts, abnormal GBEF is not the only criterion used for clinical management. Six of 11 surgical patients had normal GBEF; three of the six had symptoms during CCK infusion (symptomatology/scintigraphy discordance) leading to the decision to operate. Therefore, the subjective component of provocative CCK cholescintigraphy plays an important role in assisting our referrers in decision-making.

(SS02-03) 1:20–1:30 PM Stereotactic-Guided Breast Biopsy: Are More Sample Cores Always Better? Evaluation of Surgical Upstaging Rate with Smaller Number of Biopsy Sample Cores

Leslie Teng, DO, *Allegheny Health Network, Pittsburgh, PA*;
Sheilah Curran-Melendez; Robin Sobolewski; William R. Poller, MD*
(leslie.teng@ahn.org)

PURPOSE: Stereotactic-guided breast biopsy has all but replaced wire localization and surgical excision of suspicious calcifications, mammographic asymmetries, and masses not identified on ultrasound. Although targeting, sample acquisition, and radiography of acquired samples for targeted calcifications are similar across institutions and equipment manufacturers, the number of sample cores obtained is often arbitrary or anecdotal. A retrospective chart review was performed to evaluate if obtaining fewer than 12 biopsy sample cores resulted in a significantly greater surgical upstaging rate after subsequent surgical excision.

METHOD AND MATERIALS: Following institutional review board approval, a retrospective chart review series was performed on 415 patients who underwent stereotactic-guided breast biopsies from August 1, 2016 to August 1, 2017 at the Allegheny Health Network. Preoperative and periprocedural imaging studies were reviewed by radiology residents and a board certified, fellowship-trained breast imager. Biopsy procedural reports, surgical pathology reports, and any subsequent surgical operative notes were reviewed.

RESULTS: Stereotactic-guided biopsy indications included suspicious calcifications, mammographic asymmetries, or masses without sonographic correlate. Fewer than 12 biopsy sample cores were obtained in 155 of 415 stereotactic-guided biopsies. 58 of the 155 biopsies demonstrated atypical or malignant results on surgical pathology and 9 of the 58 (16%) atypical/malignant lesions sampled resulted in upstaging on subsequent surgical excision. Greater than 12 biopsy sample cores were obtained in 260 stereotactic-guided biopsies, 87 were atypical or malignant, and 3 (3%) resulted in upstaging.

CONCLUSION: Preliminary data suggests that obtaining fewer than 12 sample cores during stereotactic-guided biopsy results in a higher surgical upstaging rate compared to obtaining greater than 12 biopsy sample cores. Further evaluation will be performed to assess whether a statistical difference exists in the rate of successful calcification biopsy when 6 and 12 samples are obtained.

AMSER Henry Goldberg Medical Student Award

(SS02-04) 1:30–1:40 PM Metaplastic Carcinoma of the Breast: What You Must Know as a Patient-Facing Breast Imager

Joshua S. Harford, BS, *University of North Carolina at Chapel Hill, Chapel Hill, NC*; Siobhan O'Connor, MD; Johann Hertel, MD; Sheryl G. Jordan, MD; Kristalyn K. Gallagher, DO, FACOS

PURPOSE: To catalogue the clinical, pathologic, and imaging characteristics of metaplastic carcinomas of the breast (MBC), identify distinguishing features, and inform individualized treatment plans.

METHOD AND MATERIALS: With IRB approval, the study retrospectively identified all patients with histologically-confirmed MBC in our surgical pathology database from 2003–2017. We reviewed data on clinicopathologic features, imaging findings, and outcomes, identifying 83 eligible patients. These were analyzed for histologic grade, stage, receptor status, tumor subtype, and survival data. Imaging characteristics were assigned by a breast radiologist based on presentation mammography, ultrasound, CT, or MRI.

RESULTS: Of the 83 patients, 65% (54/83) were Caucasian, 30.1% (25/83) African American, and 4.8% (4/83) unidentified. Mean age was 58.3, median 57, and range 31–92 years. The most common pathologic subtypes were squamous (37.4%), spindle cell (33.7%), and matrix-producing (21.7%). Triple-negative receptor status was found in 77.3%; the remainder were 10.8% HR positive, 4.8% Her2 positive, and 7.1% unknown. Seventy-five percent of patients received mammography, 72.3% ultrasonography, 56.7% CT, and 13.3% MRI. Most tumors were irregular shape (89.3%), high density (87.5%), and spiculated (53.6%). The average mass size was 5.1 cm (range 0.7–16 cm). Most were high grade (91.2% of histologic samples), and 27% were stage III/IV at presentation. Nine patients (10.8%) had metastatic disease at diagnosis, while another seven had early recurrence within 1 year. Ninety percent of patients underwent surgery: 62.2% mastectomy, 6.8% salvage mastectomy, and 31.1% lumpectomy/WLE. At one year, overall survival was 67.1% with 23% LTF; disease-free survival was 50%, with 7.9% progression and 9.2% recurrence. At five years, overall survival decreased to 32.81% and disease-free survival to 29.7%.

CONCLUSION: We present the largest single-institution cohort of MBC patients studied to date, confirming its status as a rare, predominantly triple-negative cancer. The tumors display irregular, high-density masses on imaging, respond poorly to traditional chemotherapy regimens, and recur early and aggressively compared to other breast tumors.

(SS02-05) 1:40–1:50 PM DCIS Enhancement on CESM Provides Insight into Biological Behavior of Disease Aggressiveness

Anuj Gupta, *Cooper University Hospital, Philadelphia, PA*; Chandni Bhimani, DO; Robyn G. Roth, MD; Pauline Germaine, DO

PURPOSE: To assess degree of parenchymal enhancement in DCIS when compared to pathologic grading as a marker of disease aggressiveness

METHOD AND MATERIALS: We reviewed 2200 CESM studies that have been performed for various reasons at our institution from 2012 to date. This yielded 20 studies that were positive solely for DCIS. A board certified radiologist blindly reviewed these cases for level of parenchymal enhancement in the area of biopsy proven DCIS based on a designated scale and the degree of enhancement was correlated with a pathologic grading to assess relationship between disease aggressiveness and degree of enhancement in the area of malignancy.

RESULTS: Of the 20 cases reviewed, it was determined that 8 had mild level of enhancement, 8 had moderate level of enhancement and 2 had severe level of enhancement, and 2 had no enhancement. Our pathologic examinations demonstrated 1 case of low grade, 16 cases of intermediate grade, and 3 cases of high grade DCIS. In the studied population, 50% of cases demonstrated moderate to severe

* Faculty financial disclosures are located in the Faculty Index.

enhancement and were predominantly accounted for by the intermediate grade DCIS on pathology, which represented 80% of cases. Degree of enhancement also depends on the size of the lesion with greater enhancement in the larger area of involvement.

CONCLUSION: CESM evaluates parenchymal enhancement in the area of known malignancy. With respect to DCIS, most of the intermediate and high-grade cases demonstrated enhancement which provides valuable information regarding biologic behavior and aggressiveness of DCIS.

(SS02-06) 1:50–2:00 PM Factors Influencing Selection of an Interventional Radiology Training Program

Aaron Gould, MD, *Washington University in St Louis, St Louis, MO*; Olaguoke Akinwande; Gretchen M. Foltz, MD; Jennifer E. Gould, MD; Michael D. Darcy, MD; Raja Ramaswamy, MD

PURPOSE: Interventional Radiology (IR) was awarded primary specialty status by the American Board of Medical Specialties in 2012. The purpose of this study was to investigate the factors that were most important for trainees in selecting an IR training program.

METHOD AND MATERIALS: A thirty-four question IRB-approved survey was administered to the active membership of the Society of Interventional Radiology Resident Fellow section (SIR-RFS) and Association of Program Directors in Radiology (APDR). The survey obtained demographic data and investigated the importance of several factors pertinent to IR training program selection. A 5-point Likert scale was used to grade 22 factors from “not at all important” (1) to “very important” (5).

RESULTS: A total of 181 responses were completed with 142 males (79.8%) and 36 females (20.2%) with an average age of 29.2 years. Respondent composition was 72 (40.45%) medical students, 96 (53.93%) residents, and 10 (5.62%) fellows. 52 respondents (28.9%) are planning on applying to residency and planning on entering the IR residency match for 2018. The top 5 rated out of 22 possible factors were variety of IR cases (4.81 ± 0.47), procedural volume (4.63 ± 0.54), perceived happiness of the trainees at the institution (4.52 ± 0.70), job placement/accomplishments of prior fellows (4.44 ± 0.75), and interpersonal interactions with faculty/fellows/residents during interview (4.39 ± 0.79). The lowest 5 rated factors were diagnostic radiology class size (2.67 ± 1.15), moonlighting opportunities (2.93 ± 1.18), potential for research opportunities (3.19 ± 1.15), salary/benefits/compensation (3.22 ± 1.03), and ICU rotation experience (3.22 ± 1.28).

CONCLUSION: Potential future trainees most value diversified procedural exposure, employment opportunities after training, and interpersonal interactions in choosing an IR program. This information is useful to newly established IR residencies seeking to best structure and market their program.

(SS02-07) 2:00–2:10 PM Initial Experience of CT-guided Pulsed Radiofrequency Ablation of the Pudendal Nerve for Chronic Recalcitrant Pelvic Pain



Michael D. Collard, MD, MA, *University of Texas Southwestern, Dallas, TX*; Yin Xi, MS; Anish A. Patel; Kelly Scott, MD; Avneesh Chhabra, MD*

PURPOSE: Chronic recalcitrant pelvic pain is a complex, multifactorial disorder for which directed neuropathic therapies can often provide some degree of relief. Radiofrequency ablation (RFA) of peripheral nerves has been demonstrated to provide neuropathic pain relief, with little data on pelvic nerve RFA or the use of CT guidance.

METHOD AND MATERIALS: Single academic center IRB-approved retrospective cross-sectional study utilizing chart review and follow-up phone calls. All patients who underwent CT-guided pudendal nerve RFA with concomitant perineural injection (PNI) during a three month period were included. All patients had at least one prior PNI with positive block and no prior ablation. Pulsed RFA with a 22-gauge probe using the Neurotherm NT2000i™ (St. Jude Medical) was performed

on 14 pudendal nerves in 10 patients (male:female=3:7) with age 60+/-14 years (mean+/-SD) and BMI 24.6+/-3. Duration (in weeks) and degree of pain relief (0-10 on VAS scale) from RFA and prior PNI were compared. Subjective change in quality of life and pain medication requirement were recorded.

RESULTS: All 14 ablations demonstrated technical success without immediate complication. No long term complications (up to 9 months follow-up) were identified, although one patient developed interstitial cystitis, possibly related to intraprocedural perineural contrast injection used to confirm needle position. Best reported pain scores following RFA averaged 2.1+/-2.3, compared to 3.1+/-2.8 and 2.4+/-2.6 following the first and last PNI, respectively (Wilcoxon signed rank test: $p = 0.11, 0.75$). Duration of relief following RFA averaged 6.8 weeks +/-10.4, compared to 3.4 (SD 4.1) and 1.5 (SD 1.7) following first and last PNI, respectively. The difference between first PNI and RFA was not statistically significant ($p = 0.64$) but was significant between last PNI and RFA ($p = 0.02$). At three months post-RFA, 40% of patients reported improved quality of life and decreased pain medication usage.

CONCLUSION: CT-guided pudendal nerve ablation is well tolerated and can provide pain relief similar to or better than perineural injection with the potential for longer lasting effect, particularly after the benefits of repeat PNI begin to dissipate.

(SS02-08) 2:10–2:20 PM Change in Splenic Volume Related to IV Contrast Administration: Implications for Clinical Practice

Peter Andrew, *University of Wisconsin, Madison, WI*; Perry J. Pickhardt*; Timothy Ziemlewicz, MD* (tziemlewicz@uwhealth.org)

PURPOSE: With the dawning of automated image interpretation, organ volume will likely be one of the first available metrics. Prior to adaptation of this metric into practice it must be determined if the CT procedure itself can alter measured volume. The purpose of this study was to evaluate if there was a change in splenic volume following IV contrast administration.

METHOD AND MATERIALS: Between January 2012 and January 2017, 957 renal donor CT scans were performed at a single institution using a standardized protocol: pre- and post-contrast imaging, multiphase injection with total contrast dose of 150 mL and 100 mL of saline. Patients were analyzed further if the entire spleen was present on both pre-contrast and parenchymal phase (180 s following bolus initiation), with a final cohort of 333 patients. Splenic volume on each series was measured in a semi-automated fashion using a stand-alone workstation.

RESULTS: The average pre-contrast spleen volume was 195.0 mL and average post-contrast spleen volume was 209.1 mL. Splenic volume increased by an average of 7.2% (14.1 mL, standard deviation 12.2 mL, $p < 0.0001$) after the administration of contrast. 33.9% (113/333) cases had a volume increase of >10% while 3.9% (13/133) had a volume increase >20%. The difference between pre- and post-contrast volumes follows a linear model with R2 value of 0.98. There was an expected bias toward larger volume following contrast administration which increased as the average volume increased.

CONCLUSION: There is a significant measurable increase in splenic volume following IV contrast administration which behaves in a linear fashion. This increase in volume must be accounted for in the construction of nomograms for splenic volume and when comparing non-contrast with post-contrast scans.

(SS02-09) 2:20–2:30 PM The Role of MRCP following Sonographic Diagnosis of Cholecystitis

Jesse Chen, MD, *Staten Island University Hospital, Staten Island, NY*; Ajla Kadribegic, BS; David S. Sarkany, MD

PURPOSE: The RUQ ultrasound is an extremely useful and commonly utilized method for identifying acute cholecystitis (AC). There is less consensus about the subsequent work up following the sonographic

* Faculty financial disclosures are located in the Faculty Index.

diagnosis of AC. While MRCP may be fairly sensitive and specific for a CBD stone, this further examination is costly and can delay management of the acute process (2.9 days on average in one study). This exhibit presents the experience of our institution, and argues that while CBD diameter and laboratory examination independently are insufficient to adequately predict the presence of CBD stone, these two clues taken together may be sufficient to preclude further preoperative work up.

METHOD AND MATERIALS: All MRCP examinations performed within 1 week following a RUQ US from the last 5 years were considered, with patients <18 years excluded. While all 700+ patients from this initial screen have not yet been analyzed, enough patients have been reviewed to draw initial conclusions. MRCP results were reviewed for patients who were diagnosed with AC by RUQ US, but who *did not* demonstrate CBD dilation. Statistical analysis will be performed with a t-test to evaluate whether there is a significant difference between those patients with and without choledocholithiasis.

RESULTS: Within our institution, the large majority of patients with a normal CBD in the setting of AC had a negative follow up MRCP. These findings are consistent with publications that have argued in favor of intra-operative cholangiogram over routine MRCP. All patients in our cohort (AC with normal CBD) had elevated direct bilirubin (>0.2 mg/dL), however those with MRCP-identified choledocholithiasis seem to have elevated direct bilirubin levels even greater than their stone free counterparts. Additional data needs to be collected to adequately power this claim.

CONCLUSION: Wong et al (2012) and Boys et al (2014) demonstrated that laboratory evaluation (e.g. direct bilirubinemia) and CBD diameter are poor discriminators of associated choledocholithiasis. Our experience has demonstrated that the costly work up with MRCP may be foregone when both components are taken into account.

Wednesday, May 9, 2018
1:00–2:30 PM

SS03: Quality and Safety

Location: Congressional

Moderators: Shane A. Wells, MD*

Teresa Chapman, MD, MA



(SS03-01) 1:00–1:10 PM Development and Validation of Proposed Clinical Indication Based Image Quality Scoring Criteria (IQSC) for Pediatric CT

Atul Padole, MD, *Massachusetts General Hospital, Boston, MA*; Madan Rehani; Mannudeep Kalra*, *Subba Digumarthy*; Michael S. Gee, MD, PhD; Sjirk J. Westra, MD (*apadole@mgh.harvard.edu*)

PURPOSE: To assess the diagnostic acceptability and inter-observer agreement of pediatric CT with proposed clinical indication based IQSC

METHOD AND MATERIALS: For this quality improvement study (exempted from IRB approval), pediatric CT exams were randomly selected from Render, an image database. Clinical indication based pediatric CT exams for routine chest (n=5, mean age 10 ± 4 yr), routine abdomen (n=5, 12 ± 5 yr), renal stone (n=5, 16 ± 1 yr), appendicitis (n=5, 10 ± 3 yr), craniosynostosis (n=5, 3 ± 5 yr), and, ventriculo-peritoneal (VP) shunt (n=5, 6 ± 5 yr) were selected for diagnostic quality evaluation. Image evaluation (for total 30 CT exams) was done by 5 board certified pediatric subspecialty radiologists with proposed clinical indication-based IQSC(5-point scale (0= Not seen or included, 1= Unacceptable quality, 2= Limited quality, 3= Adequate quality, 4= Higher than needed quality).

RESULTS: Mean CTDIvol for routine chest, routine abdomen, renal stone, appendicitis, craniosynostosis, and, VP shunt was 1.7, 6, 3.7, 6, 1.4, and 19 mGy, respectively. For all 5 radiologists, the lesion detection was unaffected for all CT exams. For routine chest CT, the inter-

observer agreement among five readers (image quality: optimal score 3, 4 vs sub-optimal score 1, 2) was very good (0.8-1). The percentage of frequency of subjective image quality score (5 readers) were 4% (score1), 8% (score 2), 56% (score 3) and 32% (score 4) for routine chest CT exams. The percentage of frequency of optimal diagnostic image quality was (88%, score 3, 4) were significantly higher than the sub-optimal diagnostic image quality score (12%, score 1, 2) for routine chest CT exams (P<0.0001). All routine CT abdomen exams were scored optimal (100%, score 3, 4) by 5 radiologists. The percentage of frequency of optimal diagnostic image quality (kappa value) for CT exams performed for renal stone, appendicitis, craniosynostosis, VP shunt were 96% (0.8-1), 92% (0.6-1), 88% (0.4-1), and 92 % (0.6-1), respectively.

CONCLUSION: Clinical indication based image quality scoring criteria (IQSC) helps assess diagnostic acceptability for pediatric CT examinations with high inter-observer agreement. It can be used for radiation dose optimization in children.

(SS03-02) 1:10–1:20 PM The Use and Abuse of the Rapid Sequence MRI in Pediatric Imaging: Implications for Health Systems and Patients

Cory M. Pfeifer, MD, *University of Texas Southwestern Medical Center, Dallas, TX* (*Cory.Pfeifer@utsouthwestern.edu*)

PURPOSE: Use of non-sedated rapid brain MRI for clinical indications other than intracranial shunt evaluation is increasing in response to concerns over anesthesia-related neurotoxicity. Lack of understanding of limiting factors, however, places patients at risk. This study assesses the use and overuse of rapid MRI at 2 of the largest 8 children's hospitals in the US while exploring root causes and implications for patient health and imaging center revenue.

METHOD AND MATERIALS: 100 consecutive rapid MRIs interpreted at each of 2 large children's hospitals over the same time period were compared. The more restrictive institution (where exams are ordered almost exclusively by neurosurgeons) uses half (3) of the sequences utilized at the more permissive institution (6). The appropriateness of exams were defined by a panel of 2 pediatric neuroradiologists from each of the institutions, and the results were compared. Analysis was performed with respect to time and cost for rapid MRI compared to conventional MRI.

RESULTS: Shunt evaluation was the reason for exam in 46% of studies at the restrictive institution and 41% at the permissive institution. The expert-defined appropriate indications of ventricular assessment without shunt (20% restrictive/17% permissive), intracranial cyst follow-up (13% for both hospitals), and acute stroke (7% restrictive/8% permissive) were the most common additional indications. 3% of the exams were deemed inappropriate at the restrictive institution, and 11% of the exams were inappropriate (e.g. seizure, developmental delay, child abuse) at the permissive institution. Scanner availability and sedation risk were the major reasons for non-surgeons to order rapid MRI at the permissive institution. Rapid MRI is performed at the permissive hospital at more than twice the rate of the restrictive hospital resulting in a significant increase in revenue.

CONCLUSION: Rapid MRI can generate significant revenue given its speed, but it creates the possibility for missed diagnoses when clinicians are ill-informed of its limitations. Appropriateness criteria should address the use of the rapid MRI technique specifically, and a distinct CPT code should be considered to discourage its overuse.

(SS03-03) 1:20–1:30 PM Quality of Documentation and Prevalence of Contrast Agent Allergies in Electronic Health Records

Francis Deng, *Massachusetts General Hospital, Boston, MA*; Matthew D. Li; Adrian Wong; Leigh Kowalski; Kenneth Lai; Diane Seger; et al (*fdeng@mgh.harvard.edu*)

PURPOSE: Precise contrast agent allergy documentation in electronic health records (EHRs) is critical for quality and safety of care in radiology.

* Faculty financial disclosures are located in the Faculty Index.

The objective was to identify, describe, and assess the quality and prevalence of contrast agents entered in an EHR's allergy module.

METHOD AND MATERIALS: We compiled a lexicon of medical imaging drugs and class terms and then used a natural language processing system to search entries stored in an integrated EHR allergy repository between 2000 and 2013. We manually normalized contrast allergen entries and then categorized them by imaging modality. We evaluated whether each entry represented a specific contrast agent (high quality), a modality-specific class term (intermediate quality), or an ambiguous contrast concept (low quality).

RESULTS: Among 2.7 million patients, we identified 36,145 patients (1.3%) with at least one contrast allergy recorded. The prevalence was higher in females (1.6%) and whites (1.5%). There were 40,718 contrast allergen entries (2,735 unique). Most entries were low quality (69.1%), rather than intermediate (19.4%) or high quality (11.5%). Of the categorizable entries, the vast majority were agents used for X-ray-based imaging (82.2%, including iodinated radiopaque contrast) or MRI (16.4%, including gadolinium-based contrast media), while diagnostic radiopharmaceuticals (1.4%) and ultrasonography contrast agents (0.1%) were uncommonly reported allergens. Free-text entries comprised 15.2% of all contrast entries, which was greater than the free-text rate for other allergies (6.3%). Free-text contrast entries were less likely than structured entries to be high quality (7.9% vs 12.2%). The proportion of high quality entries did increase over time, but only from 1.0% during the first fifth of the study period to 18.6% in the final fifth.

CONCLUSION: Contrast allergy entries in EHRs are diverse and typically imprecise. Continued enhancements to EHR allergy modules are needed to support high quality contrast allergen documentation.

(SS03-04) 1:30–1:40 PM

Recent Trends in the use of Portable Chest Radiographs in Hospitalized Patients

Sarah I. Kamel, BS, MD, *Thomas Jefferson University Hospital, Philadelphia, PA*; David C. Levin, MD; Laurence Parker, PhD; Vijay M. Rao, MD (sarah.kamel@jefferson.edu)

PURPOSE: The American College of Radiology and recent literature suggest that daily routine chest x-rays (CXR) can be eliminated without increasing adverse outcomes, particularly in intensive care patients. Our purpose was to study recent trends of portable CXR utilization, particularly in inpatient and emergency department (ED) places-of-service.

METHOD AND MATERIALS: The nationwide Medicare Part B fee-for-service databases for 2003-2015 were used. We selected CPT code 71010 (single view, chest). We made the assumption that in the inpatient and ED settings, the vast majority of single view CXRs would be portables. Global and professional-component claims were tabulated to determine volume. Technical-component claims were excluded to avoid double counting. The databases indicate procedure volume for each code, and we then calculated utilization rates per 1000 Medicare beneficiaries. Medicare place-of-service codes were used to identify exams performed on inpatients and ED patients.

RESULTS: The overall single view CXR utilization rate per 1000 beneficiaries peaked in 2008 at 547 and then progressively declined to 462 in 2015 (-15%). The rates in the major places-of-service where these exams were performed in 2015 were (1) Inpatient: 270 (58% of the total), (2) ED: 129 (28%), (3) Hospital Outpatient Department: 35 (8%), (4) Other – primarily nursing homes: 24 (5%) and (5) Office: 4 (1%). In inpatients, the utilization rate of portable CXRs fluctuated between 354-371 from 2003 to 2008; it peaked at 371 in 2008. In subsequent years, there was a steady decline to 270 in 2015 (-27%). By contrast, the utilization rate in EDs demonstrated continuous growth, from 74 in 2003 to 129 in 2015 (+74%).

CONCLUSION: The recent substantial decline in utilization of portable CXR among inpatients may reflect data supporting the elimination of daily, routine CXR in the ICU. Interestingly, this is juxtaposed by a rise in CXR use in the ED. Despite the fact that CXR is a rapid, cost effective tool which is favorable in the fast paced ED setting, the significant and steady rise in utilization over the past decade calls into question the medical appropriateness of its increasing use.

A³CR² Research Award

(SS03-05) 1:40–1:50 PM

Point of Care Ultrasound Compared with Ultrasound by Radiologists: Do the Trends Indicate a Shift?

Sarah I. Kamel, MD, *Thomas Jefferson University Hospital, Philadelphia, PA*; David C. Levin, MD; Laurence Parker, PhD; Ethan J. Halpern, MD; Vijay M. Rao, MD (sarah.kamel@jefferson.edu)

PURPOSE: "Point of care" ultrasound (POC US) is a euphemism for self-referral in US; it has been touted by a number of authors and groups. Our purpose was to study recent trends to determine whether noncardiac US has shifted from radiologists to nonradiologists physicians (NRPs) as a result.

METHOD AND MATERIALS: We used the nationwide Medicare Part B fee-for-service databases for 2005-2015. All noncardiac US CPT codes were selected. Global and professional-component claims were tabulated to determine who billed the exams. Technical-component claims were excluded to avoid double counting. Invasive procedures were not included. The databases indicate procedure volume and we then calculated utilization rates per 1000 Medicare beneficiaries. Medicare place-of-service codes showed where the exams were interpreted and its specialty codes indicated the specialty of the interpreting physicians.

RESULTS: The overall Medicare noncardiac US utilization rate per 1000 increased from 397.6 in 2005 to 442.2 in 2015 (+11%). Among radiologists, the rate increased from 210.2 in 2005 to 241.4 in 2015 (+15%), while among NRPs it increased from 187.4 in 2005 to 200.8 in 2015 (+7%). The 2005-2015 interval changes in the 4 major places-of-service where imaging is done were as follows: (1) EDs: radiologists 10.9 to 22.6 (+107%), NRPs 1.5 to 3.0 (+100%); (2) hospital inpatients: radiologists 69.6 to 60.4 (-13%), NRPs 21.7 to 15.7 (-28%); (3) hospital outpatient departments (HOPDs): radiologists 86.2 to 100.7 (+17%), NRPs 21.8 to 26.7 (+22%); (4) private offices: radiologists 42.6 to 56.3 (+32%), NRPs 138.8 to 146.3 (+5%). The top NRP specialties in noncardiac POC US in 2015 and their rates per 1000 were: cardiologists 39.5, vascular surgeons 38.8, other surgeons 31.2, primary care physicians 22.4, urologists 18.1.

CONCLUSION: The overall Medicare utilization rate of noncardiac US increased by 11% from 2005 to 2015. Despite the increased advocacy of POC US by some in recent years, the growth among radiologists has been twice as great as among NRPs (15% vs 7% respectively). Radiologists predominate in US in EDs, inpatients, and HOPDs; NRPs predominate in private offices.

(SS03-06) 1:50–2:00 PM

Patient Satisfaction: Differences in Patient Perceptions of Quality and Satisfaction across Radiology Modalities

Xuan V. Nguyen, MD, PhD, *The Ohio State University Wexner Medical Center, Columbus, OH*; Joseph S. Yu, MD; Amna A. Ajam, MD, MBBS (Xuan.Nguyen@osumc.edu)

PURPOSE: In an era of increased emphasis on patient-centric medicine, the well-being of the radiology profession is likely affected by patients' perceptions of their imaging experiences. In this study, we hypothesize that patient satisfaction differs across radiology modalities and seek to identify factors contributing to such differences.

METHOD AND MATERIALS: 69,319 Press-Ganey outpatient services surveys over a 9-year period (2008-2017) at an academic institution were retrospectively analyzed. Surveys were completed by patients who underwent outpatient imaging exams in mammography (MG), radiography, CT, MRI, US, or nuclear medicine. Survey responses on a scale from 1 (Very Poor) to 5 (Very Good) were averaged to obtain a mean satisfaction score. Scores for the 5 survey subsections (Registration, Facility, Test/Treatment, Personal Issues, or Overall Assessment) were also analyzed. Differences in scores were assessed by the Kruskal-Wallis test. Mean scores ≤ 3 were designated as low-scoring, corresponding to descriptors of Fair, Poor, or Very Poor.

RESULTS: Mean satisfaction scores for MG were significantly higher than for CT, US, MRI, nuclear medicine, and radiography ($p < 0.0001$).

* Faculty financial disclosures are located in the Faculty Index.

US had higher scores than MRI ($p < 0.05$). Low-scoring surveys were uncommon, representing 6.2% of all surveys. Compared to the group mean at $\alpha = 0.05$, low scores were significantly less frequent for MG (3.9%) and more frequent for radiography (7.6%), CT (7.2%), and MRI (7.1%). For MG, all survey subsections had significantly fewer low-scoring responses than average, and for MRI, all subsections had more low-scoring responses than average. For radiography, the subsections contributing to low scores were Registration, Facility, Test/Treatment, and Overall Assessment. For CT, the contributing subsections were Facility, Test/Treatment, and Personal Issues.

CONCLUSION: In this study of 69,319 surveys, significant variations in patient satisfaction were found across modalities and may reflect inherent challenges related to modality-specific patient interactions or workflow issues. Identifying factors responsible for these differences may assist modality-specific efforts toward improving patient experiences.

(SS03-07) 2:00–2:10 PM

Safe for Sound: Ultrasound Site Assessment for Rural Clinics in Low-Resource Countries

Naiim Ali, MD, *University of Vermont Medical Center, Burlington, VT*; Robert D'Agostino, MD; Kristen K. DeStigter, MD* (*naiim.ali.md@gmail.com*)

PURPOSE: Introduction of ultrasound to rural clinics in low-resource countries is fraught with challenges. Donated ultrasound equipment is left unused within months of delivery at countless clinics. The goal of this project was to develop an assessment methodology which would help predict which clinics are able to support a sustainable, high-quality, high-volume ultrasound practice.

METHOD AND MATERIALS: A Site Assessment Questionnaire was developed covering 5 main themes: 1. Patient population: Issues related to language, education, and cultural traditions of the communities served are addressed. Specific focus is given to evaluating the efficacy of existing community health workers in order to gain cultural acceptance of ultrasound. 2. Oversight of clinic: This evaluates the leadership hierarchy, as well as the role of the clinic in the greater healthcare system. This ensures buy-in from individuals making clinical and budgetary decisions for the clinic. 3. Infrastructure: Assessment includes availability of power, running water, cellular network, physical space, as well as ability to support ongoing costs (i.e. ultrasound gel and cleaning supplies). 4. Clinical services: Evaluating services offered at a clinic helps determine if staff have the necessary skills to learn how to perform and interpret ultrasound exams along with appropriately managing newly diagnosed conditions. Determining patient volumes and most common medical conditions allows ultrasound training to be tailored for each site. 5. Referral center capacity: Rural clinics serve as sites of triage for higher levels of hospital based care. Many times the hospitals may not have the tools necessary to confirm and manage conditions diagnosed by ultrasound; making this evaluation essential before implementation.

RESULTS: This methodology has been used successfully in sub-Saharan Africa to identify ultrasound-capable clinics. This includes Malawi, and Uganda where it has been used by Rotary International to evaluate 75 potential sites.

CONCLUSION: Site assessment designed for implementation of ultrasound has proven to help anticipate potential obstacles in Uganda and Malawi. This assessment tool may have broad global applications.

(SS03-08) 2:10–2:20 PM

Radiation Dose Indices for Single and Multi-Region Scanning Protocols: Who Got What?

Rachel Vining, *Massachusetts General Hospital, Boston, MA*; Atul Padole, MD; Shivam Rastogi; Kalpana M. Kanal, PhD; Subba Digumarthy; Mannudeep Kalra* (*apadole@mgh.harvard.edu*)

PURPOSE: Can radiation dose indexes or scan lengths help in accurate classification of individual chest and abdominal CT doses for a multiregion CT examinations

METHOD AND MATERIALS: We retrospectively analyzed CT dose index volume (CTDIvol) and dose length product (DLP) associated with consecutive single-region chest (150 adult patients), single-region abdomen (150 patients), and multi-region combined chest-abdomen (260 patients) CT examinations. All CT examinations were performed on four MDCT scanners (Siemens Definition Flash, Philips iCT 256, GE Discovery 750 HD). CTDIvol and DLP for each examination were recorded from dose information page archived on the PACS workstation. Dose indexes for series with DLP less than 50 mGy-cm were excluded to filter out doses from bolus tracking and planning radiographs. Scan length was estimated for each examination and body region. Data were analyzed using student t test.

RESULTS: Single-region chest CT doses (CTDIvol 5-13 mGy; DLP 240-430 mGy-cm) and scan lengths (36-43 cm) were significantly smaller compared to corresponding values for single-region abdominal CT (CTDIvol 11-20 mGy; DLP 498-762 mGy-cm) and scan lengths (46-56 cm) ($p < 0.0001$). For single-run, combined chest-abdomen CT, DLP (1400-2018 mGy) and scan length (47-57 cm) were significantly greater than single body region chest or abdominal CT examinations ($p < 0.0001$). For split-run, combined chest-abdomen CT, scan lengths and dose indexes for individual body regions were not significantly different from corresponding single body region CT examinations ($p > 0.05$). Scanner specific analyses revealed significant variations in chest and abdomen CT doses and scan lengths ($p < 0.0001$). Delayed images of the abdomen had smaller DLP and scan length as compared to corresponding values for entire abdomen and chest CT examinations ($p < 0.05$).

CONCLUSION: Despite inter-scanner variabilities in scan lengths and CT radiation doses for body CT examinations, lower CTDIvol, DLP and scan lengths associated with chest compared to abdomen CT can help in accurate binning of radiation doses for split run, combined chest-abdomen CT.

AUR Trainee Prize: 2nd Place

(SS03-09) 2:20–2:30 PM

Predicting Malignant Potential of Subsolid Nodules: Can Radiomics Preempt Longitudinal Follow Up CT?

Shivam Rastogi; Atul Padole, MD, *Massachusetts General Hospital, Boston, MA*; Melissa C. Price, MD; Mannudeep Kalra*; Subba Digumarthy (*apadole@mgh.harvard.edu*)

PURPOSE: To assess if radiomics can (i) predict malignant potential of subsolid pulmonary nodules (SSN) on baseline chest CT, and (ii) differentiate between benign and malignant subsolid nodules.

METHOD AND MATERIALS: This IRB approved retrospective study included 108 groundglass nodules (GGN) and part-solid nodules (PSN) in 36 patients (M:F 5:31) with 31 benign (mean age 72 years) and 77 malignant (mean age 68 years) nodules on follow up CT ($> 25\%$ increase in size) and/or histology. Radiomics features were assessed for each nodule on baseline and final CT exams (mean interval: benign: 41 ± 29 months, malignant: 43 ± 32 months). Images were exported to the open source, 3D-Slicer software (version 4.7) for manual segmentation of each pulmonary nodule. A total of 92 radiomics features (including shape, first-order statistics, and GLCM) were extracted for each nodule at the baseline and final follow up CT. Data were analyzed using student t-test, ROC, and logistic regression analyses.

RESULTS: On baseline CT, only two radiomics features (cluster shade, AUC 0.60, and surface volume ratio AUC 0.62, both $p < 0.03$) were significantly between benign and malignant SSN. At final follow up, 52/92 radiomics features were significantly different between benign and malignant SSN (AUC 0.64-0.74, $p = 0.04 - < 0.0001$ with strongest differentiators being low grey level emphasis and short run low grey level emphasis). Although 63/92 radiomic features were significantly for malignant SSN different between the baseline and final CT ($p = 0.04 - < 0.0001$), there was no change in any radiomics features for benign SSN ($p > 0.05$). The backward conditional logistic regression

* Faculty financial disclosures are located in the Faculty Index.

model was also statistically significant for 59/92 radiomics features ($p < 0.0001$) for malignant SSN at baseline and final CT examination.

CONCLUSION: Although radiomics cannot reliably differentiate benign from malignant SSN at baseline CT, lack of change in radiomics over time favors benign etiology. Conversely, a change in radiomic features over time strongly favors malignant potential of SSN. On the final follow up CT, radiomics demonstrate a high level of accuracy for differentiating benign from malignant SSN.

Wednesday, May 9, 2018
1:00–2:30 PM

SS04: Resident and Medical Student Education

Location: International Ballroom II–III

Moderators: Katherine A. Klein, MD

Emily M. Webb, MD



(SS04-01) 1:00–1:10 PM

Second or Last? Most Appropriate Author Position for the Faculty Mentor: Results of an AUR Survey

Priyanka Annigeri, MD, *Henry Ford Hospital, Detroit, MI*; Elizabeth A. Krupinski, PhD; Laila Poisson, PhD; Manuel L. Brown, MD; Brent D. Griffith, MD (*brentg@rad.hfh.edu*)

PURPOSE: To assess which author position, second or last, members of the academic radiology community consider most appropriate for the primary faculty mentor and whether this perception differs based on faculty rank, leadership role in the department or promotions committee participation.

METHOD AND MATERIALS: Survey questions assessed opinions regarding the most appropriate author position for a faculty mentor and which position is considered most important for academic promotion, as well as whether corresponding author status influenced this perception. The survey was sent to all AUR members (1126 active or emeritus faculty), of which 247 (21.9%) responded.

RESULTS: Of the 247 faculty respondents, 38.1% were full professors, 31.2% associate, and 30.8% assistant. 32% were chairs or vice chairs of their departments; and 17% and 7.7% were departmental or institutional promotions committee members, respectively. 66.8% considered the last author position “most appropriate for the primary staff author/mentor” versus 31.6% for the second author position. Full professors selected last author less frequently than associate and assistant professors (58.7% versus 67.1% and 80%, respectively). Similarly, 72.1% considered the last author position as “greatest towards academic promotion” versus 27.9% for second author. Again, this was less frequent for full professors (64.1% versus 72% and 85.5% for associate and assistant, respectively). Chairs/vice chairs and departmental promotions committee members followed a trend similar to full professors; while institutional promotions committee members chose last author more frequently for both questions. Finally, when considering corresponding author status in addition to author position, only 31% changed their author position ranking according to position of the corresponding author.

CONCLUSION: When a trainee is first author, the majority of academic radiologists consider the last author position to be the most appropriate position for the primary faculty mentor and it was considered most important for academic promotion regardless of corresponding author status. Faculty should take this into account when deciding author positions on publications.

(SS04-02) 1:10–1:20 PM

30/30 Teaching Format Improves Resident Retention and Attention Compared to Traditional Lectures

Vishwan Pamarthi, MD, *Duke University, Durham, NC*; Lars J. Grimm, MD*; Karen S. Johnson, MD, MS; Charles M. Maxfield, MD (*vishwan.pamarthi@gmail.com*)

PURPOSE: Didactic lectures are the chief method of instruction in medical education despite evidence that passive learning results in inferior retention and poor attention compared to active learning. The purpose of this study is to compare the traditional lecture to the 30/30 teaching format with regards to radiology resident short- and long-term retention, as well as attention.

METHOD AND MATERIALS: The 30/30 format consists of a 30-minute didactic lecture followed by 30 minutes of cases delivered in a “hot seat” style, with all cases based on material from the lecture portion. Faculty members assigned to daily morning conference at a teaching institution were randomly selected for either a 60-minute lecture or a 30/30 presentation. To assess short- and long-term retention, a retention survey developed from the presenter’s slides was sent to all residents approximately fifteen minutes after each presentation, and again approximately three months later. The presenters were blinded to the survey questions. To assess attention, the proportion of questions answered correctly from each quarter of the presentations was compared against other quarters. Comparisons were made between the two formats via Fisher’s exact test.

RESULTS: For six 30/30 presentations, 106 and 60 residents completed short- and long-term retention surveys totaling 848 and 480 questions, respectively. For six traditional lectures, 91 and 55 residents completed short- and long-term retention surveys totaling 728 and 440 questions, respectively. Short-term retention was 75.7% (640/848) for 30/30 presentations, compared with 63.2% (460/728) for traditional lectures ($p < 0.0001$). Long-term retention was 59.4% (285/480) for 30/30 presentations, compared with 49.3% (217/440) for traditional lectures ($p = 0.002$). Retention of 49.3% (148/300) was noted in the fourth quarter of traditional lectures, compared with 61.6% (554/600) from the remaining quarters ($p = 0.0003$), suggesting decreased attention. There was no drop-off in attention for 30/30 presentations.

CONCLUSION: The 30/30 teaching format demonstrates better short-term retention, long-term retention, and attention among radiology residents when compared to traditional lectures.

(SS04-03) 1:20–1:30 PM

Current State of Ultrasound Training in Radiology Residency Programs in North America

Tanner Harmon, MD, *Maricopa Medical Center, Phoenix, AZ*; Mary J. Connell, MD; Amanda Loh, MD; Tara A. Morgan, MD (*tannerjesse22@gmail.com*)

PURPOSE: Radiologists’ preparedness to reliably serve as expert diagnostic imaging watch-guards is vital as demands for higher-value health care increase. Growing evidence suggests that ultrasound (US) is key to maximizing health care value, yet US curriculum in radiology residency is poorly understood.

METHOD AND MATERIALS: An anonymous 11-item electronic survey was created to assess US curriculum in radiology residency and program directors’ views toward US. The Association of Program Directors in Radiology (APDR) distributed the survey to all active members of the APDR, which includes 309 radiology program directors from the United States, Canada, and Puerto Rico. One reminder email, containing a survey link, was sent 9 days later.

RESULTS: Of 309 survey invitations, 55 surveys were completed (17.8%) and all were usable for analysis. The majority of program directors (72.7%) indicated that their residents spend more than 12 weeks on US rotations and 97% of respondents believe that it is

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important for residents to become competent in US scanning and interpretation. Although 80% of respondents reported that “multiple” or “all” attendings feel prepared to train residents in US, 76.4% of program directors identified sonographers as providing “most supervision of US scanning by the residents during a regular day shift.” A common view held by respondents is that residents need to be prepared to answer sonographers’ questions, not vice versa, and to perform complex US exams when called upon. The majority of respondents (74.1%) reported that their ultrasound curriculum was developed by the US section chief; however, only 38.9% of respondents reported using Society of Radiologists in Ultrasound guidelines for curriculum development. Respondents specified different extents of ultrasound training between radiology subspecialties, with 78.2% reporting “comprehensive” abdominal US training and 60% reporting “minimal” to “no significant training” in musculoskeletal US.

CONCLUSION: To truly establish a patient-centered approach to diagnostic imaging, US training in radiology residency must become more deliberate, coordinated, comprehensive.

(SS04-04) 1:30–1:40 PM Implementing Durable Measures of Quality Improvement: A 6-Year Retrospective Evaluation

Anthony D. Kuner, *University of Wisconsin School of Medicine and Public Health, Madison, WI*; Tabassum A. Kennedy, MD; John-Paul J. Yu, MD, PhD (jpyu@uwhealth.org)

PURPOSE: To analyze the long-term durability of quality improvement measures in the reporting of noncontrast CT head findings for acute stroke patients at an academic medical center.

METHOD AND MATERIALS: A 6-year retrospective, consecutive analysis of all patients with an acute stroke diagnosis was performed. For the study period, the rate of compliance with the Comprehensive Stroke Center 20-minute noncontrast head CT communication guideline was calculated on a monthly basis, which includes a 13-month pre-intervention period and a 5-year post intervention period. Monthly data were tabulated and charted.

RESULTS: For the 13-month pre-intervention period, the mean monthly compliance rate for reporting noncontrast head CT findings within the 20-minute window was 53% (range: 0-100%). A PDSA (Plan-Do-Study-Act) quality improvement (QI) program was then undertaken, which led to the installation of numerous workflow and communication interventions to raise reporting compliance. Among the interventions implemented were the placement of a stroke pager in the reading room, the definitive labeling of stroke studies in PACS, and continuous in-service education for radiologists, CT technologists, and allied clinical services. Following implementation, the mean monthly compliance rate rose to 89% in the first four months with significantly less variability (82-93%). Ongoing monitoring of reporting compliance continued to improve throughout the subsequent 5-year post-intervention period with a mean monthly compliance rate of 96%.

CONCLUSION: Short-term QI cycles are often implemented and have been shown to result in meaningful change; however, there are few studies which have evaluated the durability of these interventions and simultaneously identified features of durable and successful long-term QI projects. Our study demonstrates (1) the durable success of our interventions and (2) the importance of ongoing monitoring and in-service education in sustaining QI interventions. Our work suggests that there are successful features of durable QI interventions and programs and provides a roadmap for achieving sustained excellence in quality improvement programs.

AUR Trainee Prize: 3rd Place

(SS04-05) 1:40–1:50 PM A Checklist Manifesto: Effectiveness of Checklist Use in Hands-on Simulation Examining Competency in Contrast Reaction Management and Conflict Resolution

Sana Parsian, MD, *Seattle Cancer Care Alliance, Seattle, WA*; Daniel Hippe*, Linda Chen, MD; Ryan O’Malley, MD; William H. Bush, Jr, MD; Puneet Bhargava, MD*; et al (wangcl@uw.edu)

PURPOSE: To assess the performance of a contrast reaction management (CM) checklist for optimal management of a contrast reaction scenario and conflict resolution using high-fidelity hands-on simulation in a randomized case-controlled study to prevent mortality and morbidity.

METHOD AND MATERIALS: A safety checklist (CL) was designed depicting the 5 most common adverse events after administration of intravenous contrast and their step-by-step management. After IRB approval informed written consent was obtained from all participants. Forty-three radiology residents were randomized into checklist (n=22) and control (n=21) groups, stratified by postgraduate year (PGY). Both teams received CM training 3-6 months prior to the study. Participants took written multiple choice question (MCQ) tests 2 months prior and immediately after the high-fidelity simulation scenario which were videotaped and independently evaluated by 3 graders. Built into the scenario was a confederate who suggested an improper medication treatment. The two groups were compared using the Wilcoxon rank-sum test.

RESULTS: Both groups scored similarly on the MCQ tests before the simulation (77% vs. 80%, p=0.4). The CL group overall scored significantly higher than the control group in their overall management of a severe contrast reaction (85% vs. 65%, p=0.001), particularly in first line treatment of bronchospasm (97% vs. 91%, p=0.03) and correct route and dose of epinephrine administration (77% vs. 46%, p=0.02). Even though the CL group also scored higher at resolving the conflict when challenged by an authority with incorrect suggested management, the difference was not significant (48% vs. 39%, p=0.14). There was no significant difference in MCQ test scores after the scenario between the groups (87% vs. 85%, p=0.6), however, a trend was seen towards more improvement in the CL group than the control group (p=0.07).

CONCLUSION: A standardized CM checklist is able to reduce the number of treatment errors during a severe CM simulation, particularly the proper administration of epinephrine and treatment of bronchospasm. This could be used by radiologists, technologists and nurses to improve patient safety for both CM and teamwork skills.

Joseph E. and Nancy O. Whitley Award

(SS04-06) 1:50–2:00 PM Electronic and Social Media-Based Radiology Learning Initiative: Development, Implementation, Viewership Trends, and Assessment at 1 Year

Nicholas A. Koontz, MD, *Indiana University School of Medicine, Fishers, IN*; Danielle Hill, MD; Sean C. Dodson, MD; Alisha E. Capps, MD; Aaron P. Kamer, MD; Mark S. Frank, MD (nakoontz@iupui.edu)

PURPOSE: We report the development, implementation, and assessment of a new “Case of the Day” (COTD) educational initiative utilizing email, Social Media (SoMe), and website for disseminating content, including viewership data for the first year of implementation.

METHOD AND MATERIALS: Utilizing an image-rich format, a new unknown case was internally disseminated to all radiology attendings and trainees at our institution by email twice per week, including clinical history, salient images, and follow-up questions. Simultaneously, content was externally disseminated on Twitter and a publicly-view-

* Faculty financial disclosures are located in the Faculty Index.

able website. On subsequent days, the answer was posted via email, Tweet, and website in the form of a brief YouTube video lecture. Viewership data was collected over the first 12 months (July 1, 2016–June 30, 2017). Additionally, radiology attendings and trainees completed an anonymous survey regarding utilization and utility of the new educational tool. Summary statistics were performed.

RESULTS: 70 new COTDs were created, 65 of which had complete viewership data and were included in our analysis. There were 4,911 “case” email views (mean = 76), 3,798 “answer” email views (mean = 58), 68,034 “case” Twitter views (mean = 1,047), 75,724 “answer” Twitter views (mean = 1,164), 5,465 “case” Twitter engagements (mean = 84), and 5,307 “answer” Twitter engagements (mean = 82). COTD YouTube video lectures garnered 3,657 views (mean = 61) amounting to 10,358 minutes of total viewing time. The survey was sent to 192 radiologists at our institution with a 35% response rate ($n = 67$). There was a similar distribution in responses between trainees (57%, $n = 38$) and attendings (43%, $n = 29$). Internally, email was the most popular method of participation (87%, $n = 58$), followed by YouTube (43%, $n = 29$) and Twitter (28%, $n = 19$). 96% ($n = 63$) rated the content as “good” or “excellent” with 84% ($n = 55$) reporting difficulty of material as appropriate.

CONCLUSION: Email and SoMe can serve as effective tools for disseminating radiology education. SoMe offers the benefits of substantial external visibility, networking with educators at other institutions, and archiving of educational content in perpetuity.

(SS04-07) 2:00–2:10 PM

Patient-Centered and Specialty-Specific Case Work-Up: An Effective Method for Medical Student Education and for Teaching Appropriateness of Imaging

Mike Sheng, *University of Pennsylvania Health Systems, Philadelphia, PA*; Eleanor Gillis, MS; Sean H. Novak, MD, BS; Preya Shah, MS; Sharyn I. Katz, MD; Arun C. Nachiappan, MD

PURPOSE: Third and fourth year medical students currently learn in a passive manner on most radiology electives. This study implements active learning through assignment of cases tailored to students’ future career specialties to assess improvement in knowledge of imaging appropriateness and attitude toward radiology.

METHOD AND MATERIALS: This IRB-exempt project was conducted during three month-long radiology electives held from April to June 2017. Prior to the start of each elective, a pre-course survey about attitudes towards radiology and knowledge of imaging appropriateness was sent to the enrolled medical students. The students were then separated into groups based on their future specialty. Recent patient cases with imaging findings relevant to different specialties were identified and assigned to the student groups. The students researched and presented these customized patient cases by integrating pertinent clinical and imaging findings. A post-course survey was then distributed to the enrolled students at the end of the elective. All data was collected using our institution’s REDCap software (Vanderbilt University, Nashville, TN).

RESULTS: 33/36 (92%) and 31/36 (86%) medical students completed the pre- and post-survey, respectively. The students reported improved knowledge and attitude in responses to several 5-point Likert-type questions between the pre- and post-surveys (with 5 being strongly agree), such as how to better utilize radiologists in the future (3.6 vs 4.3, $p < 0.001$) and how to give pertinent history when requesting an exam (3.2 vs 4.5, $p < 0.001$). Students reported that working up patient cases pertaining to their future specialty would be helpful (4.5), and researching the patients’ clinical history made them more invested in the case (4.7). Lastly, students reported improved confidence in knowledge of imaging appropriateness such as indications for intravenous contrast (3.0 vs 4.2, $p < 0.001$) and for oral contrast (3.0 vs 4.2, $p < 0.001$).

CONCLUSION: Assigning customized patient cases to medical students on radiology electives, tailored to their future specialties, is an effective and engaging way of teaching radiology and imaging appropriateness through active learning.

(SS04-08) 2:10–2:20 PM

Comparison of Assessment of Medical Student Knowledge Following a Radiology Rotation by Radiology ExamWeb and Institutionally-created Final Examinations: Are the Exams Comparable and Does a Subspecialty Rotation Make a Difference in Performance?

Sarah M. Desoky, MD, *University of Arizona College of Medicine, Tucson, AZ*; Veronica Arteaga; Srinivasan Vedantham, PhD*; Mihra S. Taljanovic, MD

PURPOSE: An institutional final exam was created by the course directors of the medical student radiology rotation, who sought to validate the exam by comparing student performance to that on a similar length final exam, created by the Association of University Radiologists Alliance of Medical Student Educators in Radiology, which has been taken 3,800+ times by students nationwide. An additional goal was to see if performance in subspecialties was correlated with having a rotation in that subspecialty.

METHOD AND MATERIALS: A total of 30 medical students undertook both final exams (referred to as “internal” and “external” exams) between January and September, 2017. All students had radiology rotations for 3 or 4 weeks in 1 or more subspecialties. The overall scores on both exams, and the association between the subspecialties in which the students rotated and the proportion of questions answered correctly in the corresponding subspecialty were analyzed (SAS v9.4, Cary, NC). Effects associated with $p < 0.05$ were considered statistically significant.

RESULTS: The mean score \pm standard deviation on the external exam for students nationwide is 75 ± 8.6 and for students at our institution is 68 ± 9.7 . The difference in external and internal exam overall scores satisfied the normality assumption ($p = 0.543$, Shapiro-Wilk) with overall scores for our students on the internal exam significantly higher (mean \pm SD: 5.7 ± 7.5 , $p = 0.0003$, paired t-test). For both exams, the proportion of questions answered correctly in cardiothoracic and neuroradiology were positively correlated with rotations in the corresponding subspecialty ($p < 0.019$, Spearman rho), and for the internal exam, positive correlation was also observed for a musculoskeletal radiology rotation ($p = 0.022$).

CONCLUSION: Assessment by the external exam is superior in discriminating medical student knowledge following a radiology rotation to the institutionally created exam in which students performed statistically better. Students who rotated in cardiothoracic and neuroradiology performed better in both subspecialties on both exams, and medical student knowledge may be increased by making these core imaging rotations mandatory.

(SS04-09) 2:20–2:30 PM

Teaching Appropriate Imaging Utilization to Non-Radiology Specialties: One Institution's Experience

Kaley J. Pippin, MD, *University of Kansas Medical Center, Kansas City, KS*; Jacqueline Hill, MPH; Carissa Walter, MPH; Kevin Denton, MD; Shelby J. Fishback, MD (*kpippin@kumc.edu*)

PURPOSE: Diagnostic imaging utilization has increased over the past four decades. Technological advances and new imaging protocols have also increased exam ordering options for referring physicians. Together, these factors have led to frequent errors in radiology exam orders. The purpose of this project was to educate referring physicians about appropriate radiology exam ordering.

METHOD AND MATERIALS: Three 45-minute lectures were given during resident didactic conferences to Emergency Medicine (EM), Family Medicine (FM), and Internal Medicine (IM) specialties at our institution. The lecture described risks of ionizing radiation in medical imaging and importance of limiting exposure. The lecturer also demonstrated how to use the ACR Appropriateness Criteria® website and provided resources for patient education. Attendees were given badge cards that included reading room extensions and pager numbers,

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websites for ACR Appropriateness Criteria® and patient resources, and the pre-medication regimen for patients with contrast allergies. After the lecture, attendees completed brief surveys to assess usefulness of the lecture and resources.

RESULTS: Eighty-two surveys were completed (IM: n=38, 46.3%; EM: n=28, 34.2%; FM: n=16, 19.5%). Respondents were residents (n=56; 68.3%), medical students (n=21; 25.6%), and staff (n=5; 6.1%). Eighty-one (98.8%) found the presentation and resources “very” or “somewhat” helpful. Seventy-seven (93.9%) reported their understanding of radiation from imaging was “greatly” or “somewhat” improved. When asked which resource was most helpful, 61 reported “ACR Appropriateness Criteria® website,” 39 reported “lecture,” 37 reported “badge card,” and 7 reported “patient information website.”

CONCLUSION: Overall, ordering physicians found the brief educational session and resources helpful in understanding ionizing radiation and guiding clinical decisions for ordering radiology exams. Of all resources provided, respondents found the ACR Appropriateness Criteria® website most helpful. However, our study suggests a combination of educational resources may provide a more comprehensive approach to physician education.

Wednesday, May 9, 2018
1:00–2:30 PM

SS05: Resident Education

Location: International Ballroom I

Moderators: Jessica B. Robbins, MD
Carol P. Geer, MD

LM

(SS05-01) 1:00–1:10 PM

Required Attendance at Resident Noon Conference: Is it Justified?

Nathaniel B. Meyer, MD, *University of Michigan, Ann Arbor, MI*; Kara D. Gaetke-Udager, MD; Kimberly L. Shampain, MD; Amy E. Spencer; Richard H. Cohan, MD; Matthew S. Davenport, MD* (*nbmeyer@med.umich.edu*)

PURPOSE: To determine whether noon conference attendance by diagnostic radiology residents is predictive of measurable performance.

METHOD AND MATERIALS: All diagnostic radiology residents who began residency training from 2008–2012 were included (n=54). Metrics of clinical performance and knowledge were collected, including: junior and senior pre-call test results; American Board of Radiology (ABR) scores (z-score transformed); American College of Radiology (ACR) in-service scores (years 1–3); on-call “great call” and minor and major discrepancy rates; on-call and daytime case volumes; and training rotation scores. Multivariate regression models were constructed to determine if conference attendance, match rank order, or starting year could predict these outcomes. Pearson’s bivariate correlations were calculated.

RESULTS: Senior pre-call test results were moderately correlated with ABR (r=0.41) and ACR (r=0.38–0.48) test results, and mean rotation scores (r=0.41), indicating moderate internal validity. However, conference attendance, match rank order, and year of training did not correlate with (r=-0.16–0.16) or predict (p>0.05) measurable resident knowledge. On multivariate analysis, neither match rank order (p=0.14–0.96) nor conference attendance (p=0.10–0.88) predicted measurable clinical efficiency or accuracy. Year-starting-training predicted greater cross-sectional case volume (p<0.0001, β =0.361–0.516) and less faculty-to-resident feedback (p<0.0001, β =[-0.628]–[-0.733]).

CONCLUSION: Residents with lower conference attendance are indistinguishable from those who attend more frequently in a wide range of clinical and knowledge-based performance assessments, suggesting required attendance may not be necessary to gain certain core competencies. Rising clinical volumes can threaten the feedback faculty provide to on-call residents.

* Faculty financial disclosures are located in the Faculty Index.

(SS05-02) 1:10–1:20 PM

Data About Practice Habits: Adopting the ACGME Resident Survey’s Red-Headed Stepchild

Sheryl G. Jordan, MD, *University of North Carolina School of Medicine, Chapel Hill, NC*; David M. Mauro, MD; Robert G. Dixon, MD (*Sheryl_L_jordan@med.unc.edu*)

PURPOSE: Posing high stakes for residency programs, the ACGME Resident Survey contains questions every program director best understand. Despite the fact that the survey Educational Content category’s question reported as ‘provided data educational content parameter,’ consistently receives the lowest % National Compliant score relative to peer questions, ranking 41st out of 41, there is little to no published guidance to define this parameter. This report details our residency’s adoption of a successful practice habits strategy.

METHOD AND MATERIALS: IRB-exempted, the study collates post NAS ACGME Resident Surveys and available publications, describes our definition of the practice habit data educational content parameter, and assesses scores pre- and post-intervention of curricular change. During year 1, the intervention consisted of implementation of a NAS Milestone health care economics curriculum, wRVU and revenue cycle management being two components that overlap w/ practice habits. A national imaging expert lectured on national practice trends. During year 2 following collation of available practice habits question resources (limited), we defined practice habit data as metrics reflecting true trainee workload to allow comparison across programs, incl ACGME case logs, analysis of resident billing data. Intervention then entailed update/repeat of the health care economics module and discussion of resident case logs, billing platform data, and national imaging practice trends. Formal and informal ‘practice patterns data’ didactic sessions were given.

RESULTS: Pre-intervention results indicate low % compliance. Post-intervention data show significant improvement. Figure 1. We anticipate additional improvement in the 2018 survey practice data scores based on robust nature of open discussion during resident conference coupled with the broad use of audience response in year 3 thus far.

CONCLUSION: Adoption of a streamlined yet effective ACGME practice habits strategy yielded significant improvement in the annual resident survey scores in two years. We detail specifics for the curriculum that readily translate to programs of all sizes and economic environments. We anticipate 2018 survey scores will increase further.

(SS05-03) 1:20–1:30 PM

Resident Case Volume Correlates with Clinical Performance

Vikas Agarwal, MD, *University of Pittsburgh Medical Center, Pittsburgh, PA*; Gregory M. Bump, MD; Matthew T. Heller, MD*; Ling-Wan Chen; Barton F. Branstetter IV, MD; Nikhil Amesur, MD (*agarwalv@upmc.edu*)

PURPOSE: The objective of our study is to determine whether total volume of studies interpreted during residency training predicts success as defined by objective clinical performance data.

METHOD AND MATERIALS: We performed a retrospective cohort study of residents who entered our residency program through the NRMP as PGY-2 residents and completed the program over the past three years. The total volume of studies interpreted by each resident over the course of their residency was determined by searching the radiology information system (RIS) for the volume of cases they staffed and dictated with an attending radiologist as well as for cases which they rendered a preliminary report while on call. Performance during radiology residency was determined by calculating each resident’s cumulative discordance rate for on-call cases. This was done using the preliminary report generator in our PACS which has a system to adjudicate for the presence of substantial discordances defined as a difference between the preliminary resident and final attending interpretations that could immediately impact the care of the patient. A Pearson’s correlation coefficient was calculated to determine if a relationship between these two variables exists.

RESULTS: Thirty seven residents met inclusion criteria and interpreted on average 12,709 studies over the course of their four year radiology residency (range 8,898-19,818). The mean discordance rate was 1.1% (range 0.52%-2.54%). A Pearson's correlation coefficient of -0.4 was calculated consistent with a moderate negative correlation. In other words, as the volume of cases the resident read increased, this correlated with a better clinical performance as defined by a lower overall discordance rate.

CONCLUSION: Our goal as clinician educators is to maximize resident education and ultimately resident clinical performance. Resident education is a complex mixture of instruction, self-study, and clinical exposure. A critical component of resident education is the volume of clinical cases residents read during the course of their training. Higher overall resident volumes correlates with better overall clinical performance as reflected by lower on call discordance rates.

(SS05-04) 1:30-1:40 PM A Women in Radiology Group Fosters Career Development for Faculty and Trainees

Amber Liles, MD, MPH, *University of Michigan, Ann Arbor, MI*; Kara D. Gaetke-Udager, MD; Ursula Knoepp, MD; Katherine E. Maturen, MD; Jessica R. Leschied, MBBCh (*aliles@med.umich.edu*)

PURPOSE: To evaluate the outcomes of a Women in Radiology (WIR) group during the six years of its existence, including members' satisfaction, activities, and differences based on seniority.

METHOD AND MATERIALS: An anonymous questionnaire was distributed to group members, including female trainees and faculty. Survey questions were related to the usefulness of the sessions, mentoring, professional opportunities, and camaraderie. Comparisons were made based on training status and seniority. Continuous variables were compared using mean, t-tests, and correlations, while categorical variables were compared using counts, percentages, and Chi-squared tests or Mantel-Haenszel tests.

RESULTS: Sixty-one women, including both trainees and faculty, were sent surveys. The response rate was 49% (38% of trainees and 53% of faculty). Overall satisfaction score for WIR sessions was high (summary score 1.42 ± 0.37 , "1" being "very satisfied," "5" being "very unsatisfied"). Trainees and junior faculty were more likely than senior faculty to report expanded networking opportunities (94% vs 69%, $p=0.07$), gaining a mentor (67% vs. 8%, $p=0.001$), and increased research involvement (33% vs. 0%, $p=0.02$) after participation in the WIR group. Both groups were equally likely to have become mentors. Almost all respondents (93%) reported increased camaraderie among women in the department.

CONCLUSION: A WIR group can provide career development tools for its members. In this study, trainees and junior faculty reported increased networking and research involvement as well as gaining a mentor but were equally as likely as senior faculty to have become mentors after participation in the WIR group. Most members reported increased camaraderie among women in the department. A WIR group may help to accelerate professional development among trainees/junior faculty, thereby contributing to a more diverse and enabled workforce.

(SS05-05) 1:40-1:50 PM Female Researchers Are Better Collaborators: A 5-Year Review of Publications in Major Radiology Journals

James C. Campbell, BA, *Duke University School of Medicine, Durham, NC*; Sora C. Yoon, MD; Lars J. Grimm, MD* (*james.c.campbell@duke.edu*)

PURPOSE: Women are underrepresented in radiology, but the implications of this are poorly understood. Social sciences literature has shown that an increased proportion of women in a group is associated with improved team intelligence and collaboration. Therefore, the purpose of this study was to determine if publications in major radiology journals with female senior authors were more collaborative.

METHOD AND MATERIALS: After an IRB exemption, we reviewed all original research articles authored by U.S. senior investigators in *Radiology*, *American Journal of Roentgenology (AJR)*, and *Academic Radiology* from 2011 through 2015. For each manuscript, the gender of the first and last author was recorded. Proxy measures of collaboration were recorded, including the total number of authors, number of female authors, number of departments and number of institutions for each manuscript. Variables were tested against the gender of the senior author on univariate analysis, and those significant ($p<0.05$) were included in a multiple logistic regression analysis to control for confounders.

RESULTS: 1,934 articles were included in the analysis: 552 (28.5%) from *Radiology*, 889 (46.0%) from *AJR*, and 493 (25.5%) from *Academic Radiology*. 30.2% (585/1934) of articles had a female first author and 24.4% (473/1934) of articles had a female last author. The per article average number of authors was 6.0 ± 2.8 , female authors was 1.7 ± 1.7 , departments was 3.1 ± 2.2 and institutions was 2.0 ± 1.7 . There was no association between last author gender and total number of authors ($p=0.17$). On multiple logistic regression, a female last author was associated with a higher percentage of female first authors (44% vs 26%, $p=0.001$), greater total number of female authors (3.1 vs 1.2, $p<0.001$), more collaborating departments (3.5 vs 3.0 $p<0.001$), and more collaborating institutions (2.3 vs 1.9, $p=0.006$).

CONCLUSION: Research articles with a female senior author were more likely to have a female first author, more female authors, and more affiliated departments and institutions. This suggests that female senior authors engage in more collaborative research, which has been associated with improved innovation, knowledge creation, and team building.

(SS05-06) 1:50-2:00 PM The Vital Role of a Book Club in Radiology Residency Training

Thomas Reher, MD, *Indiana University Department of Radiology, Indianapolis, IN*; Rada G. Osman, MD; Jared Shields, MD; Jesse Mer, MD; Nathan Albertson, MD; Brandon P. Brown, MD, MA; et al (*tareher@iupui.edu*)

PURPOSE: The purpose of this presentation is to describe the function of a resident book club at our institution and discuss data regarding its potential benefit.

METHOD AND MATERIALS: The goal of the Resident Book Club at our institution is to encourage residents to engage their humanity and rekindle their passion for helping others through medicine. The book club began in the 2016-2017 academic year, meeting every month for two-hour discussions after work. The group generally meets at local restaurants and pubs, or on campus for convenience. It is led by a faculty moderator. Book selections are chosen by the residents with some guidance from the faculty moderator. The primary objective in book selection is to choose works that highlight what it means to be human and to care for others. During discussion, participants search for implications in their work as radiologists. Books read to date include: *The Death of Ivan Ilyich*, *The Emperor of All Maladies*, *The Abolition of Man*, *Gratitude*, *We Make A Life By What We Give*, and selections from the Torah, Quran, and Bible. Group discussion is organic and primarily resident-led. A short survey of the Resident Book Club was conducted among members to better understand its strengths and potential areas of improvement.

RESULTS: Results of our book club survey show overwhelming support for the group as a vital means to explore important areas of medicine that are not traditionally covered in radiology residency: human weakness, suffering, caring for others, and how we might become better doctors by applying these concepts to our daily practices. Residents felt very satisfied with the book club experience in helping them to become better doctors and human beings. Residents were very satisfied with the book selections, the process of choosing books, and the open, unstructured discussion format. Comments were made that the group should try to expand to include more medical students and faculty.

* Faculty financial disclosures are located in the Faculty Index.

CONCLUSION: The Resident Book Club at our institution has been shown to fill an important gap in residency training not found in most curricula: it reminds us what it means to be human and why it's an honor to care for others. The format could be easily adopted at other institutions.

(SS05-07) 2:00–2:10 PM

Assessing the Impact of an Orientation Week on Acclimation to Radiology Residency

Vinay Prabhu, MD, *New York University School of Medicine, New York, NY*; Joanne Rispoli, MD; Chloe M. Chhor, MD; Cecilia L. Mercado, MD; Nancy R. Fefferman, MD (*vinay.prabhu@nyumc.org*)

PURPOSE: Acclimating new residents to radiology residency requires special attention to new responsibilities, educational material, and social adjustment. To assist in this process, we instituted a structured orientation week for incoming residents and assessed its impact.

METHOD AND MATERIALS: Over the first five weekdays of July 2016 and 2017, first year residents attended orientation days free of clinical duties consisting of didactic lectures, hands-on training and simulation workshops, and social events. After completion of two cycles of orientation weeks, "junior residents" (first/second year residents who completed orientation week) and "senior residents" (third/fourth year residents who had not completed an orientation week) were given a voluntary, anonymous survey using Likert scale questions (1 [worst] to 5 [best]) regarding preparedness for new responsibilities, educational material, and social adjustment. Residents were asked which components were or would have been most helpful. Mann-Whitney U tests (two-tailed $p < 0.05$) were performed to evaluate differences between junior and senior residents.

RESULTS: 26/37 (70%) residents participated (15 junior, 11 senior). When asked about their experience during the first months of training, junior residents felt significantly more prepared for rotations ($p=0.04$) and learning new material ($p=0.02$) than senior residents. Perceived class cohesiveness amongst junior residents was greater than for senior residents and nearly significant ($p=0.07$). When asked if orientation week helped or would have helped preparing for new responsibilities, learning new material, and social cohesiveness, 12/15 (80%), 12/15 (80%), and 15/15 (100%) of junior residents and 8/11 (73%), 7/11 (64%), and 8/11 (73%) senior residents answered ≥ 4 , respectively. Individual orientation components receiving most votes of ≥ 4 in order were: social outings, resident lunches, and PACS training amongst junior residents and didactic lectures, PACS training, ultrasound workshop, and social outings amongst senior residents.

CONCLUSION: A weeklong orientation program free of clinical duties was valued by residents and contributed to resident acclimation to new responsibilities, education, and social adjustment.

(SS05-08) 2:10–2:20 PM

Reassessing AIRP: Does It Still Have a Role in Today's Crowded Resident Curriculum?

Aiza Ashraf, MD, *Indiana University, Indianapolis, IN*; William Scales, MD; Matthew Snyder, MD; Jacob Mitchell, MD; Darel E. Heitkamp, MD; Nicholas A. Koontz, MD (*nakoontz@iupui.edu*)

PURPOSE: This presentation is designed to share our institution's needs assessment of a radiological-pathological curriculum in diagnostic radiology residency training.

METHOD AND MATERIALS: A systematic review of department trainee lectures and conferences revealed no substantial organized content in rad-path education. A 13-question web-based survey was then issued to the 6 most recently graduated classes of residents at our institution, as well as to the current 4th year residents, all of whom attended AIRP. 51 of the 105 residents/alumni responded to the survey. Questions were designed to elicit their perceptions regarding the overall educational quality of the rad-path course, its utility in preparing residents for the remainder of training and for independent practice, its utility in preparing residents for the board exams, and its utility in providing

networking opportunities. Participants were asked questions about the overall value of the course and whether the program should continue sending residents. Other questions inquired about the AIRP stipend provided by the department and whether it was adequate to cover expenses related to attendance. Results were analyzed and presented to the department's academic council for discussion.

RESULTS: Some notable survey results include: 96% of respondents stated that the educational quality of AIRP was either good or excellent. 78% stated that it helped them for their board exams. 90% stated that it helped them for the remainder of training. 67% stated that it helped them for independent practice. 67% stated that it helped them network with others outside of our institution. 88% stated that our department should continue to subsidize resident attendance at the AIRP. Overall, residents felt that the department stipend was adequate to cover travel and living expenses. Many free-form comments highlighted the importance that residents felt AIRP played in their education.

CONCLUSION: AIRP remains an indispensable component of radiology training at our institution, fulfilling an important requirement for radiology-pathology education. Our current level of resident funding is sufficient.

(SS05-09) 2:20–2:30 PM

Residency Mini-fellowships: Is There Added Value?

Anuradha Shenoy-Bhangle, MD, *Beth Israel Deaconess Medical Center, Lexington, MA*; Priscilla J. Slanetz, MD, MPH; Ronald L. Eisenberg, MD, JD

PURPOSE: With the restructuring of radiology board certification, many residencies created PGY-5 "mini-fellowships" during which residents spend focused time pursuing advanced subspecialty training or developing non-clinical skills in leadership, education, quality improvement, informatics, research or global health. We surveyed graduates of an academic diagnostic radiology residency to assess the relative value and impact of these.

METHOD AND MATERIALS: 39 radiology residents at our Institution were offered the opportunity of 3-6 month mini-fellowships during the PGY-5 year. 30/39 (77%) participated whereas 9/39 (23%) opted out. Of 39 residents, 13 completed two clinical mini-fellowships, 3 completed research mini-fellowships only, and 14 completed one non-clinical and one clinical mini-fellowship. Via survey monkey, 23/39 (59%) responded to a questionnaire about the value of this experience as it relates to fellowship choice and career using a 5-point Likert scale.

RESULTS: Of 23 respondents (14 male, 8 female, 1 not specified), 78.3% practice in an academic – university based practice with 8.7% community based hospital practice, 4.3% veterans system, and 4.3% private practice. The most popular clinical mini-fellowships were MRI (31.6%), neuroradiology (21.1%), and interventional radiology (15.8%) and research (10.5%), education (10.5%), global health (5.3%), and health policy/economics (5.3%). Of the 20 respondents who did mini-fellowships, 95% felt that it prepared them well for their career, 85% felt it gave them the necessary skills to succeed, 85% cited that it gave them additional skills beyond their peers, and 40% felt it helped them create a life-long connection to a mentor. 95% would choose to do the mini-fellowship again. Suggestions were to increase the duration and to develop a more structured curriculum. Only one respondent felt that the non-clinical mini-fellowship took away time from furthering clinical skills.

CONCLUSION: Graduates who participated in clinical and non-clinical mini-fellowships during the PGY-5 year greatly value this experience and recommended that the program continue to be offered.

* Faculty financial disclosures are located in the Faculty Index.

Wednesday, May 9, 2018
1:00–2:30 PM

SS06: RAHSR Session

Location: Allendale B

**Moderators: Hediyyeh Baradaran, MD
Jana Ivanidze, MD, PhD**



(SS06-01) 1:00–1:10 PM

Are There Gender Differences on Article Citations by American Authors in Major Radiology Journals?

Derek Kim, *Stony Brook University, Port Jefferson, NY*; Mingqian Huang, MD; Zi Zhang, MD; Ana Franceschi; Mark E. Schweitzer, MD* (derek.kim@stonybrookmedicine.edu)

PURPOSE: To investigate gender differences in citations of radiology articles.

METHOD AND MATERIALS: Via retrospective bibliometric analysis, articles by first or last authors associated with American institutions in Radiology, *EJR*, *JCAT*, and *AJR* from selected years (1984, 1994, 2004, 2014) over 3 decades were categorized into 12 radiologic subspecialties. The number of citations, references, co-authors, and pages were documented, and genders of the first and last authors were determined. Data were analyzed using chi-square test and logistic regression.

RESULTS: The genders of first authors were determined of 2679 articles and that of last authors of 2717 articles. From 1984 to 2014, female first authorship grew from 13.0% to 31.5% ($p < 0.001$), and female last authorship grew from 9.3% to 22.1% ($p < 0.001$). The proportion of female first and last authorship was highest in breast (48.3% and 40.1%), and lowest in technical development (5.5%) for first author and vascular and interventional (9.1%) for last author. Articles by female first authors were cited less than male first authors (OR 0.9972, 95% CI: 0.9948–0.9996, $p = 0.021$), even after adjusting for publication year and subspecialty. Across most specialties, female first authors received less citations than men except for cardiac and genitourinary. In 1984, articles by female first authors received on average 28.7 citations vs. males at 39.2; in 1994, 50.9 vs. 60.4; in 2004, 41.8 vs. 43.7; and in 2014, 7.0 vs. 7.8. The mean difference of citation between female and male first authors decreased from 10.47 ± 6.09 in 1984 and 9.49 ± 7.12 in 1994 to 1.93 ± 5.63 in 2004 and 0.79 ± 0.39 in 2014. However, there was no difference demonstrated in article citations between male and female last authors (OR 0.9990, 95% CI: 0.9966–1.0013, $p = 0.392$). There was no significant difference in number of references ($p = 0.25$), number of pages ($p = 0.91$), or number of authors per article ($p = 0.81$).

CONCLUSION: Female first author garnished less citations compared to male despite increasing numbers of female authorships from 1984 to 2014, but there was no difference demonstrated between female and male last author citation numbers. Women were under-represented in all specialties but least so in breast.

(SS06-02) 1:10–1:20 PM

Tracking Doses for Multi-region CT: Challenges and Limitations

Rachel Vining, *Massachusetts General Hospital, Boston, MA*; Atul Padole, MD; Shivam Rastogi; Kalpana M. Kanal, PhD; Subba Digumarthy; Manudeep Kalra* (apadole@mgh.harvard.edu)

PURPOSE: To assess the challenges and limitations associated with radiation dose tracking (RDT) for multi-region CT examinations.

METHOD AND MATERIALS: The quality assessment/improvement project was exempted from IRB approval. We assessed CT examinations belonging to 560 adult patients (>18 years) performed in quaternary hospital on 4 MDCT scanners from 3 vendors (GE, Siemens, Philips) between March and August 2017. CTDIvol and DLP for exam series were recorded from the dose information page in the PACS for consecutive 150 chest CT only, 150 abdomen CT only and 260 com-

binated chest-abdomen CTs (110 single-run acquisition over chest and abdomen and 150 split-series CT with separate series for chest and abdomen). Subsequently, CTDIvol and DLP for each series of all 560 CT were recorded using a commercial RDT software (Radimetrics, Bayer). RDT dose descriptors were matched against ACR DIR. Inaccuracies represented incorrect assignment of doses for chest/abdomen regions and inadequacies were lack of separation of doses into individual body regions. Descriptive sub-stratified statistical analyses were performed to determine the accuracy, inaccuracies and inadequacies of the RDT exams for each CT vendor and exam type.

RESULTS: RDT was accurate in capturing correct doses for single region CT examinations regardless of scanner type (94–100%). For split-series combined CT, there was 0–5% inaccuracy in assigning correct doses to chest and abdomen regions for two vendors (GE, Siemens) and 100% inaccuracy for the third vendor (Philips). RDT did not assign separate doses to chest or abdomen when combined examinations were performed as a single run acquisition (100% inadequacy) regardless of the vendor and protocol type (for both vascular or non-vascular indications). There was no difference between the dose related information in the RDT software and the ACR DIR.

CONCLUSION: Vendor and acquisition related inaccuracies and inadequacies for assigning doses to different body regions for combined multi-region CT examinations can lead to erroneous dose tracking, benchmarking and outliers. Unfortunately, a majority of CT examinations for trauma, oncologic and vascular workup involve scanning over multiple body regions.

RAHSR Harvey L. Neiman Award

(SS06-03) 1:20–1:30 PM

Gender Bias in Human Subjects Radiology Research

Patricia Balthazar, MD, *Emory University School of Medicine, Atlanta, GA*; Richard Duszak, Jr, MD; Aryan Jalilvand; Brianna L. Vey; Thomas Mulvey; Courtney C. Moreno, MD*

PURPOSE: To study the presence and extent of gender bias in radiology human subjects research.

METHOD AND MATERIALS: All articles published in the 7 most cited general radiology journals (Radiology, Investigative Radiology, European Radiology, Journal of the American College of Radiology, American Journal of Roentgenology, European Journal of Radiology, Clinical Radiology) from 01/2016–03/2016 were reviewed. Articles evaluating a gender-specific body part (e.g. breast cancer, prostate cancer) were excluded. All other articles studying human subjects were individually reviewed to extract the number and gender of participants, and whether any gender-based results were reported. We calculated the percentage of gender matching for subjects by dividing the lesser sampled gender (male or female) by the greater sampled gender for each paper (e.g., a study of 50 males and 50 females would have a 100% gender match, while one of 25 males and 50 females would have a 50% gender match). Distribution was calculated by quartile.

RESULTS: Of all 448 articles, 222 articles met inclusion criteria. Of these, 16 (0.7%) made no mention at all of research subjects' gender. Of the 206 articles mentioning subjects' gender, 137 (66.5%) had more females; 65 (31.6%) had more males; and 4 (1.9%) were equally distributed. Four articles included only male subjects; 3 included only females. Fewer than one third (61/199 [30.6%]) of articles including both genders reported any gender-based results. In aggregate, 30,298/59,070 (51.3%) of subjects were male; 28,772/59,070 (48.7%) were female. By quartile distribution, subject gender matching was very variable (15.5% of articles with <25% match, 20.9% with 25–50% match, 30.1% with 50–75% match, and 33.5% with $\geq 75\%$ match).

CONCLUSION: The gender of human subjects is a poorly-controlled, and sometimes completely neglected, variable in radiology research. Better implicit bias and study design training may help minimize ongoing gender bias and improve the quality of radiology human subjects research.

* Faculty financial disclosures are located in the Faculty Index.

(SS06-04) 1:30–1:40 PM Best Practices for Radiological Imaging Communication: A Multi-Institutional Survey

Isabel Yin, *University of Chicago Medicine, Chicago, IL*; Christopher M. Straus, MD*; Andrew W. Phillips, BA (*iyin@uchicago.edu*)

PURPOSE: To reveal best practices for the communication of radiological imaging, specifically addressing multi-part CT scan results.

METHOD AND MATERIALS: A Likert item survey was administered to Emergency Medicine, inpatient and outpatient Internal Medicine, Surgery, and Radiology physicians at an urban, quaternary care academic center and an affiliated community hospital after evaluation of validity evidence. The survey explored three domains: single vs multiple specialist-specific radiologist reads for multi-part CT scans, final report characteristics, and report reading practices of nonradiology specialists. Spearman's correlation coefficient, point-biserial correlation, one-way ANOVA, and Tukey HSD were used to analyze the data.

RESULTS: 215 of 398 surveys (58%) were returned, similarly observed across all specialties at both sites. Both radiology and nonradiology specialties reported a slight overall positive impact with a single radiologist reading chest/abdomen/pelvis CT scans compared to individual subspecialty reads, mean(SD), 2.55(1.08) (radiology) and 2.36(0.98) (nonradiology), $p > .05$, (Likert 1=significantly positive, 5=significantly negative). The positive impact did not differ significantly by specialty ($F(3,169)=.798$). Radiologists perceive unnecessarily duplicated information in both CT and XR imaging more often than nonradiology specialists (CT, mean(SD), 3.04(0.934) vs. 2.74(0.896), $p=.053$; XR 3.36(0.938) vs 2.79(0.944); 1=always and 5=never). However, nonradiology specialists generally reported that duplicate information did not deter them from reading both Findings and Impressions sections. Nonradiology specialists view XR images significantly more frequently than multi-part CT images, 85.6% vs. 69.0%, $p < .001$, and XR image viewing practices varied with years in practice $r=.197$, $p=.017$. The most important characteristics of reports, according to nonradiology specialists, were avoiding ambiguity and rapid final reports.

CONCLUSION: The trend of referring physicians favoring a single report and radiologist for multi-part CT scans reconfirms the importance of a rapid, clear, and cohesive image interpretation, despite the growing trend of radiology subspecialization.

(SS06-05) 1:40–1:50 PM Utilizing Lean Six Sigma Methodologies to Identify Gaps in Emergent Stroke Evaluations

Benjamin Sawatzky, MD, *University of Wisconsin School of Medicine and Public Health, Madison, WI*; Tabassum A. Kennedy, MD; John-Paul J. Yu, MD, PhD (*jpyu@uwhealth.org*)

PURPOSE: To utilize Lean Six Sigma Methodologies to identify targets for process improvement related to emergent stroke evaluations from the emergency department.

METHOD AND MATERIALS: Consecutive paging data for emergent stroke evaluations (ESEs) over a 22-month period (1/1/2015–10/31/2016) were reviewed; 719 sentinel ESEs receiving initial evaluation in our emergency department with concurrent neuroimaging were identified. The timestamp of each of these ESEs was recorded and analyzed for this study. Hourly frequency data were tabulated and odds ratios (OR) were calculated with data subdivided into 1-hour time periods. The period of fewest initiated ESEs (0200 – 0300 hours) serves as a baseline for all subsequent statistical calculations. A complex polynomial best-fit (assuming a Poisson distribution) was then calculated. Ensuing Lean Six Sigma methodologies were applied based on the DMAIC (Define, Measure, Analyze, Improve, Control) paradigm. Process mapping was also used to identify targets for improvement.

RESULTS: Time and frequency data from identified ESEs were fitted to a complex polynomial best-fit curve. At the 1400 hour time point, we observed an unexpected marked decrease in ESEs at this hour (expected value, 54.6 ESEs; observed value 41; OR, 3.4%). Lean methodologies and

process mapping determined that a nursing shift change coincided with the temporarily isolated decrease in emergent stroke evaluations called.

CONCLUSION: Lean Six Sigma is a data driven quality improvement methodology to assist in the identification of gaps or waste in a process that result in a loss of consistently high outcomes. Application of Lean and process mapping methodologies identified a major nursing shift change that may be associated with a significant decrease in ESEs and a potential impact on patient care. Treating stroke patients is a complex task that requires coordination of many team members and processes, and tools such as Lean Six Sigma have the potential to improve patient care and outcomes significantly.

(SS06-06) 1:50–2:00 PM Benefit of a Visual Aid in the Management of Moderate Severity Contrast Reactions

Shayan Rashid, MD, *Yale University School of Medicine, New Haven, CT*; James Gardner; Lawrence H. Staib, PhD; Jay K. Pahade, MD* (*Shayan.rashid@yale.edu*)

PURPOSE: The purpose of this study was to compare management of moderate-severity contrast reactions with versus without a visual aid/flowchart in high fidelity contrast reaction simulations.

METHOD AND MATERIALS: All diagnostic radiology attendings and trainees at the study institution were requested to participate in an annual contrast reaction simulation program, which included a moderate severity reaction scenario. Groups were randomized to having or not having a visual aid. The time to administer intramuscular epinephrine via autoinjector, additional medications administered, and any errors in administration were recorded. After the simulation, all participants were provided the visual aid and completed a survey with Likert-scale questions assessing their comfort in treating contrast reactions with a visual aid versus without.

RESULTS: A total of 138 participants were involved in the contrast simulation program in 21 groups, of which 68 participated in the moderate contrast reaction scenario. 11 groups were provided with a visual aid and 10 groups were not. Errors in management occurred in 18% of the groups with visual aids versus 40% in the groups without ($p=0.35$). Excluding the groups with errors, the average time to appropriate administration of intramuscular epinephrine was 97 seconds with versus 152 seconds without the visual aid ($p=0.04$). There was 1 self-injection (9.1%) in the groups with visual aid versus 4 self-injections (40%) without visual aid ($p=0.14$). Of all 138 participants surveyed, 98% agreed or strongly agreed that the poster would aid in giving correct doses and routes of medication administration reaction management and 87% agreed or strongly agreed that the aid would help decrease the time needed to administer the medications.

CONCLUSION: A visual aid increased the subjective confidence of radiologists in the appropriate dose and routes of medication administration in the setting of a contrast reaction simulation and led to faster administration of intramuscular epinephrine. Self-administration errors with IM epinephrine were seen in both groups.

(SS06-07) 2:00–2:10 PM Readability of Spanish-Language Patient Education Materials from RadiologyInfo.org

Paul H. Yi, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; Eric Huh; Ferdinand K. Hui, MD* (*pyi10@jhmi.edu*)

PURPOSE: The United States currently has the second-largest group of Spanish-speaking citizens in the world with 41 million native Spanish speakers. However, little attention has been paid towards assessing patient comprehension of Spanish-language healthcare educational materials. The purpose of this study was to assess the readability of patient educational materials written in Spanish from the *RadiologyInfo.org* website.

METHOD AND MATERIALS: All patient education articles written in Spanish available in 2017 from the American College of Radiology (ACR) and Radiological Society of North America (RSNA)-sponsored

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RadiologyInfo.org patient education library were reviewed. We assessed each article for readability using 3 quantitative readability scales validated for assessing Spanish written text: Gilliam-Peña-Mountain scale, Läsbarhets formula (LIX) Rate Index formula (RIX), and SOL formula (modified-SMOG). The number of articles with readability \leq the 8th grade level (average reading ability of US adults) and the 6th grade level (NIH-recommended level for patient education materials) were determined.

RESULTS: 131 patient education articles were reviewed. The mean readability grade level was greater than the 11th grade reading level for all readability scales. Only 1 article was written at less than the eighth grade or the sixth grade levels.

CONCLUSION: Spanish-language patient educational materials provided by the ACR and RSNA-sponsored *RadiologyInfo.org* website are written at levels too high for the average patient. These findings are consistent with prior studies assessing radiology-related patient educational materials written in English. Future efforts should be made to improve the readability of these patient education materials for English and Spanish-speakers alike.

(SS06-08) 2:10–2:20 PM

Effects of Team Training In Advanced Communication Skills on Patient Factors Affecting Throughput in Outpatient MRI

Xuan V. Nguyen, MD, PhD, *The Ohio State University Wexner Medical Center, Columbus, OH*; Charles E. Spritzer, MD; Judith Pool, RT(R)(CT); Amna A. Ajam, MD, MBBS; Elvira V. Lang, MD* (*Xuan.Nguyen@osumc.edu*)

PURPOSE: To assess effects of team training in advanced communication techniques on patient throughput in MRI.

METHOD AND MATERIALS: Staff members at 6 MRI sites in a large southeastern university health system were trained in advanced communication techniques, including skills in gaining rapid rapport, diffusing tension, shaping the patients' experience, reframing distressing thoughts, use of calmative language, and guidance in relaxation. A 3-month period prior to training represented the baseline, and a 6-month period after training represented the post-training period. No-shows, use of sedation (general anesthesia, IV or oral), disruptive motion, and incompletions for all outpatient studies were noted on daily logs by staff. Events were compared by two-tailed chi square tests at a significance level of 0.05.

RESULTS: The study included 12,930 patients, 4051 prior to training and 8,879 after training. After training, no-shows decreased significantly from 8.9 to 8.1% ($p < 0.0001$). The frequency of general anesthesia (0.72% pre vs 0.62% post training) and IV sedation (2.54% pre vs 2.21% post training) did not change significantly, but use of oral sedation did decrease significantly from 2.47% to 1.44% ($p < 0.0001$). Instances of disruptive motion or repeat scans decreased significantly from 1.04% to 0.12% ($p < 0.0001$). The frequency of incompletions of scans decreased from 1.28% to 0.30% after training ($p < 0.0001$). Combined rates of scan incompleteness, disruptive motion/repeat scans, and use of sedation decreased from 8.05% to 4.69%.

CONCLUSION: No-show rates and frequency of events that potentially adversely affect throughput in MRI decreased after team training in communication techniques.

(SS06-09) 2:20–2:30 PM

Into the Mind of the Patient: What Do Patients Really Care About?

Amna A. Ajam, MD, MBBS, *Ohio State Medical Center, Columbus, OH*; Xuan V. Nguyen, MD, PhD (*Amna.Ajam@osumc.edu*)

PURPOSE: To identify the factors patients perceive as most important in rating overall quality of care in radiology and recommending the facility to others.

METHOD AND MATERIALS: Individual responses to questions from 69,319 Press-Ganey outpatient services surveys collected following radiology encounters at a single institution over the course of 9 years (2008-2017) were retrospectively reviewed. Each survey included 21 Likert items seeking responses along a 5-point rating scale and included questions on various topics, such as ease of scheduling, efficiency of registration, the waiting area and facility, explanations related to the test or treatment, skill of staff and other staff interactions, privacy concerns, and responsiveness or sensitivity to needs or concerns. Favorable responses for each item were defined as ratings of Good or Very Good. We identified 2 responses in the Overall Assessment subsection of the survey to serve as summary endpoints: (1) patient overall rating of care and (2) likelihood of recommending the facility to others. Logistic regression was performed to determine specific items for which a favorable response most strongly predicts favorable responses for the 2 endpoint items.

RESULTS: The 5 topics that had the greatest impact on predicting favorable responses to "Overall Rating" were response to concerns/complaints, sensitivity to patient needs, waiting time in the testing area, skills of staff, and staff concern for patient comfort ($p < 0.0001$). Likelihood of recommending the facility were most influenced by response to concerns/complaints, sensitivity to patient needs, ease of scheduling, comfort of waiting area, and waiting time in the testing area ($p < 0.0001$).

CONCLUSION: In this large study of 69,319, topics were identified that had greatest impact in predicting patient's favorable perception of overall quality and likelihood of recommending the facility and encompassed multiple domains beyond the actual clinical interaction.

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AUR 2018 Research Poster Abstracts

Research posters are located in National Ballroom D. Each poster will be presented by its author during one of the *AMA PRA Category 1 Credit*[™] poster sessions scheduled for 7:00–8:00 AM, Tuesday (Session 201) and Wednesday (Session 301). The day and time for each poster presentation follow the presentation number. Presenting author is identified by institution name, city, and state (or country if not United States or Canada). Presentations by trainees (medical students, residents, or 1st-year fellows) are noted in **blue**.

Abdominal Radiology

(R-007) Tuesday • 7:00–8:00 AM • Hard-copy poster Maple Water as an Alternative Negative Oral Contrast Agent in MRCP



David S. Sargent, MD, *Dartmouth Hitchcock, Lebanon, NH*; Robert B. Percarpio, MD; Michael J. Tsapakos, MD, PhD (*david.s.sargent@hitchcock.org*)

PURPOSE: Negative oral contrast agents are frequently used for MRCP studies to improve image quality. We investigated the MRI signal characteristics of Maple water, a popular health drink that is high in manganese, compared to currently used oral contrast agents for possible use as an effective alternative agent.

METHOD AND MATERIALS: Phantoms containing equal volumes of Maple water and pineapple juice were imaged by a 3-T MRI using T2-weighted sequences from the MRCP protocol. Pineapple juice is also high in manganese and has been shown to be an effective negative oral contrast agent for MRI in multiple studies. Phantoms of water and Volumen were also imaged as positive contrast comparisons. Signal to noise ratios were evaluated and compared.

RESULTS: Maple Water had equally low signal on T2 imaging compared to pineapple juice and markedly less signal than the water and Volumen positive contrast agents.

CONCLUSION: Maple water has low signal on T2 weighted imaging and may be an effective alternative to other negative contrast agents for use during MRCP studies. This could be beneficial to patients with allergies to other agents or who prefer the flavor of maple water. In addition it is a locally produced, sustainable product that is less expensive than commercially available contrast agents. Further studies with randomized patients will be performed following institutional IRB approval to determine in vivo effectiveness.

(R-008) Wednesday • 7:00–8:00 AM • Hard-copy poster Improving the Quality of CT Reports for Cancer Patients Through Implementation of a Summary Table and Resident-Led Audit Intervention Designed to Ensure Accurate RECIST 1.1 Assessments

Jeffrey B. Levine, MD, *Ochsner Medical Center, New Orleans, LA*; Richard Tramel, MD; Charles Matthews, MD; Dana H. Smetherman, MD, MPH (*jeffrey.levine@ochsner.org*)

PURPOSE: Measurement of solid tumors in oncologic imaging is critical for cancer staging and to assess response to therapy. In January 2017, our radiology department implemented a structured measurement table in the report impression using Response Evaluation Criteria in Solid Tumors (RECIST) 1.1 for reporting of all CT oncology studies at the request of the Oncology Department and Quality Improvement Committee. A key goal when using tumor response criteria is to follow the guidelines closely to reduce the inter-reader variability. In addition, the Oncology Department requested that RECIST criteria be easily identified in the reports in a standardized format. This study tests the effect of education and audit interventions to improve compliance with and accuracy of CT reporting of RECIST 1.1 criteria.

METHOD AND MATERIALS: A quality improvement project was performed using the Plan-Do-Study-Act (PDSA) methodology. CT scan

reports and images were retrospectively audited to document baseline compliance with inclusion of RECIST guidelines. Data collected included reporting of lesion size in the impression section of the exam. Report audits were performed by Radiology residents. When possible, the resident was assigned to audit reports in the month preceding the Body CT rotation. There were 3 separate interventions: 1. Introduction of a standardized reporting template that specified the RECIST criteria (February 2017), 2. Email communication of current compliance to residents and staff radiologists (March 2017), and 3. Didactic lecture to residents and staff (May 2017). Comparison of differences in compliance was performed with a Welch's t-test.

RESULTS: The reports compliant with RECIST criteria increased from 5% (baseline) to 12% following the introduction of a standard report template. There was a significant difference in compliance after email communication of current compliance to resident and staff radiologists, 59% ($p=0.001$) and after a subsequent didactic lecture 81% ($p=0.001$).

CONCLUSION: Performing a combination of educational and audit interventions can improve compliance with RECIST 1.1 reporting CT scans of cancer patients.

Cardiopulmonary Radiology

(R-107) Wednesday • 7:00–7:15 AM • E-poster Station #8 Evaluation of Diagnostic Radiology Involvement on Radiation Treatment Planning Process

Bannet Muhoozi, BS, *University of California San Diego, La Jolla, CA*; Alexander Gottschalk; Sue S. Yom, MD, PhD*; Kimberly G. Kallianos, MD; Travis Henry; Brett Elicker, MD (*bmuhozi@ucsd.edu*)

PURPOSE: To evaluate the impact of dedicated discussions with diagnostic radiologists on the radiation treatment planning process for thoracic tumors. The primary objective is to determine the percentage of thoracic tumor cases in which radiation oncology treatment planning is affected by a diagnostic radiology multidisciplinary discussion. The secondary objective is to determine the type and significance of the management changes.

METHOD AND MATERIALS: In this IRB approved study, cases discussed at 10 Multidisciplinary Thoracic Tumor Boards (radiology, pathology, pulmonology, surgery, radiation oncology, oncology) and 8 dedicated Diagnostic Radiology/Radiation Oncology Rounds were evaluated. Changes to the radiation treatment plan resulting from the discussion with a Diagnostic Radiologist were recorded and classified. During the dedicated Rounds, a survey was completed by the radiation oncologists to assess their perspective on the degree of change in the management plan and their change in confidence regarding the treatment plan.

RESULTS: Of the 122 Multidisciplinary Thoracic Tumor Boards cases evaluated, 38 (31%) involved a discussion regarding radiation oncology management in which the imaging played a direct role in determining whether radiation treatment was indicated and when it should be started. Of the 45 Diagnostic Radiology/Radiation Oncology Rounds cases, 14 (31%) were discussed but did not result in a change in management, whereas in 31 (69%) cases, there was a change. Changes included 15 (33%) in which whether to radiate and the timing of radiation treatment initiation was changed, 10 (22%) in which the radiation treatment plans were changed, and 6 (13%) in which both were changed. Radiation oncologists reported resultant changes were slight/moderate in 18 cases

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(40%) and significant/very significant in 13 (28.9%) of cases. After the discussion, the reported confidence in the treatment plan increased moderately-to-significantly in 82.3% (37) of the cases.

CONCLUSION: Dedicated discussions between a radiologists and radiation oncologists appear to add value, with resultant changes to, and increased confidence in, radiation treatment plans.

Education of Medical Students

(R-029) Tuesday • 7:00–8:00 AM • Hard-copy poster Immersion Learning in Radiology Education: Engaging Medical Students Through Hands-On Experience

Erin N. Gomez, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; Donna Magid, MD, MEd; Pamela T. Johnson, MD (*egomez8@jhmi.edu*)

PURPOSE: Immersion education, traditionally used in the teaching of foreign languages, is an instructional method in which the language being taught is also used as the primary method of instruction. While traditional radiology education includes didactic lectures, case conferences and shadowing, interactive experiences are becoming increasingly popular. The purpose of this study was to introduce medical students to the interpretation of computed tomography (CT) through an immersion-based approach.

METHOD AND MATERIALS: Medical students enrolled in a month-long radiology elective participated in an 8-hour workshop designed to introduce basic skills needed for interpretation of body CT. Students were provided with a diagnostic radiology workstation and completed introductory exercises focused on image orientation and navigation, identification of anatomic structures and use of a standard search pattern. Students also participated in a “hot seat” session showcasing commonly encountered pathology and reviewed cases independently to formulate a diagnostic impression. An institutional review board-approved survey was administered at the start and end of the workshop regarding comfort with various aspects of CT interpretation and level of interest in a career in radiology.

RESULTS: To date, 28 students have participated over the course of 4 sessions. Data collection is ongoing. After completing the workshop, students indicated an increased level of comfort with basic CT navigation, identification of anatomic structures, use of a search pattern, and recognition of pathology. An increased number of students indicated at least moderate interest in a career in radiology (57.2% vs. 64.3%). The workshop was rated as “extremely useful” by 93%, and 100% agreed that the workshop should be included in future iterations of the elective.

CONCLUSION: Immersion-based radiology education is an effective method for introducing students to the skills needed for interpretation of CT. Allowing students to develop a familiarity with CT through immersive learning experiences may be a key factor in increasing medical student interest in radiology and retention of concepts necessary for success on clinical rotations.

(R-030) Wednesday • 7:00–8:00 AM • Hard-copy poster Increased Medical Student Interest in Radiology following a Curriculum Involving Postmortem CT Scanning of Gross Anatomy Cadavers

Peter J. Haar, MD, PhD, *Virginia Commonwealth University, Richmond, VA*; Josephina A. Vossen, MD, PhD; Kevin B. Hoover, MD, PhD; Curtis W. Hayes, MD; Robert C. Groves, MD; Ann S. Fulcher, MD (*peter.haar@vcuhealth.org*)

PURPOSE: Medical school radiology curricula involving postmortem CT scanning of cadavers in association with a gross anatomy curriculum may provide students with an early, uniquely rewarding experience with radiology. To evaluate these possible benefits, student opinions were surveyed before and after a gross anatomy cadaver CT correlations curriculum designed to deliver experience-based radiology education.

METHOD AND MATERIALS: Prior to the start of the first-year medical school gross anatomy course at our institution, 32 dissection cadavers were CT scanned with participation from the 224 first-year medical students, aided by nine radiology residents. The radiology residents and a faculty attended gross anatomy lab on five occasions to facilitate experience-based radiology assignments involving the cadaver images, in parallel with dissection assignments. Students were surveyed regarding radiology-related perceptions prior to scanning, and again after the completion of the 10-month course. Pre-course (N=219) and post-course (N=218) survey responses were paired for each student, and changes in responses to the six 0-to-10 point scale questions were calculated and assessed with paired t-tests.

RESULTS: Average change in survey responses regarding “interest in learning to interpret radiologic images” increased by +0.85 ($p<0.0001$). Responses regarding “comfort level viewing and interacting with CT images” increased by +1.62 ($p<0.0001$). Responses for “value of cadaver CT images in medical education” decreased by -1.26 ($p<0.0001$). Responses regarding “interest in radiology as a possible career” decreased by -0.63 ($p<0.0003$). Responses regarding “value of the role radiologists play in patient care” did not significantly increase by +0.12 ($p<0.16$). Responses regarding “opinion of the VCU Department of Radiology” increased by +1.84 ($p<0.0001$). Additionally, 17 students (6.9%) developed a strong interest in the career of radiology.

CONCLUSION: This curriculum resulted in significantly increased interest in learning radiology, comfort interacting with CT images, and regard for the department of radiology at the institution. 17 students reported a very high interest in the career of radiology.

(R-031) Tuesday • 7:00–8:00 AM • Hard-copy poster Design and Use of an Interactive Website for Medical Student Teaching during All Four Years of Medical School

Stefan Tigges, MD*, *Emory Clinic, Atlanta, GA* (*stigges@emory.edu*)

PURPOSE: To describe website features that promote interactive student engagement in and outside of class.

METHOD AND MATERIALS: Learning material was uploaded to a website (xraycomix.com) for use during all 4 years of medical school. For M1 anatomy students, 15 cross sectional imaging modules are included. Pre-class work (pdfs, videos and “click on target” quizzes) was added to prepare students for in-class work. In class, students identify anatomic structures under supervision of a Radiologist, on scrollable images from the visible human project, then on normal CT/MRI scans. Students test their knowledge by finding abnormalities on scrollable unknown cases. For M2s, drawing/reading assignments for a “Graphic Medicine” elective were uploaded. Our required Radiology clerkship focuses on using ACR criteria to decide the type of imaging study required in various scenarios. For M3 students, the site links to multiple ACR criteria with illustrative scrollable cases. A supervising Radiologist uses the criteria to teach students what imaging study is appropriate and guides students as they review scrollable cases. Modules include MSK, Abdominal, Oncologic, Cardiovascular and Neuro imaging. The M3/M4 page (“Radiologist for a Day”) consists of several “worklists” with plain radiographs, scrollable CT and MRI scans (total cases=46). Each “case” consists of images, a reporting template and the answer. Chest x-rays, chest/coronary CTs, head CTs, cardiac MRIs and brain MRIs are included. Brief modules/links teach students basic image interpretation. Each answer includes an explicit teaching point. The page is intended to simulate for students what it is like to be a radiologist. The cases may be completed by students independently or under supervision of a Radiologist.

RESULTS: Since 6/5/2017, the site has been used by students independently and under supervision of a Radiologist to learn anatomy, radiology and drawing skills. By 9/22/17, the site had 1,515 visitors and 5,246 views.

CONCLUSION: A website that includes quizzes, scrollable anatomic images/unknown cases, case reporting templates and case answers

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can be used by students independently or in the classroom to learn anatomy and Radiology.

**(R-126) Tuesday • 7:20–7:35 AM • E-poster Station #7
Positive Benefits of Radiology Residents as Teaching Assistants in a Medical School Radiology Curriculum**

Peter J. Haar, MD, PhD, *Virginia Commonwealth University, Richmond, VA*; Robert C. Groves, MD; Josephina A. Vossen, MD, PhD; Kevin B. Hoover, MD, PhD; Curtis W. Hayes, MD; Ann S. Fulcher, MD (*peter.haar@vcuhealth.org*)

PURPOSE: Radiology residents may make valuable contributions teaching medical students. The benefits of radiology residents as teaching assistants (TA's) were studied in a medical school curriculum by comparing student feedback in years with and without resident involvement.

METHOD AND MATERIALS: In two consecutive years, during the first-year medical school gross anatomy course at our institution, 32 dissection cadavers were CT scanned with participation from the 224 first-year medical students. Radiology assignments involving the cadaver scans were provided in parallel with dissection assignments. During one year, nine radiology residents and one faculty attended gross anatomy lab on five occasions to facilitate the radiology assignments. The following year, the same curriculum was provided, but with no lab participation from the radiology residents. Both years, the students were surveyed regarding radiology-related perceptions after the completion of the course. The survey responses from the year with resident TA's (N=218) and year with no resident TA's (N=212) were compared for differences with independent t-tests for the six 0-to-10 point scale survey questions.

RESULTS: With resident TA's, average survey responses regarding "interest in learning to interpret radiologic images" were higher by +1.34 ($p < 0.0001$). Responses regarding "comfort level viewing and interacting with CT images" were higher by +0.72 ($p < 0.001$). Responses for "value of cadaver CT images in medical education" were higher by +1.55 ($p < 0.0001$). Responses regarding "interest in radiology as a possible career" were higher by +0.43 ($p < 0.005$). Responses regarding "value of the role radiologists play in patient care" were higher by +0.84 ($p < 0.0001$). Responses regarding "opinion of the VCU Department of Radiology" were higher by +1.19 ($p < 0.0001$). With resident TA's, 17 students (6.9%) reported a strong interest in the career of radiology, compared to 8 students (3.8%) in the class without resident TA's.

CONCLUSION: The year in which radiology residents served as teaching assistants resulted in significantly more positive student responses for all six of the surveyed questions and a higher number of students strongly interested in the career of radiology.

**(R-128) Wednesday • 7:20–7:35 AM • E-poster Station #10
How Much Does Medical School Cost?**

Peter O'Halloran, BS, MD, *Mount Auburn Hospital, Brighton, MA*; J. Pierre Sasson, MD

PURPOSE: The student debt crisis could be the next housing crisis. The cost of education is rising year over year faster than inflation and faster than wages. How fast is the cost of medical school increasing and will the student debt crisis affect our current generation of medical school students?

METHOD AND MATERIALS: The cost of medical school will be corrected for inflation using the consumer price index then compared to the current physician salary to evaluate the change in the cost of medical school over time. Penn University Medical School has published the historical cost of a medical education at Penn since before 1950. The average physician salary has also been published by the Bureau of Labor statistics since before 1950 (Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2016-17 Edition, Physicians and Surgeons. These numbers can be converted to 2017 dollars for the purpose of simple comparison using the consumer price index. Converting each dollar amount to 2017 dollars makes compari-

son easy because inflation is already taken into account. The ratio of medical school cost to average physician salary will be charted.

RESULTS: The cost of attending 4 years of medical school at Penn in 1950 cost \$60,338 in 2017 dollars. Similarly, the average physician salary in 1950 according to the Bureau of Labor statistics was \$107,745 in 2017 dollars. This means that the cost of education was 56% of the average physician salary. The cost of attending 4 years of medical school at Penn in 2010 cost \$255,353 in 2017 dollars. Similarly, the average physician salary in 2010 according to the Bureau of Labor statistics was \$365,894 in 2017 dollars. This means that the cost of education was 70% of the average physician salary. These numbers are all corrected for inflation.

CONCLUSION: The cost of medical school has been rising faster than inflation for 67 years while the average physician salary has stagnated since 1970. This puts an increased financial burden on young doctors.

Education, Other

**(R-036) Wednesday • 7:00–8:00 AM • Hard-copy poster
Using Radiology to Provide Real World Applications of
Physics to Undergraduate Students**

Thomas Lowe, *Indiana University Radiology, Indianapolis, IN*; Carrie Norris, MS, MD; Jessica Smith; Bilal Tahir, MD; Richard B. Gunderman, MD, PhD

PURPOSE: The purpose of this project was to provide real world applications of physics for college students using ultrasound, CT, radiography, and MRI. Students were also taught the general role of the radiologist in healthcare.

METHOD AND MATERIALS: Radiology residents were invited by the course professor to give lectures regarding the physics of radiology to an undergraduate physics course at a local university. A series of four 20-minute lectures were given over a 90-minute class period. Lecture material consisted of basic physics of MRI, ultrasound, CT, and radiography as well as a brief description of the role of the radiologist in healthcare. A pre and post lecture survey was administered to help gauge the students' understanding of the lecture material. Finally, students partook in an onsite visit to the radiology department where a medical physicist demonstrated how the various imaging modalities are utilized in day-to-day practice.

RESULTS: Post lecture survey results demonstrated a statistically significant increase in Likert scale scores compared to pre lecture surveys (figure), supporting the idea that students had an increased understanding of the physics used in the four different imaging modalities as well as a better understanding of the role of the radiologist in healthcare. Furthermore, both the students and the course professor had a very positive experience as indicated by their comments on the surveys and thank you letters.

CONCLUSION: Radiology residents successfully taught real world applications of physics using medical imaging to undergraduate students through a series of short lectures and an onsite tour of the radiology department. We plan to continue this teaching relationship with the university in the future.

Education of Residents

**(R-049) Tuesday • 7:00–8:00 AM • Hard-copy poster
Defining Excellence in Radiology Clinical Education:
Survey of Residents and Fellows Regarding Optimal
Faculty Skills and Practice**

Erin N. Gomez, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; David M. Yousem, MD*; Pamela T. Johnson, MD (*egomez8@jhmi.edu*)

PURPOSE: Department of Radiology faculty presentations are critiqued daily by residents for quality assurance and professional development.

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However, a significant amount of teaching also occurs at the workstation. A survey of our alumni revealed that 83% rated "learning from faculty during clinical rotations" as the most important element of training. The purpose of this study was to gain an understanding of residents' and fellows' definitions of excellence in clinical education, including which techniques are most effective for trainee learning and which attributes are most valued in a clinical teacher.

METHOD AND MATERIALS: Radiology residents and clinical fellows were invited to complete an institutional review board-approved 6-question survey (Figure 1) about faculty skills and practices necessary for optimal clinical education. Respondents were asked to describe their preferred format for teaching at the workstation, rank the types of content and supplemental resources emphasized during case review, and list the qualities most valued in a clinical teacher.

RESULTS: 25 residents and fellows completed the survey (45% response rate). 82% of respondents preferring to review studies in detail with an attending were junior residents, while most senior residents and fellows (60%) preferred to review the salient points of interesting or complex cases. Search pattern and image interpretation, pertinent findings, and interpretive errors were identified as topics which should be emphasized during teaching sessions. Websites and online resources were the most highly ranked sources of supplemental information, followed by companion cases and relevant journal articles. Qualities valued in a clinical teacher were largely based on interpersonal skills, with 68% of respondents stating that open-mindedness, patience or kindness were important, followed by efficiency (36%) and an interest in teaching (32%).

CONCLUSION: Radiology faculty should tailor their clinical instruction according to trainee experience, but in general should focus on image interpretation, pearls and pitfalls, and missed findings. Trainees most value educators who foster a supportive learning environment and who are enthusiastic about teaching.

(R-050) Wednesday • 7:00–8:00 AM • Hard-copy poster Urgent Discordance: Radiology Resident Misses Which Change Management in the ER

Kevin O'Brien, MD, *University of Chicago, Chicago, IL*; Jonathan H. Chung, MD; Michael Baad, MD (*kobrienmd@gmail.com*)

PURPOSE: A nationwide trend toward 24hr attending coverage has resulted in a discussion of resident discordance rates. In our experience, not all resident discordances alter management. Our purpose is to find the rate of on-call resident discordances which change management, an urgent discordance.

METHOD AND MATERIALS: We gathered information on every preliminary read in the chest section over the course of 3 years, spanning 2012-2014. Those marked as "major discordances" (MDs) were selected as these are deemed the most severe misses. We then compiled a list of 18 "urgent" diagnoses that may change management before an attending read could be made. Examples include pneumonia and pulmonary embolism (PE). We also compiled a list of 10 "non-urgent" misses, still deemed MDs, but would not alter management before an attending read was made. Examples include pulmonary nodule and rib fracture. Each MD was given an urgent or non-urgent diagnosis based on the preliminary read and the reason given for the discordance. We evaluated the percentage of MDs, percentage of urgent discordances (UDs), and evaluated which diagnoses were most commonly missed.

RESULTS: 33,419 preliminary chest reads were made over 3 years, spanning 2012-2014. The number of cases marked as MDs was 579 (1.7% of the total prelim reads). Of those, 278 were deemed UD (0.7% of the total prelim reads). The most common UD was a missed pneumonia, accounting for 59% of the total UD. The second and third most common UD were missed PE and overcalled PE respectively, accounting for a combined 11.5% of the total UD. The three most common non-urgent discordances were overcalled pathology on chest radiograph, missed nodule, and non-urgent finding in the abdomen on CT accounting for 73% of non-urgent discordances.

CONCLUSION: The percentage of UD, which would immediately alter patient management was less than half of the number of MDs, already a small number. More than half the UD were missed pneumonias resulting in a delayed antibiotics. The very small percentage of cases that fell into the category of UD demonstrates that an independent on-call radiology resident preliminary read is very safe and reliable for making immediate management decisions.

(R-051) Tuesday • 7:00–8:00 AM • Hard-copy poster Redefining the Face of Radiology: The Formation of a Resident-Led Radiology Consultation Service Available on the Clinical Floors as a Catalyst for Improving Understanding and Communication with Referring Services

Kerri Vincenti, MD*, *Pennsylvania Hospital, Philadelphia, PA*; Benjamin Hammelman, MD, MEd (*kerri.vincenti@uphs.upenn.edu*)

PURPOSE: We seek to explore the perceptions of the role of radiology in clinical decision making at our institution following the implementation of the resident-led radiology rounds program. The study intends to gauge both clinicians' and radiologists' viewpoints and to cause measurable improvements in the workflow and understanding between our departments.

METHOD AND MATERIALS: We created a consult service bringing radiology residents to the clinical floors for up to 1 hour each session to discuss cases at regular intervals, staffed by a senior resident with access to full PACS at a designated workstation. Prior to the service beginning, we created mirrored sixteen-question surveys to capture the prevailing attitudes and level of understanding between the radiology and internal-medicine departments. Surveys included both likert-scale and open ended questions, the latter of which were analyzed and coded with thematic analysis. We also recorded the number of cases reviewed and the amount of time spent at each session. The completion of this project in early spring will involve similar post-intervention surveys, supplemented by interviews and/or focus group sessions aimed at discovering how the floor consultation service has influenced the radiologist-clinician relationship.

RESULTS: Presurvey respondents included 20/21 radiology residents, 11/49 internal medicine residents and 14/115 internal medicine attendings (all subspecialties) Radiologists and clinicians both reported most frequent communication by phone as opposed to in person, email, or text. Clinicians believe that they understand the role of radiologists in patient care more often than radiologists perceived. Approximately 1/3 of all respondents do not believe radiology reports communicate findings effectively. Each session, residents reviewed an average of 4.7 cases (range 0 – 10) and engaged an average of 28 minutes (range 0 – 55).

CONCLUSION: In-person radiology rounds provides residents with a teaching opportunity while adding value to the patient's care plan without a large expenditure of effort or resources from the radiology department.

(R-052) Wednesday • 7:00–8:00 AM • Hard-copy poster Current Status of Mammography Fourth Year Electives in Radiology Residency

Courtney Raybon, MD, *Vanderbilt University Medical Center, Nashville, TN*; Lucy Spalluto, MD; Christine Dove, MD (*christine.dove@vanderbilt.edu*)

PURPOSE: The purpose of this study is to evaluate the current state of breast imaging electives during the fourth year of radiology residency. In 2013 the American Board of Radiology (ABR) Core Exam, the initial certifying exam for radiology residents, shifted from the end of the fourth year of residency to the end of the third year. This change has created more flexibility in the fourth year curriculum. Many institutions now offer additional elective time or a "mini-fellowship" with concentrated time in a specific subspecialty. We aim to assess resident interest in and availability of supplemental breast imaging education

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(beyond the 3 months required by the ABR) and to identify potential barriers to meeting the demand.

METHOD AND MATERIALS: Anonymous electronic surveys were sent to all radiology residency program directors (n=189) in the United States using email addresses obtained from the American Medical Association FRIEDA database. Demographic program information was obtained and survey questions were designed to evaluate resident interest and availability of fourth year breast imaging electives.

RESULTS: Fifty-nine of 189 recipients completed the survey, for a response rate of 31%. The majority of programs (70.6%) reported an overall increase in fourth year electives with most offering between 4-6 months (41.7%). In the majority of programs (70.6%), less than 25% of residents requested elective months in breast imaging, and 90% could accommodate these requests "often" or "always". Of the residents requesting additional time, 71.1% requested 1-2 months and 28.9% requested 3 months or more. The most commonly cited reasons for not accommodating requests included: "too many residents doing required breast imaging rotations" or "too many other 4th year residents also requesting elective time in breast imaging".

CONCLUSION: This study confirms the increase in elective time offered to fourth year radiology residents after restructuring of the ABR Core Exam. A small number of residents elect to spend that time in breast imaging, most requests are for 1-2 months, and the programs can accommodate these needs. Several potential barriers may impact the residents who request concentrated time (>3 months) in breast imaging.

(R-053) Tuesday • 7:00–8:00 AM • Hard-copy poster Evaluation of Music Video as an Educational Nuclear Medicine Method

Huyen Tran, MD; Weiya Mu, MD, *Einstein Medical Center, Philadelphia, PA*; Shuchi K. Rodgers, MD; Ryan J. Smith, MD; Megan V. Carrier, MS (*tranh@einstein.edu*)

PURPOSE: Didactic lectures are a core component of radiology education, but residents may find them less engaging. Given current radiology residents are young adults who regularly consume video media, we theorized that a music video would be a fun and effective method to teach nuclear medicine concepts.

METHOD AND MATERIALS: We made a music video about the localization of free Technetium in nuclear medicine scans. In an IRB-exempt study, we anonymously surveyed radiology residents in a single institution, using Google Forms, a free survey service. Before and after watching the video, residents were asked to rate on a Likert scale, where 1 was not confident at all, and 5 was very confident, their confidence in their understanding and ability to explain this topic. They were also asked about their attitudes toward alternative teaching methods. Data analysis was performed using Microsoft Excel 2007.

We will show a portion of the music video, and also give tips on how to film and edit a music video with a popular consumer smart phone and tablet, using only free applications.

RESULTS: 19/23 (82%) residents participated in the pre- and 16/23 (70%) residents participated in the post survey. On average the residents were more confident in their understanding ($p < 0.001$) and ability to explain the topic ($p < 0.001$) after watching the video, especially the junior residents. The first years averaged 1.4 on understanding before and 4.0 after the video, and averaged 1.2 on ability to explain before and 4 after the video; second year residents averaged 3.2 before and 5 after the video for both measures; no significant difference was seen among the upper years. Residents overall averaged 3.8 for paying more attention, averaged 3.9 for finding the music video more fun and engaging than a lecture, and averaged 3.8 for retaining more information.

CONCLUSION: The music video was found by all years to be fun and engaging. Junior residents became more confident in their understanding and ability to explain the concept taught. Given the widely available resources for making such videos, residency programs should consider this approach to supplement resident education.

(R-054) Wednesday • 7:00–8:00 AM • Hard-copy poster What a Kahoot! Improving Resident Engagement during the Didactic Lecture by Gamifying the Audience Response System

Huyen Tran, MD; Brett Cerniglia, MD, MPH, *Albert Einstein Medical Center, Philadelphia, PA*; Ryan J. Smith, MD (*tranh@einstein.edu*)

PURPOSE: Today's radiology residents are millennial adults proficient in the use of online technologies such as YouTube and Snapchat. According to adult learning theory, standard Powerpoint lectures often serve as a suboptimal method of communicating information. We theorize that delivering lecture focused questions in a game-based format through an audience response system will increase resident attention and information retention. Kahoot! is a cloud-based audience response system, free for educational use, which allows an educator to create and deliver live gamified questions. We evaluate whether the addition of a game-format question system improves resident perception of didactic lecture effectiveness.

METHOD AND MATERIALS: In an IRB-exempt study, we employed an anonymous cross-sectional survey to 24 radiology residents within a single academic medical center utilizing free cloud-based survey software. The questionnaire was designed with a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree). Survey responses were obtained following exposure to several Powerpoint-based lectures enhanced with gamified question sets created and delivered within the Kahoot! system. Data analysis was performed utilizing SPSS.

RESULTS: The participation rate was 88 % (21/24). On average, residents felt that during lectures with Kahoot! they paid closer attention (4.5/5) and learned more (3.9/5). They felt continued use of this system would improve lecture attendance (3.9/5) and they would be interested in learning how to employ Kahoot! in their own lectures (3.9/5). In comparing other alternative communication formats, residents did not prefer the traditional lecture format (2.3/5) and did not prefer non-gamified audience response question sets (2.3/5). Although two residents moderately agreed that Kahoot! had a distracting effect on the lecture, on average the residents did not share this perception (2.3/5). A cross-tabulation analysis did not demonstrate any statistically significant intervariable relationship between resident training year and survey responses ($p > 0.05$).

CONCLUSION: For millennial residents, Kahoot! can be a helpful instructional method. A brief live demo of Kahoot! will be given at the AUR.

(R-055) Tuesday • 7:00–8:00 AM • Hard-copy poster Education Resources for the 21st Century Radiology Resident

Gunjan Malhotra, MD, *University of Michigan, Ann Arbor, MI*; Matthew Manganaro, MD; John D. Millet, MD; William Weadock, MD*; Kara D. Gaetke-Udager, MD

PURPOSE: Produce an efficient cost effective way for radiology residents to access educational materials.

METHOD AND MATERIALS: Traditionally, our radiology residency program maintained a physical library of reference textbooks, image based case books, and software programs totaling over 750 items that cost tens of thousands of dollars (including donations). Residents checked out materials during normal business hours, while our administrative staff maintained and tracked the resources. The department also provided \$1,750 to each resident as a book fund to supplement library offerings. While this traditional library was popular, it was not possible to have an updated copy of every resource available for every resident due to limited space and money as well as the added burden it posed to administrative staff. This sparked the development of a partnership with our medical library and its licensing agreements to create a secured, radiology online e-library through which residents could access via direct links most of the physical resources in our physical radiology library.

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RESULTS: Since implementation of our e-library three years ago, use of the physical radiology library has plummeted. The physical textbooks were recycled to make room for a meeting space and the work of resident administrators has been redirected. Residents now have unlimited access to updated resources 24/7 via department-issued iPads which cost \$429 each. As an analogy, we estimate that purchasing the same physical resources for each resident entering the program would cost a total of \$6,446 each. The e-library now allows residents to use their book fund for other educational endeavors. Added benefits of these iPads include streaming interactive conferences, secure EMR and email access and convenient access to other electronic resources.

CONCLUSION: By utilizing technology, online resources and paid textbook licensing agreements through our medical library, our residency program created an e-library that provides unlimited resident access to the most current radiology educational resources with reduced cost to the department, less burden on administrative staff, and more physical space. We encourage other programs to consider a similar effort.

**(R-056) Wednesday • 7:00–8:00 AM • Hard-copy poster
Implementation of a Structured Approach to Radiology
Resident Rotations: Positive Impact on the Educational
Experience**

Nancy R. Fefferman, MD, *New York, NY*; Cecilia L. Mercado, MD; Patricia M. Clayton, BS; Chloe M. Chhor, MD; Michael P. Recht, MD (*nancy.fefferman@nyumc.org*)

PURPOSE: Preserving the educational experience of radiology resident rotations is often challenged by the increasing size of many academic radiology departments and the subsequent rapidly increasing volume of work. We recently implemented several organizational initiatives to enrich the educational value of resident rotations. The purpose of our investigation is to describe our initial experience with these initiatives and assess the impact of these changes on resident education.

METHOD AND MATERIALS: Several new education initiatives were implemented in 2015. The organization of the education team was expanded by creating a designated point person in each section (RES-Rep). Under the direction of the Program and Associate Program Directors, the RESRep is responsible for managing the resident rotation including development and delivery of curricular material, goals and objectives, rotation expectations and resident evaluations. Introduction of the Teaching Attending of the Day (TAD), whose primary responsibility is resident teaching at the workstation, provides dedicated teaching on each rotation. The development of the Rotation Attendings (RT), 5-6 teaching attendings assigned to each 4 week rotation, offers consistency and continuity in learning and ensures the highest caliber teaching. Consensus resident rotation evaluation data prior to introduction of the new initiatives (2013-14 and 2014-15) and after implementation (2015-16 and 2016-17) was reviewed; resident responses on a scale of 1 to 3 (1 below -, 2 meets- and 3 exceeds expectations) to questions regarding how well rotations met educational objectives, goals and expectations and rotation teaching.

RESULTS: Resident evaluation of rotations clearly defining educational objectives, knowledge of rotation expectations, knowledge of who the supervising rotation attending was, time dedicated to teaching on rotations, and rotations meeting their educational objectives all increased.

CONCLUSION: Implementation of innovative departmental initiatives creating a structured approach to radiology resident rotations has improved the educational value of the training experience.

**(R-058) Wednesday • 7:00–8:00 AM • Hard-copy poster
Entrustable Professional Activities (EPAs) for
Interventional Radiology (IR): A Roadmap for the Future
of IR Training**

Rachel F. Oser, MD, *University of Alabama Birmingham, Birmingham, AL*; Nathan Ertel, MD; A. K. Abdel Aal, MD, PhD (*roser@uabmc.edu*)

PURPOSE: Entrustable Professional Activities (EPAs) are defined as discrete activities which define a specialty and can be objectively assessed and entrusted to competent trainees to perform independently. They are becoming widely accepted as a way to assess competence, improving educational outcomes and patient safety in a teaching environment. We describe the development of 10 EPAs for Interventional Radiology (IR).

METHOD AND MATERIALS: Key areas for development of EPAs were identified by senior IR faculty. The EPA concept and proposed EPAs were introduced to the IR group and trainees through a series of conferences and workshops. Ten professional activities were selected as core to the practice of IR. Each EPA was detailed and mapped to the IR milestones. An assessment form using a five level entrustment scale was created.

RESULTS: The final EPAs and evaluation forms were presented to the IR faculty and program evaluation committee (PEC). All ten were approved for implementation in the IR training programs. Faculty and trainee agreement was obtained and all committed to participate in EPA evaluations.

CONCLUSION: Through a consensus model, we designed ten EPAs that encompass essential components of IR practice. The development process used was inclusive of both faculty and trainees ensuring buy in from all stakeholders. We plan to begin using EPA assessments during the next academic cycle. Challenges in implementation remain including assuring the timeliness, consistency and reliability of evaluations and establishing a process that trainees feel is empowering rather than punitive.

**(R-125) Tuesday • 7:20–7:35 AM • E-poster Station #1
Live Audience Response, Traditional Case Conference,
or Didactic Approach to Radiology Resident Education:
A 12-month Evaluation-Based Analysis**

Vishal Desai, MD, *Thomas Jefferson University Hospital, Philadelphia, PA*; Leann M. Kania, MD; Adam Flanders, MD; Christopher G. Roth, MD; Sandeep Deshmukh, MD

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.

METHOD AND MATERIALS: A lecture evaluation system was created in Feb 2016, which allowed anonymous feedback after the lecture was completed. The evaluations included lecture content ratings, lecturer rating, 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 12 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).

RESULTS: Over the 12-month timeframe, 275 lectures were performed and 838 evaluations were received. 141 lectures (51%) included a component of interactivity. Within the interactive lecture subset, 97 lectures (69%) were traditional case-based conference and 44 lectures (31%) utilized the Diagnosis Live application. The mean lecture rating for the interactive subset was 4.48, which is significantly

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higher than the mean lecture rating of 4.14 for the non-interactive subset ($p=0.02$). Within the interactive group, the web lectures were rated significantly higher than the oral case-based lectures (4.70 and 4.37, respectively; $p=0.003$). Based on consensus vote, 69 of the 134 didactic-only lectures (51%) would be improved with an interactive component.

CONCLUSION: Based on resident feedback over 12 months, interactive lectures are better received than non-interactive lectures, with Diagnosis Live as the format of choice. The results suggest a change in the preferred style of resident learning from didactic and hot seat case conference to more modern, interactive web-based approaches.

(R-127) Wednesday • 7:00–7:15 AM • E-poster Station #10 Radiology Resident Standard of Living Survey

Peter O'Halloran, BS, MD, *Mount Auburn Hospital, Brighton, MA*; Dominique Rowcroft, MS, MD; J. Pierre Sasson, MD (*pohallor@harvard.mah.edu*)

PURPOSE: In the 2017 Medscape Survey of Residents Lifestyle and Happiness, residents reported financial issues as one of the biggest challenges faced in residency. Salary shouldn't be the most important factor in choosing a residency, however applicants should be aware of the challenges imposed by low salary, growing families, high cost of living areas and the burden of student loans. The goal of this study is to publish a basic guide of current radiology residency salaries adjusted for regional cost of living as a reference point for radiology residency candidates during the MATCH process and to inform applicants how to compare salaries during the application cycle.

METHOD AND MATERIALS: All 185 allopathic radiology residency websites will be searched for resident salary and benefits information. Some radiology residency programs do not publish salary information on their websites and these programs will be excluded. The salary information will then be adjusted for regional cost of living based on city of origin using the consumer price index of each city.

RESULTS: Complete results are pending. For example, a PGY3 radiology resident at Baylor University in Houston, TX can expect an income of \$58,527 per year. A PGY3 resident at Massachusetts General Hospital in Boston, MA will make \$67,000 per year. However, after adjusting the salaries using the consumer price index it should be noted that a Boston resident would need a salary of \$86,002 to maintain the same "standard of living" as the Houston resident.

CONCLUSION: Residents are facing increased financial pressure due to rising cost of medical education and cost of living. Despite this, applicants do not have a cost of living adjusted method to determine if trainee salary can support their medical school debt and family costs during residency. Residency salary can be adjusted for cost of living using the consumer price index in each city to produce an "standard of living salary" which is a easy reference point for candidates to consider during their MATCH process. When applicants compare program salary information they should consider regional cost of living variation.

Health Services for Radiology

(R-062) Wednesday • 7:00–8:00 AM • Hard-copy poster Improving Hand Washing Compliance in the Interventional Radiology Department

Richard Tramel, MD, *Ochsner Medical Clinic, New Orleans, LA*; Jeffrey B. Levine, MD; Dennis Kay, MD; James M. Milburn, MD* (*richard.tramel@ochsner.org*)

PURPOSE: Healthcare-associated infections are a patient safety issue affecting all hospital departments, including radiology. Improving hand hygiene of healthcare staff is one of the most important ways to address healthcare-associated infections. In compliance with JCAHO safety Goal #7, our radiology department initiated a comprehensive program with goals to foster hand hygiene, monitor compliance and provide feedback for our department.

METHOD AND MATERIALS: Several team members were recruited as unknown observers, to monitor hand washing practices. Our policy required either hand washing or use of hand sanitizer upon each entry and exit from a patient care area. We observed hand hygiene compliance using standard data collection procedures. After 3 months of observation, team members were educated on our hand hygiene policy and given direct feedback in a small group setting. Signs were then placed next to doors leading to, and exiting patient areas, as well as above washing stations, reminding healthcare staff to wash their hands. Unknown observers continued to monitor hand washing practices following education and sign postage. Data was analyzed using a Z-test for two proportions.

RESULTS: 114 observed occurrences of possible appropriate hand hygiene events were recorded for 3 months prior to education of healthcare staff and placement of signs. Hand washing was observed 82.5% of the time. After education and placement of signs, 316 observed occurrences for appropriate hand hygiene were recorded over 5 months. Hand washing was then observed 97.8% of the time. An overall 15.3% increase in compliance was observed following intervention, which was found to be clinically significant ($p < .01$).

CONCLUSION: Our data demonstrates that education and constant reminders, such as placement of signs near hand washing stations, significantly improves hand hygiene compliance. Using similar methods throughout the hospital, may improve hand hygiene and may lead to decreased nosocomial infections, better patient outcomes, and shorter lengths of stay. All healthcare workers at our institution are educated on hand hygiene upon hiring. This would suggest routine re-education on hand hygiene may also improve hand washing compliance.

* Faculty financial disclosures are located in the Faculty Index.

**(R-063) Tuesday • 7:00–8:00 AM • Hard-copy poster
Assessing Radiology and Non-Radiology Safety-Related
Priorities in the Emergency Department**

Brian W. Bresnahan, PhD*, *University of Washington Harborview Medical Center, Seattle, WA*; Daniel Hippe*, Ben Hauberg, BS; Wendy Cohen, MD; Christine Cottingham, BS; Bryce R. Robinson, MD, MS

PURPOSE: To assess radiology and non-radiology safety issues in a level 1 trauma center's emergency department (ED), determine stated safety concerns and priorities, and elicit improvement recommendations through survey-based engagement of multi-disciplinary ED professionals.

METHOD AND MATERIALS: We used a two-step safety issue and prioritization strategy to identify potentially relevant ED safety issues (radiology and non-radiology) through inter-professional stakeholder engagement. First, we developed a pilot list of stated safety issues and concerns along with developing a simplified electronic survey pilot. After incorporating new safety items from the pilot, we then administered an electronic survey to hospital stakeholders in radiology, ED medicine, nursing, quality improvement (QI), and trauma surgery.

RESULTS: Thirty-one ED-related multi-disciplinary hospital professionals responded to our radiology and non-radiology safety survey (7 ED medicine, 1 QI, 21 radiology, and 2 surgery). The most common ED radiology-related safety issues listed as either first-, second-, or third-highest priority were inappropriate imaging (65% of respondents), test ordering sequence (58%), and timeliness of completion of diagnostic exams (32%). The top three non-radiology issues listed as highest priorities were ED "boarders" (i.e., admitted inpatients remaining in ED, 73% of respondents), infection control (43%), and median ED patient throughput (33%). Additional radiology "other" stated items included needs for improving processes for critical results reporting, enhancing safety of patient transfer onto a modality (e.g., better use of patient-movement devices), and improving diagnostic exam request processes. Non-radiology "other" issues included potential overuse of services and uncertainty about inpatient admission decision making.

CONCLUSION: Radiology has opportunities to strengthen professional partnerships with multi-disciplinary and inter-professional providers to develop safer, learning healthcare systems. Systematic health services research approaches applied to hospital QI strategies can facilitate cross-departmental collaboration, identify safety concerns, and provide recommendations for improvements in care processes.

Interventional Radiology

**(R-067) Tuesday • 7:00–8:00 AM • Hard-copy poster
Repetitive Restoration of Flow to Thrombosed Dialysis
Access Grafts in Patients with Limited Surgical Revision
Options: Is there a Limit to the Number of Declots?**

Kiran Busireddy, MD, *Creighton Medical Center, Omaha, NE*

PURPOSE: 1. To evaluate the outcome and feasibility of repeated pharmacomechanical thrombolysis with or without angioplasty and stent placement in patients deemed not suitable for surgical revision replacement. 2. To analyze determinants of repeated thrombosis of arteriovenous grafts.

METHOD AND MATERIALS: More health care admissions for interventional thrombosis of upper extremity AV grafts was performed. The time from initial placement of the AV graft to first and each subsequent thrombosis and restoration of flow was measured. The imaging causes of the thrombosed grafts were evaluated. The method of thrombolysis was standardized as follows: 1) rapid pharmacomechanical thrombolysis with 1mg tPA per centimeter of graft length with an Angiojet device in power pulse mode 2) Thirty minute tPA dwell time in the graft 3) Four slow Angiojet passes in rheolitic mode 4) Balloon angioplasty of the entire graft at stenotic and nonstenotic areas and 5) Endograft stent placement at persistent stenosis.

RESULTS: In this study we focus on a subgroup of patient who had more than 6 pharmacomechanical thrombolysis performed on the same AV graft. There were 3 male and 3 female with an average age of 65 years. These 5 patients had an average of seven rapid pharmacomechanical thrombolysis performed on completely thrombosed AV grafts. These grafts were maintained from the first episode of thrombosis to the latest thrombolysis an average of 1235 days. 4 of these patients are still followed up were having functioning AV grafts. One patient is now outside our system.

CONCLUSION: With repeated pharmacomechanical thrombolysis and angioplasty it is possible to maintain an AV graft way beyond its expected lifetime in patient who has very limited options for dialysis access.

* Faculty financial disclosures are located in the Faculty Index.

Neuroradiology

(R-153) Wednesday • 7:20–7:35 AM • E-poster Station #7 Going Beyond the Imaging Guidelines: Is Unnecessary Cervicocerebral CT Angiography ever Necessary?

Chad Sudoko, BS, BA, *Geisel School of Medicine at Dartmouth, Lebanon, NH*; Natalie Y. Ring; Matthew E. Maeder, MD; David A. Pastel, MD

PURPOSE: The utilization rate of cervicocerebral computed tomography angiography (CTCCA) has increased dramatically over the last two decades and has replaced invasive diagnostic cerebral angiography in many instances. The widespread use of this revolutionary modality, however, contributes to rising health-care costs, increased radiation exposure, and widespread reporting of incidental findings, especially when ordered inappropriately. We hypothesize that CTCCAs performed for indications considered inappropriate by established guidelines have low diagnostic yield and are unlikely to alter management decisions.

METHOD AND MATERIALS: The Dartmouth-Hitchcock radiology database was reviewed for all CTCCAs performed between October 2011 and December 2016. Radiology reports were included for analysis in patients 18 years or older when the clinical history did not meet appropriateness criteria for a CTCCA as determined by ACR-ASNR-SPR Practice Parameters and ACR Appropriateness Criteria. Reports that met inclusion criteria were reviewed and classified into three categories: 1. normal findings, 2. incidental findings of varying degrees of clinical significance, and 3. findings possibly related to the indication. In the latter case, further chart review was conducted to determine whether or not findings on CTCCA altered clinical management.

RESULTS: 255/2,783 CTCCAs (9.2%) met inclusion criteria. Of these, 113 (44.3%) were normal studies, and 129 (50.6%) had incidental findings. Common incidental findings included stenosis <50%, thyroid lesions, and other soft tissue findings. Of note, two incidental intracranial aneurysms were diagnosed. 13 (5.1%) cases had findings possibly related to the indication, which included stenosis >50%, vascular malformation, and possible dissection or thrombus. In none of these cases did CTCCA alter clinical management of the patient. The most common indications for inappropriate CTAs were simple headache (77/255, 30.2%) and dizziness or vertigo without other neurologic symptoms (103/255, 40.4%).

CONCLUSION: 9.2% of CTCCAs were ordered outside of established imaging guidelines and were unlikely to affect patient management in this cohort.

Pediatric Radiology

(R-093) Tuesday • 7:00–8:00 AM • Hard-copy poster Transitioning Away from the Transition Zone: How Valuable is the Contrast Enema in Evaluating for Hirschsprung's Disease?

Samuel M. Knecht, BA, *University of Maryland School of Medicine, Baltimore, MD*; Narendra S. Shet, MD; Jane S. Kim, MD; Nidhi Rawal, MD (*narendras@gmail.com*)

PURPOSE: Hirschsprung's disease (HD) is the congenital absence of ganglion cells in the bowel leading to functional bowel obstruction. HD is typically diagnosed in the neonatal/infancy period, with rare diagnosis in patients greater than 6 months of age. In the small subset of patients who present later in life, the chief complaint typically is chronic constipation, which can also be due to a wide variety of other causes. Diagnostic workup of these patients often includes contrast enema (CE) to screen for a transition zone. The purpose of our investigation was to explore the efficacy of the CE in this older subset of pediatric patients.

METHOD AND MATERIALS: Reports from CE studies performed in pediatric patients between the ages of 0 and 18 years over a 3 year period (2014-2016) were reviewed. Patients with any history of abdominal surgery were excluded. Histopathology from rectal biopsy was retrieved from the patient's electronic medical record, if available. Patients were stratified by age and exams were categorized as true positives, false positives, false negatives, and true negatives. Patients who had a CE without findings suspicious for HD often did not have histopathologic correlate; in these instances, clinical documentation such as progress notes were reviewed and if HD was no longer considered in the differential diagnosis, the case was deemed a true negative.

RESULTS: A total of 87 CE cases were included. Sensitivity and specificity of CE was 90.0% and 92.2%, respectively, when correlated with rectal biopsy results or clinical documentation. Across all ages, the positive predictive value (PPV) and negative predictive value (NPV) were 60.0% and 98.6%, respectively. When stratified by age, in patients greater than 6 months of age (47 total), NPV was 100%, with one false positive CE in this group and no true positives (PPV of 0%) based on histopathology or clinical notes.

CONCLUSION: As a diagnostic tool for Hirschsprung's disease, CE has a high negative predictive value while the positive predictive value is rather limited. While the CE therefore is a strong exam at excluding HD, we question the clinical efficacy of CE in the diagnosis of HD, especially in patients older than 6 months.

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AUR 2018 Instructional Poster Abstracts

Instructional posters are located in National Ballroom D. Each poster will be presented by its author during one of the *AMA PRA Category 1 Credit™* poster sessions scheduled for 7:00–8:00 AM, Tuesday (Session 201) and Wednesday (Session 301). The day and time for each poster presentation follow the presentation number. Presenting author is identified by institution name, city, and state (or country if not United States or Canada). Presentations by trainees (medical students, residents, or 1st-year fellows) are noted in **blue**.

Abdominal Radiology

(E-001) Tuesday • 7:00–8:00 AM • Hard-copy poster **Combining Video and Fluoroscopic Guidance in Post Pyloric Feeding Tube Placement: Does It Reduce Procedure Time and Radiation Exposure?**

Tram N. Schroeder, MD, *Indiana University School of Medicine, Indianapolis, IN*; Bilal Tahir, MD

PURPOSE: Post pylorus feeding tube placement is often challenging and can result in long fluoroscopic procedure times, increased patient discomfort, and elevated levels of radiation exposure. We aimed to determine whether a new feeding tube with an added ability to visualize anatomy directly via a camera at the distal end of the tube (Kangaroo [K], Covidien-Medtronic, Minneapolis, MN) when placed under fluoroscopy decreased overall procedure time or radiation dose compared to a traditional feeding tube (Frederick Miller [FM], Cook Medical, Bloomington, IN).

METHOD AND MATERIALS: We performed an IRB-approved, retrospective, single institution study over the course of a two month period to determine whether combined video and fluoroscopic guidance with the K feeding tube decreased overall procedure time or radiation dose of post pyloric feeding tube placements compared to fluoroscopic guidance alone with the FM tube. Parameters, such as total procedure time, fluoroscopy time, air kerma, and dose area product, were evaluated. A total of 19 patients underwent FM tube placement and a total of 9 patients underwent K tube placement.

RESULTS: Differences between the two tubes were found to be not statistically significant for all parameters (*p* values of 0.07, 0.25, 0.16, and 0.19 for total procedure time, fluoroscopy time, air kerma, and dose area product (DAP), respectively). However, there was a trend of longer procedure times, fluoroscopy time, air kerma, and DAP for the K tube compared to the FM tube.

CONCLUSION: Our current experience demonstrates no advantage of combined video and fluoroscopic visualization when placing post pyloric feeding tubes compared to fluoroscopic visualization alone. There are benefits to the K tube such as ease in navigating past the trachea without unintentional airway placement. At the same time, there are limitations such as difficulty passing the nares of a patient with a significantly deviated septum due to the larger distal end. Future work will focus on increasing the number of K and FM feeding tube placements to see if trends become statistically significant.

(E-002) Wednesday • 7:00–8:00 AM • Hard-copy poster **Magnetic Resonance Liver Elastography: The Bare Essentials for Radiologists**

Chau Vo, MD; Millie Yu, BS, MS; Jeremy B. Nguyen, MD, MS, *Tulane University Hospital and Clinics, New Orleans, LA*; Mandy Crause Weidenhaft, MD; Drake A. W. McArthur, MD (*jnguye2@tulane.edu*)

LEARNING OBJECTIVES: • Describe the physical concepts of elasticity of materials including the characterization of Young's, shear and bulk moduli • Describe the concepts of stress and strain (i.e. stress-strain curve) • Describe the physical properties of shear wave • Describe the physical principle of MR elastography • Describe MRE protocol and pulse sequence design • Describe the clinical application of MR liver elastography

CONTENT DESCRIPTION: Elastography is a medical imaging modality that measures and display the elastic properties of body soft tissues, which can yield diagnostic information about the presence or status of disease. Magnetic resonance elastography (MRE) of the liver is a non-invasive imaging technique for quantitatively assessing the elasticity of liver and the associated diseases. Liver stiffness is usually indicative of fibrosis or steatosis, which are in turn indicative of numerous disease conditions, including cirrhosis and hepatitis. There is a strong correlation between MRE-measured hepatic stiffness and the stage of fibrosis at histology. MRE is particularly advantageous in this case because when fibrosis is diffuse, a biopsy can easily miss sampling the diseased tissue, which results in a false negative misdiagnosis. MRE is performed by using a vibration source on the surface of the patient's body; this creates shear waves that travel into the patient's deeper tissues. Special MR pulse sequence synchronized with the shear waves can be formulated to acquire the characteristics of the propagating waves. The acquired data of the wave information is used to generate quantitative images showing tissue stiffness (the shear modulus). The result of an MRE scan is a quantitative 3-D map of the tissue stiffness and a conventional 3-D MRI image, which can cover an entire organ. The aim of this tutorial is to present the fundamental physics of elastography including the concepts of elasticity, stress-strain relation, shear wave generation and propagation. The reader will learn about MRE pulse sequence design, the techniques of performing a liver MRE, analysis and interpretation of MRE images. MR cases will be given to clarify the learned concepts.

(E-003) Tuesday • 7:00–8:00 AM • Hard-copy poster **High-order Texture Features Differentiate Transition Zone Prostate Cancer from Non-cancerous Tissue on T2-weighted MR Imaging**

Ali B. Syed, MD, *Thomas Jefferson University Hospital, Philadelphia, PA*; Mahdi Alizadeh, PhD; Feroze B. Mohamed, PhD; Sandeep Deshmukh, MD

PURPOSE: Multiparametric prostate MRI (mpMRI) is an increasingly common diagnostic option in the evaluation of prostate malignancy. Our purpose was to examine the utility of texture analysis in differentiating between cancerous and non-cancerous transition zone (TZ) prostate tissue on T2 weighted images (T2WI).

METHOD AND MATERIALS: 8 patients of ages 57 to 75 were retrospectively identified for the study. These patients underwent mpMRI and proceeded to radical prostatectomy, after which whole mount *ex vivo* pathology was obtained. Histologic correlation was used to identify lesions on MRI that corresponded to prostate cancer (pCa) as defined by a final Gleason score of 3+3 or higher. Cancerous lesions as well as similar sized ROIs of non-cancerous tissue (nCa) were manually segmented. Texture features of these ROIs were computed using custom software written in MATLAB. First order features of mean, variance, skewness, kurtosis, and entropy were calculated from the source images. 16 second-order features were computed from a co-occurrence matrix in 4 directions (0, 45, 90 and 135 degrees) including contrast, homogeneity, correlation, and energy. High order wavelet-based textures were also computed in 3 directions (horizontal, diagonal and vertical). A *t*-test was used to compare mean texture values inside the pCa and nCa ROIs. *P* < 0.05 was considered statistically significant.

RESULTS: No significant differences were shown between pCa and nCa in first or second order texture features. High-order mean value of

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the wavelet map in the vertical (anterior-posterior) direction was significantly different between pCa and nCa ($p < 0.05$). Also, entropy value calculated from all wavelet components differed significantly between pCa and nCa ($p < 0.05$).

CONCLUSION: Our data suggest that the wavelet-based entropy feature in particular may be able to provide a quantitative cutoff that can aid in the diagnosis of pCa, and could serve as a quantitative imaging biomarker for TZ pCa. Additionally, these features may potentially be used in automated identification and segmentation of pCa, which is of interest given the increasing frequency of MRI-fusion biopsy.

(E-004) Wednesday • 7:00–8:00 AM • Hard-copy poster Readability of CT Abdomen and Pelvis Reports: Will Patients Understand?

Paul H. Yi, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; Sean Golden; John Harringa; Mark A. Kliewer, MD (*pyi10@jhmi.edu*)

PURPOSE: Although radiology reports have traditionally been written for referring clinical providers, patients are increasingly reading their radiology reports through electronic health record portals, which raises concerns about whether they can adequately comprehend these reports. The purpose of this study was to assess the readability of CT abdomen/pelvis reports.

METHOD AND MATERIALS: We reviewed 120 consecutive CT abdomen/pelvis reports at a single academic center (10 consecutive reports for each of 12 fellowship-trained abdominal imaging faculty). We assessed each article for readability using 5 quantitative readability scales: the Flesch-Kincaid (FK) grade level, Flesch Reading Ease, Gunning-Fog Index, Coleman-Liau Index, and the Simple Measure of Gobbledygook (SMOG). The number of reports with readability \leq the 8th grade level (average reading ability of US adults) and the 6th grade level (NIH-recommended level for patient education materials) were determined.

RESULTS: The mean readability grade level of the CT reports was greater than the 12th grade reading level for all readability scales. There was no significant difference in readability levels between different radiologists or based on number of years the radiologist had been in practice. No reports were written at or below the 6th or 8th grade levels.

CONCLUSION: CT abdomen/pelvis reports are written at a level too high for the average patient to comprehend, which may result in challenges for patients who are increasingly accessing their radiology reports through online medical records.

(E-005) Tuesday • 7:00–8:00 AM • Hard-copy poster Use of Standardized LI-RADS Templates is Dependent Upon Resident Involvement

Wesley Hatfield, BS, *University of Kentucky, Lexington, KY*; Andres R. Ayoub, MD; Matthew McCann, BS; Kristen McQuerry, PhD; James T. Lee, MD (*jtle3@uky.edu*)

PURPOSE: The aim of this study was to evaluate the effects of formal didactic lectures and the provision of dictation templates on utilization of the Liver Imaging Data and Reporting System (LI-RADS) in an academic radiology department.

METHOD AND MATERIALS: Outpatient abdominal CT and MR imaging reports from liver transplant clinic patients at increased risk of developing hepatocellular carcinoma (HCC) were selected for analysis. A didactic lecture on LI-RADS was given to providers, followed by the upload of standardized reporting templates with LI-RADS parameters. Reports prior to the lecture comprised Group A; reports after the lecture but before the templates comprised Group B; reports after the templates comprised Group C. Data on the utilization of LI-RADS were abstracted from the imaging reports. Data were analyzed with Chi-squared, Fisher's exact test, and multivariable logistic regression. All analyses were completed in SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS: 225 reports were included for analysis. The respective frequencies of LI-RADS use were 2.2% for Group A, 23.8% for Group B, and 60.7% for Group C (p -value < 0.0001). The multivariable logistic regression showed no significant change from Group B compared to Group A; there was a significant increase in LI-RADS use in Group C compared with Group A ($p = 0.0043$). Furthermore, odds ratio of use of LI-RADS for attending only dictation was 9179 (3.014, 27.955; 95% CI, $p < .0001$), suggesting resident involvement significantly lowered the use of LI-RADS.

CONCLUSION: Our results suggest that a lecture in isolation was ineffective at changing the reporting behavior of providers; however, upload of templates was associated with a significant increase in adherence to LI-RADS. Radiologists attempting to institute LI-RADS in CT and MR reporting in patients at risk for HCC would likely benefit by providing educational lectures and dictation templates. Radiologists at residency training programs should specifically target residents to improve utilization of standardized reporting.

(E-006) Wednesday • 7:00–8:00 AM • Hard-copy poster Abnormal Testicular Blood Flow in the Acute Scrotum: What the On-Call Overnight Radiology Resident Needs to Know

Dean W. Thongkham, MD, *Emory University, Atlanta, GA*; Gayatri Joshi, MD

LEARNING OBJECTIVES: Abnormal testicular blood flow in the setting of acute testicular pain is a common scenario in the Emergency Department, and can reflect ischemic, infectious, and/or traumatic etiology. Ultrasound is the initial modality of choice, and familiarity with the spectrum of sonographic findings of testicular torsion, epididymo-orchitis, and acute traumatic injury is crucial in both making the correct diagnosis and appropriately and efficiently directing management. Early, correct diagnosis is critical, as treatment for these entities differ significantly and delayed or incorrect treatment often results in diminished prognosis. Thus the aim of this exhibit is to prepare on-call Radiology residents to correctly identify the common causes of abnormal testicular blood flow in the emergent setting and to appropriately direct management. After reviewing this poster, the learner should be able to: 1. Demonstrate familiarity with the common etiologies for abnormal testicular blood flow in the setting of acute scrotal pain 2. List the differentiating clinical features between these etiologies and identify the key sonographic features of each entity 3. Discuss basic management concepts specific to each entity

CONTENT DESCRIPTION: This poster will: 1. Review the basic anatomy and vasculature of the scrotum 2. Illustrate the common causes of abnormal testicular blood flow in the setting of acute scrotal pain, including acute testicular torsion at various stages, acute epididymo-orchitis, and acute trauma, using a case-based approach 3. Discuss sonographic techniques to detect subtle cases of abnormal testicular blood flow 4. Highlight key distinguishing clinical and sonographic features of each culprit entity with a conceptual framework for making the correct diagnosis 5. Briefly discuss relevant pathophysiology and treatment of each entity, as applicable to the Radiology resident, to efficiently and appropriately direct management in the emergent overnight setting

(E-100) Tuesday • 7:40–7:55 AM • E-poster Station #4 Acute Gastric Dilatation: An Uncommon Cause of GI Tract Pneumatosis

Vaishali Kapare, MD, *Saint Vincent Hospital, Worcester, MA*; Ganesh Joshi, MD; Susana Candia, MD

LEARNING OBJECTIVES: Understand the pathophysiology and etiology of Acute Gastric dilatation. Review CT imaging features of this rare entity through case examples. Make radiologists aware of this diagnosis and differentiate it from more fatal conditions such as mesenteric ischemia and emphysematous gastritis.

CONTENT DESCRIPTION: Acute gastric dilatation (AGD) is an uncommon condition with an acute presentation. There are multiple

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etiologies for AGD described in literature including trauma, postoperative complications, eating disorders like psychogenic polyphagia, anorexia nervosa and bulimia, acute infections, emotional stress, and spinal deformities. Mechanical obstructions due to foreign body, tumor, pyloric stenosis, superior mesenteric artery compression syndrome, and small bowel obstruction can result in AGD. Diabetes mellitus and Parkinson's disease can be responsible for AGD due to a decrease in gastric motility. Due to gastric distension, intraluminal pressure increases leading to mucosal injury with resultant gas entering the gastric wall. Gastric pneumatosis is an uncommon location for gas in the bowel wall compared to small and large bowel. Gastric pneumatosis travels via perigastric and mesenteric veins to the portal veins in the liver. Portal venous gas is typically an ominous sign of bowel ischemia. Various etiologies are responsible for portal venous gas including mesenteric ischemia, digestive tract distension, gastric ulceration, ulcerative colitis, Crohn's disease, and complications related to endoscopic procedure. The foremost step in the management of AGD is urgent nasogastric tube decompression. Improvement of symptoms in most patients has been shown with partial decompression. This decompression is followed by fluid resuscitation and correction of electrolytes. Surgical intervention is required in cases with gastric perforation or infarction. Conclusion: Four radiologic findings including distended stomach, gastric pneumatosis, gas in gastric or mesenteric veins and portal gas were found in most cases. Computed tomography (CT) scan is the investigation of choice for diagnosis of AGD.

(E-101) Tuesday • 7:40–7:55 AM • E-poster Station #9 Polyembolokoilamania: Role of Imaging in Diagnosis and Management of This Rare Clinical Disorder

Puneet S. Kochar, MBBS, MD, *Yale New Haven Health Bridgeport Hospital, Bridgeport, CT*; Pranav Sharma, MBBS, MD; Ahmadreza Ghasemiesfe, MD; Harpreet Sawhney, MBBS, MD; Rami Sulaiman, MD (drkochar.puneet@gmail.com)

LEARNING OBJECTIVES: Polyembolokoilamania is a broad group of disorders in which patients insert foreign bodies into various body orifices which may be psychopathological or otherwise, leading to recurrent emergency room visits. Pictorial review of multimodality imaging of foreign bodies ingested / inserted. • Oral: Pen, razor blades, clips, metal wires, needles, rings, glass, screws, jewelry, sharpener razors, bra clips, hair clip, pen, metal coin, batteries, spring, etc. • Urethral / bladder: Pen, clips, crayons, knife base, fragments of intravenous tubing, injection site port, etc • Vaginal: Crayons, metal pin • Rectal: Pen, crack pipe, comb 3. Correlation with photos from therapeutic procedures including UGI endoscopy, proctosigmoidoscopy, colonoscopy and cystoscopy.

CONTENT DESCRIPTION: Polyembolokoilamania is a disorder of inappropriate foreign body insertions into various natural body orifices. This leads to recurrent emergency room visits. In some cases, these are urological or GI emergencies which need urgent intervention by subspecialty. Imaging plays a key role in identifying the foreign bodies and associated complications and finally guiding appropriate management. Post emergency intervention, a holistic approach to management is crucial, which not only includes infection prevention, minimization further injury, analysis more sinister underlying injury, monitoring delayed complications; but also, thorough evaluation of motivation and psychosocial issues, to prevent future episodes.

(E-102) Wednesday • 7:00–7:15 AM • E-poster Station #6 Hernias Made Easy: The Trainee's Guide to Diagnosing and Differentiating Abdominopelvic Hernias

John D. Millet, MD, *Michigan Medicine, Ann Arbor, MI*; Kushal Parikh, MD, MBA; Suzanne T. Chong, MD; Ashish P. Wasnik, MD

LEARNING OBJECTIVES: At the conclusion of this activity, the learner will be able to: • Recognize and characterize classic external and internal hernias in the abdomen and pelvis • Identify key anatomic landmarks used to differentiate similar abdominopelvic hernias • Describe complications of abdominopelvic hernias that impact patient management

CONTENT DESCRIPTION: Background: Accurately identifying and differentiating abdominopelvic hernias can pose a significant diagnostic challenge to radiology trainees. Contrast-enhanced multidetector computed tomography (MDCT) is the modality of choice for detecting and characterizing abdominopelvic hernias. This educational exhibit reviews the MDCT appearance of classic abdominopelvic hernias with an emphasis on key anatomic landmarks used for differentiation and critical imaging findings that can impact patient management. **Content:** Classic external and internal abdominopelvic hernias are reviewed including inguinal, femoral, Spigelian, obturator, paraduodenal, and foramen of Winslow hernias. Classification by anatomical location and landmarks used for differentiation are reviewed, including key relationships to adjacent structures and/or internal foramen. Similar appearing hernias are clearly differentiated, including indirect vs. direct inguinal hernias, inguinal vs. femoral hernias, left vs. right paraduodenal hernias, and paraduodenal vs. foramen of Winslow hernias. Primary and secondary imaging findings at MDCT are highlighted. Key terminology (e.g. strangulation vs. incarceration) is defined and critical findings relevant to treatment, particularly those that indicate complications such as bowel compromise, are discussed. **Summary:** Knowledge of abdominopelvic hernias and their key imaging findings is essential for the radiologist in training. Understanding these complex entities is necessary in order to facilitate timely recognition, provide an accurate diagnosis, and direct optimal clinical management.

(E-104) Wednesday • 7:40–7:55 AM • E-poster Station #6 Peritoneal Disease: Beyond the Expected Locations and Malignancies

Udit Rawat, MD, *University of Virginia Health System, Charlottesville, VA*; Arun Krishnaraj, MD; Jason N. Itri, MD, PhD (uditrawat1087@gmail.com)

LEARNING OBJECTIVES: 1. Discuss normal anatomy and fluid circulation of the peritoneum 2. Develop a structured method to evaluate for peritoneal disease guided by principles of anatomy 3. Identify uncommon locations of peritoneal disease 4. Recognize the potential of peritoneal disease with primary malignancies that do not commonly present with peritoneal spread

CONTENT DESCRIPTION: 1. Peritoneal anatomy and normal fluid circulation 2. Common locations of peritoneal disease illustrated with case examples 3. Uncommon locations of peritoneal disease illustrated with case examples 4. Peritoneal disease in primary malignancies that do not commonly present with peritoneal spread illustrated with case examples

Cardiopulmonary

(E-009) WITHDRAWN

(E-010) Wednesday • 7:00–8:00 AM • Hard-copy poster Pictorial Presentation of Chest Tube Complications

Shamima Y. Ahmed, BS, *University of Cincinnati, Cincinnati, OH*; Carl C. Flink, MD (sahmed6@neomed.edu)

LEARNING OBJECTIVES: Chest tube placement is a crucial procedure for pneumothorax, pleural effusions, hemopneumothorax, bronchopleural fistula or tension pneumothorax. It proceeds without issue; however, serious complications can occur. Chest radiography has a relatively low yield when evaluating for said complications. CT chest +/- contrast, on the other hand, can provide all the information necessary to evaluate issues with chest tube placement. This article is to increase the awareness among the clinicians as well as the budding Radiologists about the potential complications of chest tube. This can also help decrease in comorbidity and mortality.

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CONTENT DESCRIPTION: Active extravasation: Intercostal arteries run along the inferior border of each rib, making it vulnerable during a chest tube placement. A significant arterial injury can lead to active extravasation with risk of significant morbidity and mortality. Malposition of the chest tube: If the chest tube is not inserted properly, there will be inadequate drainage. Knowing the anatomy of the pleura is important for a chest tube placement. Pneumomediastinum: When a chest tube is advanced too far; it can injure or pass through the visceral and parietal pleura overlying the mediastinum resulting in pneumomediastinum. In severe cases, the resultant mediastinal air can compress the adjacent vascular structures resulting in hemodynamic instability. Pneumopericardium: Chest tube can increase morbidity if not properly positioned. If it extends into the pericardium, morbidity increases rapidly. Scrotal insuflation: Per Jones et.al, subcutaneous emphysema can also be a complication from inadequate chest tube drainage. In extreme cases, it can extend up to the scrotum causing scrotal insuflation. Angio catheter malposition: During the emergent situation, angio cath is used for tension pneumothorax. If the catheter is not positioned properly, it can manifest as life threatening complications including cardiovascular injury. Intraabdominal injury: Although the malposition of the chest tube into the abdominal cavity is rare, however, it can cause visceral injury and eventual morbidity.

**(E-011) Tuesday • 7:00–8:00 AM • Hard-copy poster
Evaluation of the Lateral Chest Radiograph**

Ariel L. Bailey, MD, *West Virginia University, Morgantown, WV*; Lana B. Winkler, MD (*arbailey@hsc.wvu.edu*)

LEARNING OBJECTIVES: After reviewing this presentation, the learner should be able to: 1. Discuss normal cardiothoracic anatomy on the lateral chest radiograph, including the diaphragms, fissures, bronchi, pulmonary arteries, as well as cardiac contours and location of the cardiac valves; 2. Evaluate the retrosternal, retrocardiac, and retrotracheal air spaces to determine if a space-occupying lesion is present, which may not always be visible on the PA/AP view; 3. Assess the osseous structures and upper abdomen for commonly-encountered abnormalities.

CONTENT DESCRIPTION: Although the frontal chest radiograph is thought of as the primary view and workhorse of chest imaging, the lateral chest radiograph remains a vital component of the diagnostic imaging evaluation of the chest. The lateral chest radiograph is used less frequently and therefore presents more of a challenge to diagnostic radiologists. Our presentation will guide both beginner and experienced radiologists, as well as referring physicians, on accurate interpretation of the lateral chest radiograph.

**(E-105) Tuesday • 7:20–7:35 AM • E-poster Station #2
The Basics of Clinical Cardiac MRI: A Primer for
Radiology Residents**

Ryan S. Dolan, MD, *Emory University, Atlanta, GA*; Frederic J. Bertino, MD; Peter Filev; Zaid Said; Brent P. Little, MD; Arthur E. Stillman, MD, PhD; et al (*rsdolan@emory.edu*)

LEARNING OBJECTIVES: 1. Introduce the basics of cardiac MRI (CMR) acquisition and techniques with an emphasis on clinical relevance. 2. Examine normal cardiac anatomy in short and long axis orientations throughout the heart using multiple CMR techniques, as well as correlation with echocardiography. 3. Apply multiple CMR techniques to evaluate several example cases of common indications for CMR.

CONTENT DESCRIPTION: Introduction: Use of cardiac MRI (CMR) in clinical practice is increasing for diagnosis and monitoring of many cardiovascular diseases, including myocardial infarction, nonischemic cardiomyopathies, valvular disease, cardiac masses, congenital heart disease, and acute rejection post-transplant. CMR is unique in its capacity to evaluate subtle structural and functional change throughout the entire heart, as well as characterize abnormalities in blood flow. Despite its increasing use and diverse clinical utility, radiology residents have limited exposure to cardiac MRI during residency, and experience with CMR is usually reserved for radiologists and cardiologists with fel-

lowship training in cardiovascular imaging. Our goals are 1) to provide a clinically-relevant primer of CMR techniques and anatomy and 2) to evaluate several common example cases to improve resident comfort with CMR. **Methods:** We will create an educational exhibit consisting of three parts: 1) an introduction to the basics of CMR acquisition (indications, contraindications, gating, post-processing) and techniques (cine, stress, LGE, tissue characterization/mapping, functional, perfusion, flow), 2) a review of normal cardiac anatomy using different short and long axis images throughout the heart in multiple techniques (with correlation to echocardiography images), and 3) several example cases radiologists would be most likely to encounter in clinical practice (myocardial infarction, acute rejection, amyloidosis, valvular disease, etc). **Conclusion:** Even though CMR is complex due to its numerous techniques and complicated post-processing, a basic understanding of cardiac anatomy and underlying cardiac properties highlighted by each technique allow radiology residents to interpret common cardiac diseases.

Education of Medical Students

**(E-012) Wednesday • 7:00–8:00 AM • Hard-copy poster
You Want A Piece of Me? The Benefits and Faculty
Resource Cost of Medical Student Recruitment**

Christine M. Peterson, MD, *Pennsylvania State Medical Center, Hummelstown, PA*; Jeanine Beatty-Chadha, MEd; Janet A. Neutze, MD; Alison L. Chetlen, DO; Pamela L. Brian, MD; Joseph S. Fotos, MD (*cpeterson3@pennstatehealth.psu.edu*)

LEARNING OBJECTIVES: Learners will learn about different strategies for medical student recruitment into radiology that have dramatically improved Penn State medical student interest in our specialty over the past few years; learners will be familiar with the costs to the faculty involved in medical student recruitment in terms of resources such as time, networking with other faculty and staff, time away from clinical duties, and energy for innovation.

CONTENT DESCRIPTION: As a result of increasing medical student recruiting/advising efforts, Penn State has seen a dramatic increase in the number of medical students who seek residency positions in either diagnostic or interventional radiology. Some recruiting efforts include education and mentoring of high school students and college students, usually on an informal one-on-one shadowing basis. There is, of course, education and mentoring of medical students, as early as their first year with radiology-rich gross anatomy instruction and continuing on in required clerkships, such as internal medicine and surgery, as well as in dedicated radiology electives. The faculty also provide early exposure of medical students to our specialty through career fairs and radiology 'open houses'. These efforts, in particular those that result in exposure to the field of radiology early in medical school, have substantially increased both medical student awareness of the specialty and medical student pursuit of graduate education in radiology. However, it is prudent to understand the cost in terms of faculty resources. Faculty time for teaching, grading, curriculum development, mentoring, as well as other activities centered around student education/mentoring must be realistically considered.

**(E-014) Wednesday • 7:00–8:00 AM • Hard-copy poster
Impact of Early Radiology Research Experiences on
Medical Student Perceptions of Radiology and Research:
A Pilot Study**

Preya Shah, MS, *University of Pennsylvania, Philadelphia, PA*; Mike Sheng; David A. Mankoff, MD, PhD*; Scott O. Trerotola, MD*; Maya Galperin-Aizenberg; Arun C. Nachiappan, MD (*preya@pennmedicine.upenn.edu*)

PURPOSE: To promote opportunities for medical students to gain early exposure to radiology and research, our institution has initiated programs which fund summer radiology research projects for rising second year medical students. Our study assesses the impact of these faculty-mentored summer research experiences on medical student perceptions of radiology and research, in terms of both knowledge and interest.

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METHOD AND MATERIALS: A voluntary, anonymous survey was administered to students both before and after the six-week research period in summer 2017. Both the pre-survey and post-survey included 31 7-point Likert-scale questions (1 = strongly disagree; 7 = strongly agree) to evaluate students' perceptions in four categories: (i) perceived knowledge of radiology as a specialty, (ii) interest in radiology, (iii) perceived knowledge of research skills, and (iv) interest in research. Faculty mentors were sent an analogous post-summer survey that included an evaluation of their student's research skills. Wilcoxon signed-rank tests were used to determine significance of differences between the students' pre- and post-survey category-averaged responses, and Mann-Whitney U tests were used to determine significance of differences between student and mentor responses.

RESULTS: 9/11 (82%) students and 10/11 (91%) mentors completed the surveys. Students' perceived knowledge of radiology improved ($p=0.017$) between the pre-survey (5.19 +/- 0.97) and post-survey (5.88 +/- 0.75). Similarly, there was an increase in students' perceived knowledge of research skills ($p=0.021$) between the pre-survey (5.18 +/- 0.76) and post-survey (5.92 +/- 0.60), with no significant difference between student post-survey responses and mentor responses (6.26 +/- 0.59). Initial student interest was high for both radiology (5.60 +/- 0.57) and research (5.07 +/- 1.15), and was maintained over the course of the program.

CONCLUSION: Our pilot study suggests that summer research experiences can improve knowledge of radiology and research among medical students. Further evaluation of these programs over several years will allow us to maximize benefit to medical students and bolster interest in academic radiology.

(E-015) Tuesday • 7:00–8:00 AM • Hard-copy poster IR Interest Group Creation Made Ridiculously Simple (...and quick)

David Maldow, MD, *University of Rochester Medical Center, Rochester, NY*; Devang Butani, MD

LEARNING OBJECTIVES: At the conclusion of this submission, participants will understand the components of an Interventional Radiology Interest Group (IRIG) and the benefits to starting one in medical school. In a stepwise approach, participants will learn how to efficiently build an IRIG, including selection of board members, planning educational activities and recruitment of members. Participants will also learn about opportunities to take their IRIG to the national level, which includes the development of a regional medical student symposium.

CONTENT DESCRIPTION: The content of this educational poster will be focused on simplifying the process of starting an IRIG. There are many components to its creation and a stepwise approach will help students quickly organize the process and start one at their medical school. This starts with identifying a supportive faculty member and engaging residents and fellows to serve as advisors. A board of medical students must be established with clearly delineated positions (e.g., Chair, Communications Chair, Events Coordinator etc). Planning of activities throughout the year should reflect a mixture of educational talks such as Q&A sessions with more hands-on activities demonstrating the different IR devices and techniques used. Recruitment of medical students through various communication channels is critical and options for maximizing participation in the medical student body will be discussed. Challenges to implementation and strategies for success will be addressed during each step of the process.

(E-016) Wednesday • 7:00–8:00 AM • Hard-copy poster IR Primer: A Multi-center Medical Student Education Initiative

Chandresh Shah, MD, *University of Louisville, Louisville, KY*; Cameron Ghazi; Qiong Han, MD, PhD; Harit Kapoor, MD; Gaby E. Gabriel, MD; Douglas M. Coldwell, MD, PhD; et al (*cnshah01@louisville.edu*)

LEARNING OBJECTIVES: 1) Demonstrating how a single-day medical student fair developed with collaboration between faculty and residents from multiple university programs can help in encouraging interest in

the field of interventional radiology among students in different years of medical school. We aim to set an example which other centers can emulate to promote and encourage interest in the field. 2) Introducing new developments in Interventional Radiology through an interactive curriculum using combination of didactic lectures and hands-on skill labs and demonstrations. 3) Spreading awareness among applying medical students about the new ACGME accredited DR-IR Residency and ESIR pathways in Radiology.

CONTENT DESCRIPTION: The Universities of Cincinnati, Kentucky, and Louisville partnered to develop a Medical Student Radiology Fair for the first time. We invited medical students from all three schools to come and learn more about the fields of Diagnostic and Interventional Radiology. They were subdivided into smaller groups to facilitate participation and interaction with faculty and residents. Content will include: Introduction discussing growing field of Interventional Radiology with development of new residency pathways (DR-IR, ESIR, and fellowship) and increasing medical student interest in the field. Discuss how we conducted the medical student fair including how we collected expired equipment and models for our hands-on sessions and display multiple pictures from our set-up at the event. Discuss how open question and answer sessions between medical students and faculty were conducted after each hands on session to help answer questions on various topics including work life balance, research opportunity and work satisfaction in Interventional Radiology. Questions on the changes including role of radiologists with increasing use of artificial intelligence, gender bias in IR and "turf-war" between interventional subspecialty procedures were among the many relevant questions posed by medical students. Finally, a section discussing how such a collaboration between institutions can be mutually beneficial to medical students and even residents and attendings alike.

AUR Trainee Prize: 3rd Place

(E-017) Tuesday • 7:00–8:00 AM • Hard-copy poster Introduction to the Radiology Profession: The Effect of Early Exposure on Medical Student Interest and Perception of the Field

Daniella Asch, MD, *Yale University, New Haven, CT*; Mahan Mathur, MD (*Daniella.asch@gmail.com*)

PURPOSE: To examine the effect of early exposure to radiology on understanding and perception of the profession for first year medical students.

METHOD AND MATERIALS: All 104 first year medical students at our institution participated in an "introduction to the profession" radiology course during the first 1-2 weeks of the academic year. They first participated in one of the following small group activities for one hour: ultrasound scanning, reading room, radiology lecture, or a radiology game show. All students then participated in an interventional radiology session which involved a combination of didactics and hands-on familiarization with different IR devices. The course concluded with a radiology panel, comprised of a variety of attendings and residents. Survey participation was optional. A pre-course survey assessed understanding of and interest in radiology (using a 5-point Likert scale), and asked students to describe what they believe a radiologist does during a typical work day. A post-course survey included the same questions as the pre-course survey, as well as evaluations of each individual session on a 5-point Likert scale. This survey also included open-ended questions about the utility of the course and areas for improvement, as well as a question asking the students how their perception of radiology has changed.

RESULTS: Response rate was 88% for the pre-course survey and 92% for the post-course survey. The average score for each of the sections was as follows: game show (4.8), reading rooms (4.5), US scanning (4.5), lecture (4.4), IR (4.5), and panel (4.7). Comparing the pre- and post-course surveys, there was a significant increase in understanding of the profession (2.3 vs 3.8), level of interest in

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radiology (2.8 vs 3.2), and perceived patient contact for both diagnostic (2.3 vs 3.0) and interventional radiologists (4.0 vs 4.7), $p < 0.001$ for all questions.

CONCLUSION: Early exposure to radiology resulted in a significantly increased level of interest in and understanding of the profession. Although further follow-up is necessary to determine if interest persists throughout medical school, this increased understanding can improve the perception of radiology and enhance interdisciplinary relations.

(E-018) Wednesday • 7:00–8:00 AM • Hard-copy poster Medical Student Experience in a Hybrid (Academic-Private) Program: An Institutional Perspective

Jennifer E. Caero, MD, *Baylor University Medical Center at Dallas, Dallas, TX*; Umesh D. Oza, MD; Joseph V. Philip, MD

LEARNING OBJECTIVES: 1. Recognize the unique challenges and opportunities for medical student education that occur in a hybrid practice setting. 2. Discuss methods used to integrate medical students into a hybrid practice setting, including rotations through radiologic subspecialties, participation in noon conference, and dedicated didactic sessions. 3. Appreciate the utility of allowing students to dictate reports in providing a more hands-on experience for students interested in pursuing radiology as a career.

CONTENT DESCRIPTION: Our hybrid academic-private practice setting serves as a high volume, subspecialized practice that facilitates resident and medical school education. Our institution now hosts approximately 50 medical students yearly for a radiology core curriculum, and provides a dedicated elective for those pursuing a career in radiology. This setting presents the challenge of balancing medical student education with the realities of private practice, including high volumes and turn-around times. We have developed a unique medical student curriculum oriented toward teaching students to interpret basic radiologic findings, recognizing study indications and relative cost, and focused on providing those interested in a radiology residency firsthand experience through access to the PACS and dictation software. Under staff supervision, these students are given the opportunity to dictate radiologic studies with immediate feedback. This hands-on experience solidifies their newly acquired knowledge and further informs their decision to pursue radiology. Our students have one-on-one interactions with residents and subspecialized attendings, with exposure to both inpatient and outpatient imaging. These interactions shed light on the practice setting of a large subspecialized group. Students participate in dedicated didactic sessions with their peers, and attend resident noon conferences focused on image interpretation, the business perspective of radiology, and medical ethics. Online modules, including MedU's case based online radiology education (CORE) are utilized. This multifaceted teaching approach fosters a basic understanding of radiology, which can be applied to future practice.

(E-019) Tuesday • 7:00–8:00 AM • Hard-copy poster Testing a New Method of Teaching Musculoskeletal Anatomy & Radiology to First-Year Medical Students

Tawnee Sparling, MD; Neal Rubinstein, MD, PhD; Paul J. Niziolek, MD; Ronnie Sebro, MD, PhD; Arun C. Nachiappan, MD, *Hospital of the University of Pennsylvania, Philadelphia, PA* (arun.nachiappan@uphs.upenn.edu)

PURPOSE: There is an opportunity to enhance musculoskeletal anatomy education for first-year medical students. The purpose of our study is to assess novel round robin sessions using MRI, radiographs, ultrasound and physical exam skills as a new educational method.

METHOD AND MATERIALS: Initial survey data was collected from clinical faculty ($n=50$) and medical students at our institution (second, third and fourth year students, $n=630$), as well as medical gross anatomy course directors nationwide ($n=176$). New teaching methods were developed from survey results for the 2016 gross anatomy course MSK block, specifically round robin sessions focused on the knee and shoulder joints. Each was formatted into four thirty-minute sections:

radiology, ultrasound, physical exam and injuries. The radiology section introduced students to X-rays and MRIs, and students spent hands-on time scrolling through cases on OSIRIX. Physician preceptors from various specialties proctored each session. Retrospective first-year medical student ($n=149$) satisfaction surveys were conducted upon completion of the course.

RESULTS: The non-cadaveric, non-lecture teaching modalities most commonly used by gross anatomy courses nationwide (response rate 30.7%, $n=54/176$) were in-person radiology sessions (64.8% of programs) and physical exam demonstrations (46.3%). Our institutional faculty (response rate 48%, $n=24/50$) reported poor student performance in interpreting MSK radiology (mean 2.42 on a 1-5 scale, sd 0.84). MSK-specific first-year medical student surveys (response rate 26.2%, $n=39/149$) showed an average overall satisfaction with the MSK block of 3.58 (sd 0.98) compared to the average of 3.36 (sd 0.98) reported by medical students who had taken anatomy in prior years (response rate 20%, $n=126/630$). This slight increase was not statistically significant (one tailed $p=0.12$). The shoulder and knee round robins received a mean satisfaction score of 4.59 (sd 0.74) and 4.62 (sd 0.68), respectively.

CONCLUSION: Novel round robin sessions that include MRI, radiographs, ultrasound and physical exam skills are an effective new educational method to teach musculoskeletal anatomy and radiology to first-year medical students in the gross anatomy course.

(E-020) Wednesday • 7:00–8:00 AM • Hard-copy poster The Modified Barium Swallow: Assessment of Radiology Resident and Speech Language Pathologist Attitudes about an Increasingly Common Fluoroscopic Study

John Hohenberger, MD, *Medical University of South Carolina, Charleston, SC*; Jonathan Poirier, DO; Kendrea Garand, PhD; Madelene C. Lewis, MD; Kate Humphries, MS; Douglas H. Sheafor, MD*; et al (sheafor@muscc.edu)

PURPOSE: The purpose of this study was to evaluate attitudes of Radiology residents and Speech Language Pathologists (SLPs) about the clinical and educational value of the modified barium swallow (MBSS) at a tertiary referral center.

METHOD AND MATERIALS: Using an anonymized survey, 36 radiology residents (PGY2-5) and 13 SLPs were surveyed about performance of MBSS in clinical practice and during residency training. No resident had formal MBSS instruction prior to study inclusion. Surveys were performed at the beginning of the academic year thus limiting PGY2 resident practical experience as well. MBSS was performed using a standardized 17 component protocol (MBSImP), including an esophageal sweep. Exams were performed collaboratively with an SLP and Radiology resident.

RESULTS: SLPs are least comfortable interpreting the ES and most (84%) desire radiologist input in its interpretation. Residents are also least comfortable interpreting the ES. Compared to upper level residents, PGY2s reported lower comfort levels performing and interpreting MBSS, including diagnosing esophageal abnormalities ($p < 0.01$). Compared to PGY2s, PGY3-5 residents (regardless of desired fellowship) reported less value of radiologist participation in MBSS, less educational value of MBSS, and less desire to perform future MBSS ($p < 0.0005$). 100% of the PGY2 residents thought MBSS important for future practice, compared to 19% of PGY3-5 residents ($p < 0.00001$). While residents at all experience levels valued the clinical relevance of MBSS, importance was rated 33% lower than their SLP counterparts ($p < 0.005$). Confidence in performing MBSS, interpreting findings (including diagnosis of esophageal abnormalities), and ratings of clinical importance of MBSS did not vary significantly among SLP's, regardless experience level.

CONCLUSION: Current MBSS practice at our tertiary referral center leaves significant room for improvement if the goal is to educate radiologists who view the MBSS as a valuable residency learning tool and a rewarding exam for future practice. Additional studies designed to

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find meaningful ways to add educational value for Radiology residents who perform MBSS are needed given the broad clinical impact and increasing use of MBSS.

**(E-021) Tuesday • 7:00–8:00 AM • Hard-copy poster
Incorporating Radiology into the Undergraduate Medical
School Preclinical Team Based Learning Curriculum**

Kristen A. Bishop, MD*, *University of Texas Southwestern, Dallas, TX*; Janine Prange-Kiel, PhD; Alisa Winkler, PhD; Julie Champine, MD (kristen.bishop@utsouthwestern.edu)

LEARNING OBJECTIVES: 1) Define the purpose and advantages of team based learning 2) List the components of a team based learning module 3) Explain how the team based learning module can be applied to a large preclinical medical school class 4) Describe how radiology can be incorporated into the preclinical team based learning modules

CONTENT DESCRIPTION: Working in groups is considered imperative for medical students to prepare for collaborating in interprofessional teams as a physician. There is also a current emphasis on case based learning and testing critical reasoning skills rather than rote memorization. For these reasons, some medical schools have incorporated team based learning (TBL) modules into their curricula. TBL is a standardized method of active learning with multiple small groups working simultaneously through problem based scenarios. A TBL module typically contains preparation material the student completes before the session, readiness assessments completed at the beginning of the session, and the session itself focused on applying knowledge gained in the previous steps. Through a collaboration of human anatomy faculty and clinical radiology faculty, we designed a TBL module for the thoracic anatomy unit for a large class of 230 first year medical students. The students studied multimedia resources such as books, live lectures, instructional videos, and cadaver dissection in preparation for the session. The students took both individual and group readiness assessment tests (iRAT and gRAT) based on the preparatory material. During the TBL session, the students applied anatomic and radiologic knowledge to clinical case scenarios of pneumothoraces requiring needle decompression and thoracostomy tube placement. Post-course surveys demonstrated up to 95.2% of students agreed/strongly agreed that the radiologic anatomy TBL module added value to their learning experience.

**(E-022) Wednesday • 7:00–8:00 AM • Hard-copy poster
RADFLICKs - Three Institution Combined Medical
Student Fair : A Collaborative Experience Using the
AUR Medical Student Expo Tool Kit**

James T. Lee, MD, *University of Kentucky, Lexington, KY*; Lily L. Wang, MBBS, MPH; Tracy L. Van Meter, MD; Carl C. Flink, MD; Brittany Johnson Schulz, MD; Paul J. Spicer, MD; et al (jtlee3@uky.edu)

PURPOSE: Our primary aim was to promote radiology as a subspecialty to medical students surrounding 3 regional academic radiology departments. Our secondary aim was to evaluate perceptions of attendees prior to and after medical student fair. Our tertiary aim was to identify potential areas of improvement for future meetings.

METHOD AND MATERIALS: Three academic radiology residency programs separated by less than 100 miles combined resources to hold a medical student expo following the template provided by the AUR tool kit found at <http://www.aur.org/medical-student-expo-tool-kit/> Planning began 10 months prior to the event with extensive e-mail communication, web-meetings, and in person meeting at AUR annual meeting in Hollywood, FL Survey of medical students was performed before and after the event for quality improvement purposes

RESULTS: 7 hour event was held on August 18, 2017 22 Faculty, 7 Staff, and 16 volunteers participated in the event 58 medical students from 5 different medical schools participated Morning lectures, noon time interactive cases and games, and afternoon workshops were provided Prizes, T-shirts, and ACR “swag” bag with goodies were provided Sample survey results from RADFLICKs: Question: Does your

medical school require you to do a dedicated radiology rotation? Yes: 6%, No: 94%. Question: Do you have any concerns about choosing radiology as a profession with increasing utilization of Artificial Intelligence? 50% moderate concern prior, 20% moderate concern after

CONCLUSION: The AUR Medical Student Expo Tool Kit provides a robust template for radiology residency programs to encourage medical students to explore a career in radiology. Collaboration between regional residency programs allows for sharing of limited resources including faculty, staff and volunteers. Medical students perceptions about radiology are altered before and after medical student expo Medical students enjoyed hands-on workshops, opportunities to network, and Program Director/Assistant Program Director question/answer panel Feedback from medical students provide invaluable insight into improvement for future regional fairs

**(E-024) Wednesday • 7:00–8:00 AM • Hard-copy poster
The New Interventional Radiology Recruiting Paradigm:
Interventional Radiology Master Craftsmen Seek to
Engage the Medical Apprentice, While Continuing to
Train and Recruit the Diagnostic Radiology Journeyman**

Allene S. Burdette, MD, *Penn State University Hospital/Hershey Medical Center, Hershey, PA*; Janet Neutze, MD

LEARNING OBJECTIVES: Describe the three Interventional Radiology training pathways Recognize factors medical students consider while selecting their future specialty Identify processes and implement educational experiences that capitalize on these factors to attract medical students to interventional radiology

CONTENT DESCRIPTION: Interventional Radiology (IR) was recognized as a specialty by the American Board of Medical Specialties in 2012. With this change came three new pathways for training the Interventional Radiologist: the Integrated IR Residency, Early Specialization in IR (ESIR) and the Independent IR Residency. These pathways require Masters of the Interventional Radiology Guild to begin recruiting the Medical Student Apprentice who brings basic medical skills, limited Radiology experience and a desire to learn, while continuing to recruit the Journeyman Diagnostic Radiology resident. Research indicates that familiarity with a specialty early in medical school increases the likelihood a student will choose it as their future career. Medical students (MS) consider various factors as they select their specialty. It is critical to utilize these factors as we expose students to IR. These factors include early exposure to the specialty, working with specialty-specific mentors and positive training experiences. Because IR is so subspecialized, most students do not learn about it until their clinical rotations. Initial efforts required the establishment of an identity distinct, but not separate from Diagnostic Radiology. This included the creation of an IR Medical Student Interest Group for early exposure and IR-focused electives to provide in-depth experiences. Moving forward, by refining existing educational and outreach offerings as well as creating new ones, we will introduce IR to MS early in the education and career decision making process. Thereafter, providing opportunities throughout medical school for mentorship, research and positive educational and training experiences, will encourage the pursuit of IR as a career. This presentation will show the existing, recently established and future endeavors for exposing medical students to Interventional Radiology early and often.

**(E-025) Wednesday • 7:00–8:00 AM • Hard-copy poster
How Does the Current Generation of Medical Students
View the Radiology Match? An Analysis of the Aunt
Minnie & Student Doctor Network Online Forums**

Paul H. Yi, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; Sherwin Novin; Taylor Vander Plas; Eric Huh; Donna Magid, MD, MEd (pyi10@jhmi.edu)

PURPOSE: The Aunt Minnie (AM) and Student Doctor Network (SDN) online forums are popular resources for medical students applying to residency. However, no study has evaluated either forum for medical

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student concerns regarding applying to radiology. The purpose of this study was to describe medical student radiology-related posts on AM and SDN to better understand the medical student perspective on the application and Match process.

METHOD AND MATERIALS: We reviewed all posts made on the AM and SDN online forums dedicated to medical students over 5 consecutive application cycles from July 2012 to July 2017. Each thread was organized into 1 of 6 major categories. We quantified the forum utilization over the past 5 years by total number of threads posted and the most frequently posted and viewed thread topics.

RESULTS: We reviewed 2683 threads with 5,723,909 views. Total number of threads posted and viewed fell by 46% and 63% during 2013-2014, after which they returned near baseline, along with concomitant increase in interventional radiology (IR)-related posts between 2012-2013 (13%) and 2016-2017 (32%). The most common application-related topics were pre-application and program ranking advice (approximately 20% of all threads and views). Surprisingly, many posts were related to post-interview communication with residency programs (2% of all posts and views). Two peaks in viewership and thread posting activity were observed in September and March of each year, coinciding with the residency application submission and Match rank list submission deadlines, respectively.

CONCLUSION: Apart from a drop in 2013-2014, utilization of AM and SDN has steadily increased over the past 2 years, concomitant with increased interest in IR. Addressing the concerns identified in our study, especially in preparing residency applications and ranking programs, as well as navigating difficult situations such as post-interview program communication, may help improve the radiology application process for future medical students.

(E-026) Wednesday • 7:00–8:00 AM • Hard-copy poster Radiology Residency Interview Invitations and Dates: What Should a Medical Student Expect?

Paul H. Yi, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; Ross Liao; Patrick Young; Andrew Lee; Ferdinand K. Hui, MD* (pyi10@jhmi.edu)

PURPOSE: Similar to other competitive fields, scheduling diagnostic radiology (DR) residency interviews may be a challenge with potentially few interview dates per program and likely interview date conflicts. The purpose of this study was to identify DR residency interview date patterns and potential scheduling conflicts.

METHOD AND MATERIALS: We reviewed an online thread of DR residency interview dates posted during the 2012-2013 through 2016-2017 application seasons on the publicly available, anonymous Student Doctor Network online forum. Anonymous medical student users regularly updated this thread with residency interview dates, as well as the day that an interview invitation was offered. We reviewed all programs for date of initial interview offer, number of interview dates, and the month and day of the week of the interview date. We also calculated the number of overlapping interview days for the top 30 programs as ranked by Doximity to determine theoretical scheduling conflicts for a medical student interviewing at the top-ranked programs.

RESULTS: There was an average of 153 programs whose interview dates were listed each application season. Initial interview offers were sent predominately in October (60%) and September (44%), with only 9% and 1% of programs sending invitations in November and December, respectively. On average, each program offered 9 interview dates (range 1 to 46). The most common months for interviews were November and December, followed by October and January. There was an average of 1069 total interview dates for 153 programs. The interviews were spread relatively evenly between the weekday (Monday through Friday) with very few interviews held on weekends. Of the top 30 Doximity-ranked programs, 32 interview slots had at least one overlapping interview slot.

CONCLUSION: The majority of DR residency interviews are initially offered in September and October, with most held in November and December on a weekday. Although most programs offer several inter-

view dates, there is considerable overlap with potential for scheduling conflicts. Our findings can help set expectations for medical students regarding residency interview invitations, as well as strategy for scheduling interviews.

(E-027) Tuesday • 7:00–8:00 AM • Hard-copy poster Simulation in Radiology Medical Education: Moving Rotations beyond Passive Observation

Jason K. Locke, MD, *University of Florida College of Medicine, Gainesville, FL*

PURPOSE: Create and evaluate a medical student curriculum that provides opportunities for active participation by medical students on the radiology rotation, including simulation of radiology workflow.

METHOD AND MATERIALS: The educational curriculum for the simulation, which was designed by a core group of educational faculty, included basic milestones for radiology training adapted to medical students. These milestones included selection of appropriate testing, communication and professionalism, and medical knowledge. The three activities utilized were the following: clinical scenario evaluation for exam selection, correlative case presentation, and radiology plain film simulation.

RESULTS: At our institution, medical students on the radiology rotation were provided these activities over the current period of two years. Initial rotation feedback to the department shows that students appreciate the autonomy obtained during the simulation and have an increased perspective into the field of radiology. There has been an increase in the number of medical students enrolling on the elective radiology rotation and in those applying to radiology for residency.

CONCLUSION: Medical student radiology rotations are traditionally based on observation with few opportunities for student participation, role playing, or exploring the elements of a radiology residency. Many tools and educational methods exist to increase interaction in medical education. Simulation, which is already used in many radiology residencies, can help to provide autonomy to medical students and increase their perspective on the field of radiology. Although there is an initial investment in logistics, introducing simulation allows medical students to explore radiology in a novel, interactive way. Therefore, students can better determine if radiology is the right specialty pathway for them.

(E-028) Wednesday • 7:00–8:00 AM • Hard-copy poster Evaluation of Diagnostic Radiology Residency Websites

Paul H. Yi, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; Eric Huh; Sherwin Novin; Taylor Vander Plas; Donna Magid, MD, MEd (pyi10@jhmi.edu)

PURPOSE: Maintaining a complete diagnostic radiology (DR) residency website is important for recruiting medical students. However, no prior study has assessed the content of DR residency websites. The purpose of this study was to evaluate the comprehensiveness of DR residency program websites.

METHOD AND MATERIALS: All DR residencies listed on the AMA Fellowship and Residency Electronic Interactive Database (FREIDA) were queried for a dedicated website. We then searched each website for the presence of 46 criteria previously identified as important considerations for medical students applying to DR residency; these included information about the application process, clinical and research training, and current residents. We compared prevalence of criteria between regions of the country and Doximity program ranking using ANOVA.

RESULTS: Of 189 DR residency programs, 187 (99%) had a dedicated website. Of these, only 14 (8%) had at least two-thirds of criteria assessed; on average, each website reported 22 items (52%). The most frequently included information included number of residents (97%), contact e-mail (87%), courses attended by residents (83%), current resident listings (79%) and facility descriptions (79%). The least common information included resident academic interests (7%), Chief Residents' Message (10%), resident research interests (11%) and international educational opportunities (12%). Midwest and Northeast programs had significantly more items than those in the West (23 items

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for both Midwest and Northeast vs. 18.2 for West) [$p < 0.01$]. There was no significant difference in website comprehensiveness between programs in different Doximity ranking quartiles ($p = 0.062$).

CONCLUSION: DR residency websites are inadequately comprehensive, with roughly half of criteria assessed present on each website. Few websites included information about resident academic and research interests, a Chief Residents' Message, or International educational opportunities, factors known to be important to medical students applying to DR. Addressing these gaps in website content may help DR residencies better inform and recruit medical students into both their programs and DR as a whole.

(E-106) Wednesday • 7:20–7:35 AM • E-poster Station #4 Pre-reading Templates: Improving Medical Student Learning in the Reading Room

Natalie Y. Ring, *Geisel School of Medicine at Dartmouth, Hanover, NH*; Robert B. Percarpio, MD; Ellen Chang; Petra J. Lewis, MD (natalie.y.ring.med@dartmouth.edu)

LEARNING OBJECTIVES: • Outline the process of and rationale for students pre-reading studies • Identify barriers to students pre-reading studies during their radiology rotation • Synthesize a basic template to facilitate pre-reading for students

CONTENT DESCRIPTION: Pre-reading entails medical students independently reviewing films before receiving feedback from a radiologist. AMSER National Medical Student Curriculum in Radiology recommends that medical students pre-read studies; however, more commonly students only “shadow” radiologists while in the reading room, even when there is a free workstation available. Advantages of pre-reading over shadowing include generative rather than passive learning, improved metacognition with more opportunities for constructive feedback, and increased desirable difficulty for more durable learning. An advantage to the radiologist may be an improved workflow, as pre-reading students largely work independently. Barriers to pre-reading include students having inadequate image search algorithms, or not being able to read fast enough for the radiologist's workflow. This exhibit describes how simple paper templates for chest radiographs and abdominal CTs help facilitate students to independently pre-read studies. The templates describe what structures students should identify as well as key evaluation points, allowing students with minimal training to actively read exams and record their observations. Effective templates may help reinforce a search pattern students are already familiar with (e.g. ABCDE pattern for chest radiographs), enabling elaboration of current knowledge. Templates then may be adjusted as the rotation progresses to contain less prompting information and encourage more active knowledge retrieval. Lastly, we describe how these templates may be integrated into resident and attending workflows.

(E-109) Tuesday • 7:00–7:15 AM • E-poster Station #3 Innovations in #FOAMed: Using G-Suite to Teach Radiology to Medical Students through Interactive Academic Writing

Frederic J. Bertino, MD, *Emory University, Atlanta, GA*; Dexter Mendoza, MD; Hernan R. Bello Velez, MD; Ryan B. Peterson, MD; Brent P. Little, MD; Stefan Tigges, MD* (fbertin@emory.edu)

LEARNING OBJECTIVES: The reader will: 1) Utilize the Google office suite as a free, widely available, browser-based tool that allows for the creation of documents, presentation slides, spreadsheets, and survey forms that can be adapted for the teaching of radiology to medical students. 2) Create high-quality teaching files in radiology that provide real-time feedback to radiology students through direct, remote and real-time resident mentorship. 3) Build a radiology simulator with minimal resources with the ability to track student progress and learning depth.

CONTENT DESCRIPTION: The Google office suite (G-suite) is a free, lightweight, browser-based tool that can be used to create a high-quality teaching file for free open-access medical (radiology) education (#FOAMed/#FOAMrad). We have created a curriculum centered on

this tool to encourage medical students to become anatomic investigators by introducing them to academic writing of case reports and medical literature reviews. Student's work created through G-suite is edited by an assigned radiology resident mentor in real time and in tandem with the student via chat and video communication. It is then published to a website teaching file as a chapter in the first radiology simulator virtual textbook. In our paper, we detail the methodology of how G-suite can provide a web-based system of real-time remote writing feedback, evidence based case report generation, and web-publication for our student authors. Finally, we provide satisfaction and impact survey results from our student authors detailing their experience. Results of our author survey shows satisfaction in the writing exercise and publication experience, with a greater appreciation of the radiologist's thought process, early interest in pursuit of the field, and appreciation for the role of radiology in the health care system.

(E-110) Tuesday • 7:00–7:15 AM • E-poster Station #4 Developing a Radiology Subinternship

Kristen A. Bishop, MD*, *University of Texas Southwestern, Dallas, TX*; Julie Champine, MD; Carlos L. Perez, MD, BS (kristen.bishop@utsouthwestern.edu)

LEARNING OBJECTIVES: 1) Define the purpose of the radiology subinternship 2) List the expectations of the radiology subintern 3) Describe the difficulties in hosting radiology subinterns 4) Learn the steps to implement the radiology subinternship

CONTENT DESCRIPTION: In many medical schools, the subinternship is a senior rotation for the student to fulfill an advanced medical student role similar to that of a beginner level resident. The student has the opportunity to participate in the daily clinical workload during the subinternship and show a true representation of his/her skills. The student works in a collaborative role with residents and faculty, allowing the supervising faculty member to realistically assess the student's work ethic and aptitude for the purposes of writing a recommendation letter for the student's residency application. The diagnostic radiology subintern is expected to be familiar with general diagnostic radiology after having completed a pre-requisite general diagnostic radiology clerkship. During the subinternship, the student works more in depth with one subspecialty division and is assimilated into that divisional team. The subintern will review diagnostic images on a PACS workstation, check out with faculty, and create draft reports in the voice recognition dictation system. The student attends radiology resident teaching conferences, interdisciplinary conferences, journal clubs, and grand rounds. At the end of the month, the student gives an oral presentation to the subspecialty division. Developing such a rotation requires cooperation with the medical school leadership, hospital leadership, radiology departmental leadership, billing compliance, and information technology components of the academic radiology department. We will describe our experience implementing a radiology subinternship rotation, review steps taken, and discuss lessons learned.

(E-112) Tuesday • 7:00–7:15 AM • E-poster Station #9 Integration of Radiology Education and Core Entrustable Professional Activities (EPAs) Can Significantly Impact Patient Care: A Study Quantifying the Ordering and Interpretation of Radiological Studies by PGY-1 Residents

Daniel K. Cook, MD, *West Virginia University, Morgantown, WV*; Michael Cousar, MD; Benjamin J. Crowder, MD; Andrew J. Lu, MD; Prashanth Sompalli, MD; Layla Nasr, MD; et al (jhogg@hsc.wvu.edu)

LEARNING OBJECTIVES: • Quantify the number of radiology-related tasks that post-graduate year 1 (PGY-1) residents complete while on an inpatient medicine service • Gain perspective on the need and importance of medical school radiology education on patient care through data accumulation and analysis

CONTENT DESCRIPTION: Our purpose was to quantify the radiology-related tasks that PGY-1 residents (interns) complete while on an inpatient medicine service to gain a data-grounded perspective on the

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need for and importance of medical school level radiology education on patient care. We hypothesized the number of radiology-related tasks is high, indicating need for inclusion of required radiology instruction in medical school curricula. Interns representing four different medical schools were enrolled in this IRB-approved prospective study. All participants completed a survey about prior radiology education in their respective medical school. Another survey regarding the interns' confidence in performing the designated radiology-related tasks they would face as interns was administered before and after the study period. Interns also completed daily surveys during the study period addressing the number of times they completed several pre-defined radiology-related tasks including: selecting and ordering appropriate radiological studies, independently interpreting imaging studies, consulting with radiologists, and performing bedside ultrasound procedures. Interns ordered radiology studies in approximately 31% of patients. They reported making an attempt to initially interpret approximately 73% of the ordered studies. Only one third of the enrolled interns reported a required radiology clerkship in medical school. None reported feeling confident in selecting appropriate imaging at the beginning of the study period. Our data indicate that interns on inpatient medicine services are involved in a large number of radiology-related tasks. We believe larger organized studies may help influence required inclusion of medical school level radiology instruction in curricula to achieve the core Entrustable Professional Activities (EPAs) for entering residency.

(E-113) Tuesday • 7:20–7:35 AM • E-poster Station #8 Radiology in a Preclinical Medical School Curriculum: Feasibility and Students' Acceptance of a Hands-On Interactive Radiology Experience

Alexander Boscia, BS; Karin A. Herrmann, MD, *University Hospitals Case Medical Center, Case Western Reserve University, Cleveland, OH*

PURPOSE: This pilot study was designed to test the feasibility and acceptance of hands-on interactive Radiology teaching sessions (IRTS) during a preclinical medical school curriculum. The purpose is to determine students' subjective learning benefit from interactive small group Radiology sessions in alignment with the anatomy curriculum and from direct interaction with radiologic imaging material using DICOM viewers.

METHOD AND MATERIALS: First year medical students (n=163) of the year 2016/2017 were asked to download on their personal laptops or electronic devices a free standard DICOM viewer. A set of radiographic examinations with normal anatomy was provided in DICOM format through connection to a central server including radiographs and computed tomography of the chest, abdomen and pelvis. Students were asked to individually identify in these radiographic studies a total of 20 anatomic structures in alignment with their anatomy curriculum using their personal devices. Students were divided in groups of 8 with each group being facilitated by a Radiology resident with 1-3 years of experience who was available for guidance and questions. Students were asked to complete a survey at the end of each session addressing their subjective overall impression of the event, learning benefit, impact of interactions with the radiology resident, number and timing of the sessions.

RESULTS: 90% of the total of 163 students considered the interactive Radiology hands-on sessions as an excellent, very good or good experience. 94% of students indicated that the event was somewhat to very helpful to understand radiology and anatomy and to achieve the Radiology learning objectives in the 1st year. 89% of all students indicated that they would like more such sessions while the individual time slot was considered appropriate by 52% of the participants. The interaction with residents was very much appreciated (86%).

CONCLUSION: Integrating interactive Radiology with hands-on experience in small group sessions under guidance is very much appreciated and accepted by first year medical students. Such sessions in alignment with anatomy seem to improve the subjective learning experience of medical students in the preclinical curriculum.

(E-120) Wednesday • 7:20–7:35 AM • E-poster Station #1 SONICS: A Model of Integrated Ultrasound Education for Medical Students

Ruth Sarmiento, MD, *Hofstra Northwell School of Medicine, Manhasset, NY*; William Rennie; Ali Noor, MD; Maria-Louise Barilla-LaBarca, MD; Daniel J. Ohngemach, MD; John S. Pellerito, MD; et al (*rsarmiento@northwell.edu*)

LEARNING OBJECTIVES: An essential tool in clinical practice, ultrasound has recently gained traction as a tool for teaching medical students in both the preclinical and clinical arenas. We present an integrated 4 year longitudinal ultrasound curriculum, SONICS (SONographic Integration of Clinical skills and Structure), implemented at the Hofstra Northwell School of Medicine in 2011. The curriculum is designed to adhere to the ACGME mandated competency-based model of learning and satisfy core medical student clinical point-of-care ultrasound milestones.

CONTENT DESCRIPTION: Introduction: Hands-on, small group sessions integrated into the preclinical curriculum allow students to develop the skills and knowledge required for basic ultrasound performance and interpretation and act as an adjunct to the teaching of anatomy, physiology and the physical exam. Ongoing training during the clinical clerkships reinforces previously-acquired skills by placing them in a relevant clinical context. **Curriculum Goals:** Understand ultrasound physics and technology. Acquire, annotate and archive images to perform and interpret basic ultrasound exams. Correlate normal and pathologic ultrasound findings with expected findings from physical exam. Appreciate limitations of ultrasound and its place within the ACR appropriateness criteria. **Curriculum Development and Implementation:** Interdisciplinary faculty includes members from Radiology, Emergency Medicine, Cardiology, Critical Care, OB- GYN, Internal Medicine, Rheumatology, and Science Education. Skills sessions are integrated into the classroom, anatomy lab, and clinical rotations. **Student Assessment and Outcomes Measures:** Knowledge assessment is included in summative assessment during end-of-course exams. Formative assessment occurs during the end-of-course evaluation of physical exam and ultrasound skills. **Summary:** In our 6-year experience with the curriculum, ultrasound has been integrated into most courses and clinical rotations. Initial evaluation suggests enhanced medical education and increased student satisfaction. Further work is in progress to assess impact on future clinical practice of students.

Education, Other

(E-032) Wednesday • 7:00–8:00 AM • Hard-copy poster Prevalence of Stimulants and Sleep Aids amongst On- Call Radiologists

Shannon Kim, MD, *Eastern Virginia Medical School, Norfolk, VA*; Jonathan Revels, DO; Sarah Shaves, MD (*sbkimx@gmail.com*)

PURPOSE: The effects of sleep deprivation have been extensively studied demonstrating impacts on physicians, including alterations in mood, clinical and diagnostic performance, level of burnout, as well as deleterious effects on health. In an effort to combat fatigue, stimulants and sleep aids are often used. The use of these agents has been studied in other specialties, but no such study has been conducted in the radiology community. The purpose of this study is to determine the prevalence of stimulant and sleep aid use among radiologists at our institution, and to correlate their use to level of fatigue.

METHOD AND MATERIALS: Using Survey Monkey, a survey was sent to the EVMS radiology residents and attendings. Questions consisted of the Epworth Sleepiness Scale, level of training, frequency of overnight call, as well as frequency and type of stimulant and sleep aid use.

RESULTS: There were 33 responses, 25 take overnight call and 8 do not. The overnight call group was then divided based on the Epworth Sleepiness Scale as Group 1 (N=17, unlikely to be abnormally sleepy) and Group 2 (N=8, average sleepiness and possibly excessive sleepi-

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ness depending on the situation). There was no statistically significant difference between the amount of overnight call taken by either group, with both groups taking an average of 6-10 overnight call shifts over the last 2 months. For Group 1, 88% use stimulants and 24% use sleep aids. For Group 2, 75% use stimulants and 25% use sleep aids. There was no statistically significant difference between the prevalence of use of stimulants and sleep aids between both groups. The most frequently used stimulants were coffee /caffeinated beverages, and the most frequently used sleep aids were over the counter agents (such as antihistamines).

CONCLUSION: There was no difference between the prevalence of stimulant or sleep aid usage between those who were unlikely to be excessively sleepy and those who had average or possibly excessively sleepiness depending on the situation. The amount of overnight call was also similar in both groups. Among all participants who take overnight call, 75-88% use stimulants to combat fatigue during their shift and 24-25% use sleep aids after their shift.

(E-033) Tuesday • 7:00–8:00 AM • Hard-copy poster Getting a Feel for Radiology: Kinesthetic Approaches to Radiology Education

Samuel J. Pevzner, MD, PhD, *Vanderbilt University, Nashville, TN*;
Jared Grice, PhD; Edwin F. Donnelly, MD, PhD (samuel.j.pevzner@vanderbilt.edu)

LEARNING OBJECTIVES: - Gain awareness of kinesthetic approaches to teaching the traditionally visual field of radiology. - Describe and experience visual-tactile sensory augmentation with 3D printed examples. - Leverage crossmodal perception to better understand contrast and noise.

CONTENT DESCRIPTION: The interpretation of radiological images is beset by the iniquities of noisy images and challenging to understand processing techniques. To help shepherd others through this treacherous terrain, we propose that kinesthetic approaches may aid in the understanding of traditionally visual phenomena. We have developed methods for translating visual information into three dimensional models and are rapidly prototyping with 3D printing. Just as topographical relief is represented by contour maps, we transform pixel values into printed textures. As demonstrative examples, we have prepared uniform segments of ACR phantom based images from three tomographic modalities, SPECT, CT, and MRI. Side by side comparisons, as well as additional demonstrative educational examples, invite learners to literally grasp contrast and noise in a more profound manner. By integrating such tactile elements into an educational poster, we demonstrate the utility of this new radiology learning experience.

(E-034) Wednesday • 7:00–8:00 AM • Hard-copy poster Imaging Findings of Intravenous Opioid Abuse Complications

Michael B. Burch, MD, *University of Cincinnati Medical Center, Cincinnati, OH*; Lily L. Wang, MBBS, MPH; Carl C. Flink, MD; Rifat A. Wahab, DO (burchmb@mail.uc.edu)

LEARNING OBJECTIVES: 1. Identify the complications of IV opioid abuse that can be diagnosed by imaging. 2. Describe radiologic findings of IV opioid abuse across a broad range of imaging modalities and organ systems.

CONTENT DESCRIPTION: Opioid abuse in the United States has reached epidemic proportions in recent years. According to the Department of Health and Human Services, over 2.1 million Americans misused opioids for the first time in 2015. Demands on the medical system have increased accordingly with opioid-related ED visits having doubled nationwide between 2005 and 2014. The escalation of intravenous opioid abuse (namely heroin and other synthetic morphine derivatives) is particularly alarming with deaths related to heroin now exceeding those attributable to gun homicides. Medical complications of intravenous opioid misuse include the direct neurotoxic action of the drugs, adverse effects of contaminants or filler agents, retained nee-

dles and needle fragments, and hematogenous seeding of microorganisms. These can affect nearly any organ including the musculoskeletal, cardiopulmonary, and nervous systems. Imaging often plays a critical role in both the diagnosis and management of IV-drug related pathology. The clandestine nature of opioid abuse use can present a diagnostic challenge to clinicians as patients may not be forthcoming about their substance abuse history. Imaging findings can be the first clue to suggest underlying drug use, and identification of one complication on imaging should lead to a search for others. Radiologists should be familiar with the full range of imaging abnormalities associated with intravenous opioid abuse. In this exhibit, we present a number of case examples with characteristic findings related to opioid abuse across multiple imaging modalities and organ systems.

(E-035) Tuesday • 7:00–8:00 AM • Hard-copy poster IR Residency Selection Process: What We've Learned So Far

Minhaj S. Khaja, MD, MBA, *University of Michigan Health System, Ann Arbor, MI*; Janet E. Bailey, MD; Wael E. Saad; Corrie M. Yablon, MD; David P. Fessell, MD; N. Reed Dunnick, MD (mkhaja@umich.edu)

LEARNING OBJECTIVES: Review criteria for selection of high-quality Interventional Radiology (IR) residents. Highlight the importance of collaboration between Diagnostic Radiology (DR) and IR selection committees. Illustrate changes made at a single institution over the course of 3 selection cycles with sample interview schedule.

CONTENT DESCRIPTION: Although IR and DR have much in common, including residency training, the complexity of IR procedures and non-procedural patient care has increased such that IR has become distinct from DR. The new training paradigm requires medical students with little or no experience in IR to decide to enter IR and to select an IR residency. Selection of high-quality students for IR residency is therefore a complex process. For IR residency programs and students to succeed, selection committees must look beyond board scores and class rank to match the best applicants. Participation in IR rotations, student interest groups, research, and IR-related organizations can help identify the interested students. Selection committees for DR and IR must coordinate their efforts to recruit the highest-quality trainees to both programs, which remain closely related. It is imperative to collaborate throughout the process: review of applications, selection of interview candidates, and ranking of candidates. Leadership from the Chair and Program Directors is essential to success. For candidates, the interview is critical to determine if the DR and IR programs are aligned, with the trainee's best interests at the forefront. Programs should organize the interview day to allow candidates exposure to DR and IR faculty and residents and DR and IR facilities. Structuring IR and DR interview days together, so candidates for both programs are in the department together, allows trainees more flexibility and reduces their travel costs. The authors will illustrate their experience with a sample interview schedule and how their selection process has evolved over 3 years.

(E-114) Tuesday • 7:20–7:35 AM • E-poster Station #10 An RVU-Based System for Quantifying Physician Academic Productivity in an Academic Radiology Department

Kedar Jambhekar, MD, *University of Arkansas for Medical Sciences, Little Rock, AR*; Linda A. Deloney, EdD; William C. Culp, MD (KJambhekar@uams.edu)

LEARNING OBJECTIVES: To share a customizable RVU based method designed to quantify physician efforts in the educational arena.

CONTENT DESCRIPTION: In Radiology, as in other medical specialties, clinical productivity is measured using relative value units (RVUs). The RVU system assigns a numeric value to a clinical activity based on its complexity and the degree of physician work required. Teaching tasks also have different levels of complexity and can be placed on a comparable value scale. There are no metrics available, however, to

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assess the totality of academic activities or gauge different teaching activities relative to each other. We suggest that academic RVUs can be used to determine how academic time should be allocated among the faculty. In our department, a faculty member's allocation of non-clinical time is determined by the section chief and overseen by the Vice-Chair for Research. Assessments of faculty member's academic productivity are made during semi-annual reviews using an academic "relative value system" (RVU) that was formulated as a method of quantifying productivity using teaching value multipliers (TVMs). The TVM is the ratio of the value of a unit of time spent on teaching tasks and scholarly activity based on their educational value and complexity. Weights assigned to the various activities are arbitrary but were chosen to align faculty activities with department and the college expectations. Expected typical scores for faculty on the tenure track are expected to total 25 to 50 RVUs. As a pilot project, academic RVUs for 2014-17 educational activities were analyzed. Our initial experience confirms that expected totals were feasible and that the model appears to discriminate higher versus lower academic producers.

(E-117) Wednesday • 7:00–7:15 AM • E-poster Station #1 Factors Associated With Diagnostic Radiology as a Career Choice: A Study of Resident Physicians

Darya Kurowecki, MA, MD, *McMaster University, Hamilton, ON*; Stefanie Y. Lee, MD; Sandra Monteiro, PhD; Karen Finlay, MD

PURPOSE: A cause for the steady decline in interest in diagnostic radiology as a career remains elusive. The purpose of this study was to survey resident physicians of all training levels to identify attitudes towards radiology that could account for the declining interest.

METHOD AND MATERIALS: An online retrospective survey was distributed to resident physicians at a single academic centre between July and August 2017. Respondents were asked to evaluate their level of agreement with statements regarding radiology using 5-point Likert scales. Higher scores indicated stronger agreement. Participants also identified factors affecting career choice. Data were described using group means and frequencies. Comparisons were made between radiology and other specialties, and between training levels. Participants were categorized as junior (PGY1-2), intermediate (PGY3-4), and senior (PGY5 or higher).

RESULTS: A total of 151 medical residents completed the survey: 20 from radiology, 18 from a surgical discipline, 102 from a non-surgical discipline, and 9 unspecified. Fifty percent were junior residents, 34% intermediate and 17% senior. There were no notable differences between training levels. Among radiology residents, there was general agreement that radiologists have high job satisfaction. Additionally, diversity of pathology (mean=4.5) and positive interactions with staff/residents (mean=4.4) were the top attractors. For non-radiology residents, positive clinical experiences influenced their choice of career. Moreover, 70.5% believed that radiologists have little patient contact outside of interventional radiology and identified lack of patient contact (mean=3.9) and dark work environment (mean=3.6) as top deterrents. Some trainees considered radiology, but changed their mind due to lack of a mentor (52%) and becoming interested too late during training (16%).

CONCLUSION: The results indicate that exposure to positive experiences in radiology should occur earlier in training. More interactive clerkship experiences are being explored at our institute to address this issue. Finally, additional qualitative exploration of trainees' perceptions may identify key interventions that can be introduced early in training.

AUR Trainee Prize: 2nd Place

(E-118) Wednesday • 7:00–7:15 AM • E-poster Station #3 Factors and Resources Affecting Ranking of Diagnostic Radiology Residency Programs by Medical Students in 2016-2017

Mary D. Maher, MD, *Columbia University, New York, NY*; Lyndon Luk, MD; Elise Desperito, MD; Joshua L. Weintraub; Sheik Amin, BA; Rama Ayyala, MD (*mdm9013@nyp.org*)

PURPOSE: To evaluate demographics of medical students that applied to our radiology residency program in the 2016-2017 academic year, determine which factors applicants valued most highly when ranking radiology programs and identify the major resources used to learn about residency programs during the interview process.

METHOD AND MATERIALS: A questionnaire of 19 questions was sent to 622 applicants to our diagnostic radiology (DR) and combined diagnostic/interventional radiology (DR/IR) residency program tracks. Survey results were anonymized and collected after both candidates and residency programs submitted rank lists to the National Resident Matching Program (NRMP) and before Match Day to ensure that the selection process was not biased. Applicants ranked thirty-five unique factors that may influence their residency rank list order from 1 (not important at all) to 5 (very important), listed their top five 'very important' factors, and ranked various sources of information used to learn about residency programs.

RESULTS: 117 of 622 applicants (18.8%) replied to the survey, 65.8% (73/111) male and 34.2% (38/111) female. The five most important ranked factors in determining the applicant's rank list were perceived happiness of the residents and faculty (4.69), fellowship and job placement of recent graduates (4.34), interactions with the program's current residents (4.33), stability of the department and residency program (4.29) and geographic location of the program (4.27). Of the factors deemed very important, the top three factors were geographic location of the program (26.4%, 29/110), academic reputation of the program (25.4%, 28/110) and perceived happiness of the residents and faculty (17.3%, 19/110). The top four resources for learning about residency programs were current residents at the program (4.47), program director(s) at the program (3.87), faculty that interviewed at the program (3.64) and the residency program website (3.64).

CONCLUSION: Medical students consider a large number of factors and resources in determining their rank lists, with factors encountered during the interview day playing a significant role in shaping the applicants' view of a residency program.

Education of Residents

(E-037) Tuesday • 7:00–8:00 AM • Hard-copy poster Laboratory Values: A Radiologist's Forgotten Best Friend

Jesse Chen, MD, *Staten Island University Hospital, Staten Island, NY*; David S. Sarkany, MD

LEARNING OBJECTIVES: An overarching theme in radiology is the effort to make an imaging study's dictation clinically meaningful. But all too often, radiologists work in a vacuum, forgetting the wealth of information readily available at their workstations. There are specific laboratory values that are both commonly used and particularly important for all radiologists to be familiar with. A quick glance at a patient's laboratory values can often help the radiologist rule in or rule out a specific diagnosis, and attention to the patient's laboratory history can help the radiologist generate a report that fits within the greater clinical picture. This poster breaks down an array of helpful laboratory values by radiological subspecialty, and discusses their meaning and application for radiologists. Relevant images are provided as examples of what the radiologist might encounter given a specific laboratory derangement.

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CONTENT DESCRIPTION: General Laboratory values to check prior to imaging. • eGFR for IV contrast for CT and MRI: **Subspecialties of Radiology:** - Abdominal imaging • Tumor Markers (CEA, CA19-9, PSA, CA125) • Lactate • LFT (AST, ALT, Albumin, GGT) • Biliary labs (Direct bilirubin, Indirect bilirubin) • Pancreas labs (Amylase, Lipase) • Renal labs (BUN, Creatinine) • GU (βHCG, urinalysis) - Breast Imaging, - Cardiac Imaging • Troponin levels • Lipid panel (Total cholesterol, HDL, LDL, Triglycerides) - Emergency Radiology • CBC • Chemistry - Musculoskeletal Imaging: • ESR/CRP - Neuroradiology • CSF analysis - Nuclear Medicine • Thyroid function testing. - Thoracic Imaging • DDimer - Vascular Interventional Radiology • Platelet • Coagulation profile • BNP in PE lysis

(E-038) Wednesday • 7:00–8:00 AM • Hard-copy poster Radiology Residency Training and Health Care Disparities

Amit Ramjit, MD, *Staten Island University Hospital, Staten Island, NY*; Lisa Americo; Michelle Wu, MD; Mark Raden, MD; David S. Sarkany, MD (*aramjit@gmail.com*)

LEARNING OBJECTIVES: 1. Define health care disparities and their relationship to radiology and practicing radiologists. 2. Summarize and classify existing research published on radiology specific health care disparities. 3. Provide a framework for education on health care disparities for radiology residency programs.

CONTENT DESCRIPTION: The population of the United States grows increasingly diverse, creating the need for innovations in patient-physician communication and accessibility. As a result, residency education must strive to meet these varied needs and to combat the formation of health disparities. Especially prevalent in underserved communities, these disparities are differences in the presence of disease, health outcomes or access to healthcare. Radiology curricula must reflect radiologists' role as not only consultants, but vital members of public health care improvement. Currently, there are no standardized models for teaching health care to radiology residents and our poster aims to not only identify examples of health care inadequacies within radiology, but also provide a possible framework for ACGME accredited radiology residency programs. Topics to be discussed are the new ACGME guidelines on education and health care disparities as well as define concepts such as health care disparities, cultural competency and unconscious bias. Examples of healthcare disparity in the radiology literature will be cited and discussed. Finally, an educational framework for teaching our radiology residents will be presented. A literature review was performed using a Pub Med and Google Scholar search for publications addressing health care disparities and education in radiology.

(E-039) Tuesday • 7:00–8:00 AM • Hard-copy poster Teaching Residents to Be Authorized Users for Radioactive Iodine Treatment

Tram N. Schroeder, MD, *Indiana University School of Medicine, Indianapolis, IN*; Vasantha D. Aaron

PURPOSE: Radioactive iodine therapy for hyperthyroidism is not without risks, and patient instructions are extensive. Residents should understand hyperthyroidism, possible treatments, and risks and benefits of radioiodine therapy prior to graduating as authorized users. In addition, they must learn how to counsel patients effectively. The purpose of this study was to evaluate whether a video reviewing radioiodine ablation improves their knowledge base and makes residents more comfortable with the process.

METHOD AND MATERIALS: A video was created detailing the process of undergoing radioactive iodine therapy for hyperthyroidism with pre- and post-treatment instructions. Residents were asked to complete a short test about radioiodine thyroid ablation, as well as a ten-question "feelings" survey about their comfort level regarding the treatment process prior to and one day after watching the video. The knowledge survey questions were derived from material directly discussed in the educational video. The feelings survey included questions such as, "How

knowledgeable do you feel about the purpose/goal of radioactive iodine therapy?" and "How knowledgeable do you feel about care instructions after receiving radioactive iodine therapy?" Residents answered the latter survey with a numerical score between 1 and 5 inclusive with 1 being the least and 5 being the most knowledgeable/comfortable.

RESULTS: A total of 11 first year residents participated. Ten residents had not yet rotated through nuclear medicine or had prior experience with radioactive iodine therapy. There was statistically significant improvement in knowledge and feelings scores (in total as well as for each question within the survey) after watching the video. There was an average improvement of 3.5 points on the knowledge survey ($p = 0.00002$) and an average improvement of 8.8 points on the feelings survey ($p = 0.0001$).

CONCLUSION: Our study demonstrates that an educational video detailing the radioactive iodine treatment process for hyperthyroidism improves residents' knowledge base and their comfort level with performing thyroid ablations. We plan to continue recruiting first year residents and may expand the study to include more senior residents.

(E-040) Wednesday • 7:00–8:00 AM • Hard-copy poster Effect of Formal MRI Foreign Body Clearance Training on Radiology Resident Knowledge

Elias P. Taxakis, MD, *University of Michigan, Ann Arbor, MI*; Kara D. Gaetke-Udager, MD; Hemant A. Parmar, MD; Matthew S. Davenport, MD*

PURPOSE: Screening for retained or implanted foreign bodies is required for all patients undergoing an MRI examination at our institution. The evaluation of patient radiographs for these items is commonly performed by radiology residents. Many residents felt uncomfortable when responsible for "clearance" of foreign bodies prior to MRI, especially in the on-call setting. The aim of this study is to determine the effectiveness of MRI foreign body clearance training.

METHOD AND MATERIALS: A one-hour didactic training session using PowerPoint slides with example images was created by a senior radiology resident and presented at a resident conference. A twelve question, pre- and posttest was administered to the residents in attendance. One question regarded year of training, one question regarded subjective comfort level with foreign body clearance, and ten questions were knowledge based. Scoring was done on a 25-point scale. Residents completed the pretest before and the posttest immediately after the training session. The results were analyzed using paired 2 sample t-tests to evaluate for statistical significance.

RESULTS: 7 first-year, 8 second-year, 5 third-year, and 6 fourth-year residents completed the pre- and posttest. There was a 42% improvement ($P = 0.0004$) for first year, 17% improvement ($P = 0.04$) for second year, 12.5% improvement ($P = 0.01$) for third year, 18% improvement ($P = .01$) for fourth year, and a 22% improvement ($P = < 0.0001$) for all residents combined. The majority of residents self-reported feeling between "somewhat uncomfortable" to "neither comfortable nor uncomfortable" on the pre-test regarding MRI foreign body safety clearance, but the majority of residents felt "somewhat comfortable" ($P < 0.0001$) on the post test.

CONCLUSION: Formal training for MRI foreign body safety clearance is important for residents of all levels. After a one-hour didactic session on this topic, junior and senior residents have increased understanding of the concepts necessary to deem a patient safe for MRI examination as well as improved self-reported comfort levels with MRI safety "clearance." Other institutions may benefit from implementing a similar training course, especially for junior residents prior to beginning call.

(E-041) Tuesday • 7:00–8:00 AM • Hard-copy poster Establishing and Implementing a Surgical Preliminary Year in the IR Residency: Keys to Success

Minhaj S. Khaja, MD, MBA, *University of Michigan Health System, Ann Arbor, MI*; Bill Majdalany; David Hughes; Paul Gauger; Janet E. Bailey, MD; Wael E. Saad (*mkhaja@umich.edu*)

LEARNING OBJECTIVES: Review the basis for the clinical model of the Interventional Radiology (IR) residency Highlight the importance of

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establishing strong interdepartmental relationships with an educational and clinical focus. Outline the process and collaborative method for obtaining institutional approval and ACGME accreditation.

CONTENT DESCRIPTION: IR is historically a Diagnostic Radiology (DR) subspecialty and image interpretation continues to be a critical component of IR practice. The complexity of IR has increased with development of therapeutic procedures. The role of IR in non-procedural patient care has increased, such that IR has become more distinct from DR, which motivated development of the IR residency. IR physicians conduct physical examinations, obtain patient histories, formulate plans of evaluation and treatment, perform treatments, and provide post procedural care. IR patient care now requires assumption of longitudinal inpatient and outpatient management by the IR physician. IR clinical responsibilities have increased to the point that it became difficult or impossible to prepare IR trainees to be competent in both the clinical care of IR patients and the performance of IR procedures within the confines of a traditional one year VIR fellowship. The new IR training paradigm is designed to ensure that interventional radiologists are prepared to provide excellent clinical care for patients undergoing image-guided procedures, to perform IR procedures, and to interpret DR imaging which remains critical to successful practice. To develop competence in non-procedural patient care IR residencies have sought innovative educational opportunities. We describe how to partner with colleagues in General Surgery to offer a one-year surgical internship specifically designed for IR trainees, designed to establish a surgically-oriented foundation in clinical care. We will highlight specific objectives of this partnership and potential benefits for both surgical and IR programs. The authors aim to illustrate the pathway to establishing and implementing a surgical preliminary year in a flow diagram including an example timeline of events and key decision making points.

**(E-042) Wednesday • 7:00–8:00 AM • Hard-copy poster
Proposed Core Medical Student Radiology Curriculum
for All Graduating Medical Students: The Canadian
Experience**

Elsie Nguyen, MD, *Toronto General Hospital, Toronto, ON*; Alexandre Menard, MD, FRCPC; Christopher M. Straus, MD* (elsie.nguyen@uhn.ca)

PURPOSE: To generate a core radiologist-led imaging curriculum to be implemented across all Canadian medical schools.

METHOD AND MATERIALS: Background: In 2012, a revised medical student radiology curriculum was published representing an “overarching compendium of possible topics and resources from which educators can pick and choose those portions that best suit their needs”. While useful and comprehensive, it contains many learning objectives that are not achievable for the majority of medical schools due to limitations both in time and resources. Topics were also not ranked in order of importance.

Method and Materials: In order to identify a condensed core series of learning objectives, education leads across Canada were solicited for content working from known accepted resources, student needs and the AMSER endorsed curriculum. This national curriculum went through a modified Delphi process to vet the content and achieve national consensus. We aimed to formulate a more realistic national curriculum to be implemented by a radiologist-led initiative nationwide. Validation included acceptance by all undergraduate educational leads across Canada (n=14), and subsequent endorsement by the Canadian Heads of Academic Radiology (CHAR) and the Canadian Association of Radiologists (CAR).

RESULTS: This curriculum includes twelve major content areas targeting core competencies and skills that medical students should master by graduation. Thus the list evolved into the expected minimum competencies for medical students irrespective of their future specialty training. These core competencies purposefully overlap with expectations set by the Accreditation Council for Graduate Medical Education (ACGME) competencies and AMSER learning objectives.

CONCLUSION: As radiologists are challenged by medical imaging that is taught extensively by non-radiologists, it is critically important for

radiologists to lead medical student education. Implementing our core medical imaging curriculum has helped us achieve uniform expectations across a national network of educators, and has supported radiologists negotiating for more time in medical student education.

**(E-043) Tuesday • 7:00–8:00 AM • Hard-copy poster
Radiology Resident Resilience: Strategies for Wellness in
the Workplace**

Sarah Eliades, MD, *New York Presbyterian-Weill Cornell Medical College, New York, NY*; Lily M. Belfi, MD (sab2041@nyp.org)

LEARNING OBJECTIVES: 1. Define resilience and understand its impact on the overall wellness of physicians in training. 2. Recognize the importance of resident resilience in radiology. 3. Identify features of radiology resident burnout and/or physical strain. 4. Gain insight into novel strategies to enhance radiology resident wellness. 5. Apply wellness techniques to one’s own residency experience.

CONTENT DESCRIPTION: Resident wellness is a topic of growing interest in the medical community. However, within radiology, there is a relative paucity of data regarding resident wellness and discussion of techniques to reduce physical strain secondary to the sedentary nature of radiology as well as emotional burnout. Our educational poster will discuss the concept of resilience as it relates to radiology residents, examine emotional and physical signs of resident burnout and strain, and review barriers to achieving wellness. We will introduce strategies and techniques to enhance radiology resident wellness and explore potential opportunities for implementation in the workplace.

**(E-044) Wednesday • 7:00–8:00 AM • Hard-copy poster
Quality by Committee: Implementing an Enduring
Residency-Wide Quality Improvement Program**

Kelly W. Capel, MD, *UW Health Hospitals and Clinics, Madison, WI*; Matthew W. Shore, MD; Nathan Y. Kim, MD; John-Paul J. Yu, MD, PhD; Richard J. Bruce, MD*; Stephen Tang, MD (kcapel@uwhealth.org)

PURPOSE: To create an enduring practice quality improvement program for diagnostic radiology residency programs.

METHOD AND MATERIALS: At the beginning of the academic year (July 1, 2017), our program launched a residency-wide practice quality improvement initiative. This new program is designed to meet five important criteria meeting including objectives and outcomes as outlined by the ACGME and the Milestones Project. Residents are expected to (1) describe current departmental QI initiatives; (2) incorporate QI into clinical practice; (3) participate in a QI project; (4) become familiar with national radiology quality programs; and (5) design and implement a QI project. Every year, the program is led by a Chief Resident and two lead representatives from each residency class who as a committee propose, research, design, and execute a residency-wide QI project under the auspices of a faculty mentor. Each residency class is charged with following through and executing one portion of the QI project (led by the class representatives) ensuring participation of all residents across the residency program. Future projects are proposed and designed on a yearly rotating basis, always commencing at the beginning of each academic year.

RESULTS: Only first quarter results are available for review (July 2017–September 2017). We currently have 100% engagement across our residency program with all residents currently participating in a radiation dose QI project. At this early stage, residents have already met 4 of the 5 objectives outlined at the outset of the program, with residents just beginning to incorporate QI into our academic clinical practice. As our project progresses, we will highlight our methods and techniques for establishing this project across our residency and to encourage ongoing resident engagement.

CONCLUSION: We have created an innovative framework for a residency-wide quality improvement program that achieves early and high level resident engagement and participation. By utilizing our formula, concepts will easily translate across radiology residency programs nationwide assisting them to better systematically and routinely incorporate quality projects throughout their residency education.

* Faculty financial disclosures are located in the Faculty Index.

**(E-045) Tuesday • 7:00–8:00 AM • Hard-copy poster
Research Production for the Clinical Educator:
Extracting Objectivity from Educational Interventions**

Alexander Dabrowiecki, MD, *Emory University Hospital, Atlanta, GA*; Frederic J. Bertino, MD; Patricia Balthazar, MD; Ryan B. Peterson, MD; Elizabeth A. Krupinski, PhD (*adabrow@emory.edu*)

LEARNING OBJECTIVES: 1) Design educational interventions with the capability of generating data for scientific publication. 2) Recognizing which data metrics are appropriate for various types of educational interventions. 3) Understand potential outcome measures for education-centered research.

CONTENT DESCRIPTION: A problem that exists in radiology education lies in the inability of many educational interventions to generate objective data to demonstrate benefit. Because of this, many educational methods often go underreported to the academic community, and subsequently lack the benefit of reproducibility that is needed to justify positive change in how educators instruct radiologists in training. We present key steps in gathering relevant data with the goal of publication and dissemination of our methods for educators to implement into their own practice. As with most robust and relevant research, initial steps include clearly defining the goal and core questions to be answered. Particularly relevant data to educators are: decisions about what task is under investigation (diagnosis vs recommendation), what is being measured (diagnostic accuracy vs time to interpretation), and how best to compare groups after intervention (same group of subjects pre- and post- intervention or control vs intervention group). Once defining the intervention and developing relevant hardware/software, study implementation considerations include: number of cases, location of abnormalities, subtlety, number of subjects, and importantly how will the relevant data be obtained given the metrics to measure success objectively? Educational studies should utilize learning theory and, specifically for radiology, focusing on a specific cognitive or perceptual aspect of image interpretation to generalize to other trainees can ultimately improve the educators' efficiency in disseminating relevant material. Approaching an educational intervention with scientific methodology results in testable educational hypotheses with objective outcomes amenable to reproducibility for evaluating the extent of benefit. Sharing successful educational intervention is crucial to the advancement of radiology education.

**(E-046) Wednesday • 7:00–8:00 AM • Hard-copy poster
The Role of Educators in Radiology Residents
Well-being: The Case of UTHealth Diagnostic and
Interventional Imaging Department**

Raya H. AlHalawani, MD, *UTHSC Houston, Houston, TX*; Latifa L. Sanhaji, MD (*raya.h.alhalawani@uth.tmc.edu*)

LEARNING OBJECTIVES: As burnout and resilience are increasing in popularity in the academic medical journals and conferences, we propose to review the literature, compare our institutions' data and discuss various management methods using individual, departmental and organizational resources targeted to residents. The learning objectives include: - Analyze the components of burnout, resilience and well-being specific to residents, and particularly radiology residents. - Review of the literature and comparison with our department demographics - Learn about individual, organizational and departmental means to build resilience, promote well-being and the role of radiologists educators.

CONTENT DESCRIPTION: UTHealth and the Diagnostic and Interventional Imaging (DII) Department are aware of the growing burnout ailment and are taking the appropriate measures to address it. We have recently assessed our residents' wellbeing, resilience, challenges and stress relief mechanisms in an informal 18-question survey. With more than 30% response rate, the extracted data was analyzed and compared to residents on the national level using different resources (including Medscape resident lifestyle and well-being 2017 and Well-being Index by Mayo Clinic). The Institutional contribution through the

Residents and Fellows Assistance Program involves several fields: • Educational, management and leadership seminars. • Financial, legal and work life referral resources. • Wellness tools are also offered such as a recreation center, nutritional programs and yoga/meditation sessions. • Mental Health Counselors are available, 24/7 at no out of pocket expense. The departmental contribution includes currently: • Educational resources • Opportunity to volunteer • Monthly meeting with the chair • Monthly social meetings • Dedicated study/relaxation lounge • And more... The limitation of these efforts lies in the difficulty to reach out to busy residents. Limited funding is also a hurdle to take into consideration. However ongoing improvements are planned, as dictated by feedbacks and regular evaluation.

**(E-047) Tuesday • 7:00–8:00 AM • Hard-copy poster
Utilizing Focus Groups to Evaluate Radiology Resident
Rotations**

Hasnain Hasham, MD, *University of Kansas, Kansas City, KS*; Kaley J. Pippin, MD; Shelby J. Fishback, MD; Sarah M. Hartman; Lacy Bemboom; Jacqueline Hill, MPH; et al

PURPOSE: Resident evaluations of staff and rotations are a critical component of radiology training. Not only are they required by ACGME, but they can help improve the quality of resident education. Traditionally at our institution, radiology residents complete electronic Likert scale evaluations, which limits information that can be gleaned from the evaluation. This evaluation style does not engage the reviewer, builds complacency in the review process, and limits constructive criticism. Most importantly, feedback rarely results in meaningful change. The goal of this study was to evaluate if interactive focus groups, frequently used in marketing and social research, could improve the resident evaluation process and provide more meaningful feedback to guide change.

METHOD AND MATERIALS: We developed focus groups for each of our 13 radiology rotations, to be performed over 8 months starting in August 2017. Each group is moderated and recorded by two non-clinical program coordinators and observed by a chief resident. Two representatives from each radiology class, who have completed at least one block in the rotation being evaluated, participate in each group. All residents are excused from clinical duties during the session to keep the review process anonymous. Six general, open-ended questions are posed in each session with 1-2 additional section-specific questions. Anonymized feedback from the focus groups is consolidated by the program coordinators and delivered quarterly.

RESULTS: Focus groups will be completed in March 2018, with 3 sessions completed to date. Initial feedback from 20 participating residents has been different from previous electronic feedback, with suggestions leading to improvements in rotation orientation, instruction on using different image viewers, and staff feedback mechanisms. At completion, staff and residents will be surveyed to determine if they found the focus group feedback helpful and if it resulted in meaningful improvements to each rotation.

CONCLUSION: Focus groups have been found to be a beneficial tool in a variety of professions. Our goal is to determine if focus groups can be utilized to more effectively evaluate and improve radiology resident education at our institution.

**(E-048) Wednesday • 7:00–8:00 AM • Hard-copy poster
Welcome to Radiology: Navigating the Start of Residency**

Brendan McCleary, *Lahey Hospital & Medical Center, Burlington, MA*; Jalil Afnan, MD (*Brendan.McCleary@Lahey.org*)

LEARNING OBJECTIVES: 1. Facilitate the transition of new trainees to a Radiology residency program with structured exercises and formal departmental and systems based orientation. 2. Test baseline resident knowledge of safe clinical practice, and hazards within a Radiology department. Re-test following specific education in safety protocols and quality assurance processes.

* Faculty financial disclosures are located in the Faculty Index.

CONTENT DESCRIPTION: Background: The outset of Radiology residency training is typically an abrupt transition from internship, the lasting memory of which, for most, is an interminable list of mundane tasks and administrative duties. This provides little training for, or exposure to the daily practice of radiology, despite most residents finding themselves in a reading room within their first week. A resident poll revealed deficiencies in early IT training (PACS, Dictation, EHR, and an Integrated Departmental workflow tool used for reading lists, protocolling and communication), understanding of image acquisition/artifacts, safety protocols and the role of technologists and ancillary staff. **Method:** A series of exercises was planned to formally orient the new residents with the Department, including subspecialty image acquisition areas and common artifacts, interaction with technologists/managers, review safety protocols, typical patient interactions, and expected communication of urgent/critical results with referring physicians. A pre- and post test was administered to evaluate the residents baseline knowledge and relative improvement, with Likert scale responses. **Results:** A significant improvement in knowledge and relative comfort was demonstrated for each resident following the formal training process. The technologists and other staff provided positive feedback of departmental orientation, identification of emergency equipment and improved understanding of resident roles and expectations. **Conclusion:** The exercises provided a clear and structured foundation for the outset of residency training, enhancing resident confidence and accuracy in providing higher quality work at an earlier stage. Other residency programs will likely benefit from this early intervention.

(E-108) Tuesday • 7:00–7:15 AM • E-poster Station #2 Review of Current Radiology Consultation Models and Experience with Resident Driven Services

Hernan R. Bello Velez, MD, *Emory University, Atlanta, GA*; Dexter Mendoza, MD; Frederic J. Bertino, MD; David M. Theriot, MD; Ryan B. Peterson, MD (hbellov@emory.edu)

LEARNING OBJECTIVES: 1) Review the models of radiology consultation services reported in the literature 2) Explore the published experience with resident-driven radiology consult services in academic centers 3) Describe the opportunities, challenges, and triumphs in implementing radiology consultation services.

CONTENT DESCRIPTION: Referring physicians often seek the radiologists' guidance not only in selecting appropriate imaging and in determining diagnosis, but also in directing patient management and treatment. With the threat of radiology commoditization and with the national shift towards value-based-care, preserving our reputation as imaging experts and reminding our patients and colleagues of the value we add to care have become more important than ever. One way of doing so is through the consultation services we provide. Multiple models exploring how to best serve the role of imaging consultants have been described and have been published since at least the 1970s. Academic institutions have been at the forefront of these creative efforts to find a model that is both valued by clinicians and efficient for the radiologist, often times with initiatives led by radiology residents. Models ranging from utilizing technology to implement virtual radiology rounds, to physically embedding the reading rooms within clinics have shown promise. More novel ideas include radiology clinics with direct consultation with patients, and "concierge radiology" where radiologists decrypt imaging reports into layman's terms geared towards patient understanding have also been described. Besides providing a valuable service to referring clinician and patients, these strategies have also been used to enhance resident education. These resident-focused and resident-driven interventions allow for greater visibility for radiology to other clinicians and patients, while fostering training radiologists to take on the role of consultant, healthcare team member, and leader. In this educational exhibit, we explore the evolution of radiology consultation services and explore the unique opportunities and challenges in implementing such services with residents taking lead.

AUR Trainee Prize: 1st Place

(E-111) Tuesday • 7:00–7:15 AM • E-poster Station #8 Overview of the Emergencies in the Radiology Department

Iris Chen, MS, BS, *Mount Sinai, New York, NY*; Nolan J. Kagetsu, MD

LEARNING OBJECTIVES: - Learners will appreciate the importance of reviewing management of emergencies in the radiology department as they are uncommon but are associated with high risk. - Learners will be able to identify and effectively manage common emergencies in the radiology department.

CONTENT DESCRIPTION: While medical emergencies are not common in the radiology department, they are important to review as these situations can be life-threatening for patients when they do occur. Patients who visit the radiology department may be particularly at risk for adverse events as those who need diagnostic imaging may have more comorbidities than the average patient in the hospital. Furthermore, there are less resources, equipment, and staff for emergency care in the radiology department. The poster provides a compilation of emergency cases that can occur in the radiology department, including anaphylactoid reaction, vasovagal syncope, pulmonary edema, seizure, contrast media extravasation, retinal artery occlusion, and chest wall rigidity syndrome. The poster will review the pathophysiology, clinical manifestations, risk factors, and initial management of each emergency. **Sample case:** A 71-year-old man with lung cancer presents for a mediport placement and receives conscious sedation with fentanyl and midazolam. He subsequently becomes restless then unconscious. Physical exam is notable for clenched hands and jaw, a rigid chest, and apnea. This is chest wall rigidity syndrome, also known as "stone chest", which is caused by the use of fentanyl, and is attenuated by midazolam. Symptoms include a loss of consciousness, chest wall rigidity causing apnea and desaturation, and bradycardia. This syndrome is dependent on the dose and rate administered, although it has also been shown in patients receiving fentanyl patches. Other risk factors include extremes of age, patients with comorbidities, and antidepressant use. Management involves a neuromuscular blockade and intubation to secure the airway. The effects of fentanyl can be reversed with 0.2 mg IV of naloxone.

(E-115) Tuesday • 7:40–7:55 AM • E-poster Station #2 Precision Radiology Training: Special Distinction Tracks for Noninterpretative Professional Development

Elizabeth J. Snyder, MD; Karen M. Horton, MD; Pamela T. Johnson, MD, *Johns Hopkins Hospital, Baltimore, MD* (pjohnso5@jhmi.edu)

LEARNING OBJECTIVES: The role of radiologist has expanded beyond the tripartite mission of patient care, education and research to include cross-specialty consultation for patient management, innovative solutions to improve healthcare quality and safety, device design, and policy advocacy. As such, residency programs should include formalized training to prepare residents for these various professional roles. Since the 2015-2016 academic year, 5 special distinction tracks focused on non-interpretive skills have been integrated into our residency program: Clinician Educator, Quality Improvement, Entrepreneurship/Innovation, Policy Advocacy and High-Value Care. Each of tracks is longitudinal, with a set of metrics throughout the residents' training required to achieve certification. In addition to developing important skills, these tracks enrich training by facilitating residents' ability to make meaningful contributions to the department and institution during their 4 years and disseminate successful initiatives through presentation at national meetings or publication. **Learning objectives:** 1. Viewers of this exhibit will learn about the unique requirements for each special distinction track and the resources used to support each program. 2. Residents in each of the special distinction tracks have implemented successful initiatives related to the focus area., which will also be described.

* Faculty financial disclosures are located in the Faculty Index.

CONTENT DESCRIPTION: *Introduction Requirements for each professional development track (number of graduates)* • Clinician Educator (3 residents) • Quality Improvement (3 residents) • Health Care Policy (3 residents) • High-Value Healthcare (1 resident) • Entrepreneur/Innovator (1 resident) *Resources developed by residents participating in these programs* • Body CT lab for medical students • Online teaching modules for CT and MR protocol design and ACR Appropriateness® Criteria • Creation of Resident and Fellow Section in ACR branch. • Annual lobbying events in Washington, DC • Senior resident consultant who staffs PACs in medical step-down unit • Provisional patent application for interventional radiology IT solution *Future directions*

(E-116) Tuesday • 7:40–7:55 AM • E-poster Station #10
The Thinking Radiologist: A Novel Method of Teaching Emergency Radiology to First-year Radiology Residents Before Independent Call

Sanjaya Viswamitra; Rohan Samant, MD; Linda A. Deloney, EdD; Kedar Jambhekar, MD, *University of Arkansas for Medical Sciences, Little Rock, AR*

LEARNING OBJECTIVES: To introduce a unique and innovative approach, the Thinking Radiologist, to teaching R1s emergency radiology.

CONTENT DESCRIPTION: There is no requirement by the ACGME or ABR for a subspecialty emergency radiology curriculum. Nor is there a standardized process to assess a radiology resident's preparedness to take call. Most programs expect R1s to learn sufficiently on core rotations and by observing a senior resident on call during the first 12 months. A 10-hour Emergency Radiology course based on the ASER core curriculum was prepared for residents starting call. Combined workshops and lectures were given during protected teaching time. Before clinical duties each morning, each R1 was given a PACS station and a list of 10 to 15 anonymized cases to review. Normal cases were included. Each study was exactly as the resident would see it on call. The resident had an hour to give preliminary readings for all cases. The cases were reviewed in the afternoon with some didactic teaching. A new term – "thinking radiologist" – was coined to emphasize efficient and accurate imaging evaluation in high stress situations. The R1s were taught to use a 30 second 'time-out' before beginning image review as well as to review a mental check list – clinical diagnosis, complications and relevant findings. This was practiced for each case during the review and residents were encouraged to develop their own check lists during the independent morning workshop. It was a unique and innovative component of the course. The course has been given twice (2016 and 2017) in January, the mid-academic year. This also allowed 3 months for reflection/remediation before call. All R1s were required to attend. Residents were highly satisfied as their weaknesses were identified and corrective methods offered to improve their confidence and skill in the emergency setting. In an unexpected response, 50% thought the course was too short. Perhaps this indicates course excellence as the residents desire to see a broader scope of teaching. Four months post-course, we used a computer-based simulation test to provide formal documentation of each resident's competence for independent call.

(E-119) Wednesday • 7:00–7:15 AM • E-poster Station #9
Leveling the Playing Field: Boot-Camp Style Use of MedU Core Cases and Workshops for Incoming Radiology Residents

Lee A. Myers, MD, *University of Southern California, Los Angeles, CA*; Sravanthi Reddy, MD; Jeffery Hogg, MD; Carl R. Fuhrman, MD; Petra J. Lewis, MD

LEARNING OBJECTIVES: • Describe existing disparities in medical schools' provision of basic radiology instruction • Describe how using widely available, peer-reviewed instructional resources can teach consistent basic radiology concepts to new residents, remediating disparity • Discuss how engaging 2nd-4th year radiology residents as workshop

facilitators helps them form bonds with new residents • Describe accreditation requirements fulfilled by engaging residents as teachers • Reflect on effects of creating multilevel teaching-learning communities in training programs to focus and engage stakeholders in the mission of education

CONTENT DESCRIPTION: Authors from four University residencies describe their similar use of MedU CORE cases and Flipped Classroom Workshops for initial Boot-camp style instruction of new R1 residents. Details and differences of methods are presented, including the use of: • Peer-to-near-peer teaching to promote teacher/learner community. • A single faculty to standardize teaching from year to year. • A combination of both faculty and residents. Beneficial effects of this Boot-camp curriculum early in the R1 year on the "learner" residents, the "teacher" residents, and the overall program are the focus of this poster. The outcomes exceed simply remediating a disparity in provision of radiology education among different medical schools. Several additional beneficial effects are described, including: • Create communities of teaching-learning partnerships among teacher-learner of different levels • Provide potent substrate for cultivation of positive relationships among program personnel • Lower barriers for becoming engaged in teaching activity • Make and sustain ongoing atmosphere of co-equal primacy of education with patient care in our academic health centers • Opportunities for ladder mentorship

(E-121) Wednesday • 7:20–7:35 AM • E-poster Station #6
Best Practices for Resident Missed Case Conference (MCC)

Udit Rawat, MD, *University of Virginia Health System, Charlottesville, VA*; Arun Krishnaraj, MD; Jason N. Itri, MD, PhD (*uditrawat1087@gmail.com*)

LEARNING OBJECTIVES: 1. Describe best practices for effective resident missed case conference (MCC) 2. Develop didactic content regarding diagnostic error and peer review to enhance resident MCCs 3. List interventions that can reduce cognitive biases and diagnostic errors among residents 4. Explain how the principles of a Just Culture can be applied to resident misses and MCCs

CONTENT DESCRIPTION: 1. Didactic content regarding diagnostic error and peer review with learning objectives 2. Methods to identify resident missed cases 3. Methods to present resident missed cases emphasizing contributing factors and systematic causes of errors 4. Principles of Just Culture

(E-122) Wednesday • 7:40–7:55 AM • E-poster Station #2
Flipping the Classroom: An Alternative Approach to Radiology Resident Education

Madeleine Sertic, *University of Toronto, Toronto, ON*; Laila Alshafai; Luis Guimaraes; Linda J. Probyn, MD; Nasir Jaffer

LEARNING OBJECTIVES: 1) Briefly revisit current formal resident teaching rounds 2) Define Flipped Classroom, the new concept of learning 3) Learn how Flipped Classroom pedagogy can be applied to formal teaching rounds to increase active learning and improve retention among residents

CONTENT DESCRIPTION: Historically, radiology resident education relied on didactic, passive teaching methods. Classic viewbox rounds involve selected resident taking cases while the rest observe. Increasing understanding of adult learning strategies has revealed the importance of active learning. "Flipped Classroom" is an active pedagogy, which inverts traditional rounds. We use 3 approaches: 1) 7-10 cases e-mailed to residents in PDF format prior to rounds, residents submit responses (diagnosis or key findings). Facilitator reviews responses and adjusts the rounds presentation to address weaknesses. 2) Comprehensive review articles distributed prior to rounds. Related cases are taken by residents during rounds. 3) Combination of approaches 1 and 2. Cases and related articles are e-mailed to residents prior to rounds. Flipped Classroom has been discussed in various iterations in the radiology resident education literature since the 1970's. However, it has yet to be widely adopted

* Faculty financial disclosures are located in the Faculty Index.

over traditional rounds. Our experience demonstrates multiple benefits to Flipped Classroom rounds, which correlate with findings in the literature. In traditional rounds, residents taking cases receive the most benefit. In Flipped Classroom, every resident takes every case, eliminating the passive “audience member” effect. Elimination of the “hot-seat” decreases pressure on individuals; positive learning environments correlate with higher rates of information retention. Forcing residents to commit to diagnoses also improves retention. More cases can be covered during one conference. Having the instructor preview responses allows for recognition of gaps in detection and knowledge. The rounds presentation can then be modified to focus on these relative weaknesses. Following the conference, the presentation PDF, which contains detailed discussions, extra images, and references, can be distributed to the residents for self-directed study.

(E-123) Wednesday • 7:40–7:55 AM • E-poster Station #3 Unintended Benefit of the Integrated IR Residency: Enhancing Diagnostic Imaging Interpretation through Clinical Correlation

Nishant Patel, MD, *University of Michigan, Ann Arbor, MI*; William Sherk, MD; Michael R. Cline, MD; Minhaj S. Khaja, MD, MBA (*pnishant@med.umich.edu*)

LEARNING OBJECTIVES: Demonstrate the value of clinically-based rotations in enhancing residents’ ability to interpret diagnostic radiology studies. Learn ways to use clinical correlation in daily imaging interpretation to increase the value of radiology to clinicians. Propose a curriculum change to enhance clinical prowess of diagnostic radiologists.

CONTENT DESCRIPTION: The IR integrated residency mandates clinically-based rotations in the longitudinal residency curriculum, including vascular surgery, surgical ICU, hepatology, transplant, and others. All DR residents complete a one-year internship following medical school prior to obtaining radiological prowess. While some radiologists emphasize integration of clinical knowledge in daily imaging interpretation, high volumes of imaging and pressure for report turnaround has moved radiology away from the clinical realm. IR residents rotate on clinical rotations after years of training in DR and are valuable to their clinical colleagues “on the floors”. However, the benefit of direct clinical correlation upon the ability to interpret diagnostic imaging is not well-known. We aim to give examples of specific patient cases in which the proper interpretation of diagnostic imaging was achieved because the resident on clinical rotation knew the clinical context of the patient. Several of the cases presented will demonstrate significant changes to the official radiologic report, realized from direct clinical correlation. Examples include: hypoventilation resulting in pulmonary opacity in the setting of decreased ventilator settings (pneumonia versus atelectasis), the identification of a foreign body in the setting of recent operation resulting in infection, the diagnosis of deep venous thrombosis in a thrombophilic patient. This presentation will also review “quick and easy” ways to clinically correlate in order to increase the value of the radiologic report to referring clinicians. Finally, this presentation will propose a curriculum change to diagnostic radiology such that clinical rotations are included in the later years, possibly deferring such rotations from the internship year.

(E-124) Wednesday • 7:40–7:55 AM • E-poster Station #10 ACGME Core Didactic Curriculum Requirements for Diagnostic Radiology: Excel in an Era of Change

Joshua A. Wallace, MD, *University of North Carolina-Chapel Hill, Chapel Hill, NC*; David M. Mauro, MD; Andrew Barnes, MD; Sheryl G. Jordan, MD; Paul L. Molina, MD (*jwallace1500@gmail.com*)

PURPOSE: Radiology residencies’ didactic curricula are again undergoing change involving method and content. Long gone (or should be) are the days when an attending speaks from a slide tray for sixty minutes uninterrupted on a narrow topic of expertise or interest in a darkened room to an audience of multilevel learners who may or may not be listening, or learning. We must fulfill changing curriculum requirements of the ACGME

Program Requirements while we adequately prepare our residents for the new format of board certification. Additionally there is millennial and educator demand for collaborative active learning, use of technology, and shorter sessions. We describe successful overhaul and the subsequent tracking of our residency’s formal didactic curriculum.

METHOD AND MATERIALS: IRB-exempted, the study collates recent prior and current ACGME core didactic curriculum requirements, describes use of technology and analytics to shepherd our formal residency curriculum, comprises a two year July 2015–June 2017 period of dramatic change for our residency, and assesses scores pre- and post-intervention of mandated curricular change. The new curriculum relies on weaving (and branding) focused curricula within the overall didactic curriculum, use of technology, and frequent feedback from the learners regarding efficacy. Example focused curricula include Physics, Fundamentals, Core, Call, and ACGME Milestones. Business intelligence tools provide structure and foundation for data-keeping of our implemented change and this data informs educational liaisons of their division’s lecture titles, curricula, and feedback. ACGME national publications and notification letters, ACGME annual surveys, E*Value resident and faculty assessment scores are analyzed as to effectiveness.

RESULTS: Pre-intervention results indicate low resident (and ACGME) satisfaction. Postintervention scores are significantly improved.

CONCLUSION: Eliciting feedback and employing detailed analyses using business intelligence tools have combined with motivated core faculty to yield significant improvement. The development of synchronous curricula within the formal curriculum has both met governing body mandate and achieved resident/faculty approval.

Health Services for Radiology

(E-059) Tuesday • 7:00–8:00 AM • Hard-copy poster Quality Improvement (QI) Project to Ensure Appropriate Follow-up for Patients Post Inferior Vena Cava Filter (IVCF) Placement

Stephen Bracewell, MD, *Medical University of South Carolina, Charleston, SC*; Taylor Kuhlman, BS; Marcelo S. Guimaraes, MD*; Ming Lim; Heather Hartung; Shannon Shuler; et al (*bracewel@muscc.edu*)

PURPOSE: A Quality Improvement (QI) project at an academic institution was designed to ensure appropriate follow up after IVCF placement by the Division of Vascular and Interventional Radiology (VIR).

METHOD AND MATERIALS: Initial retrospective review was performed on all patients who had an IVCF placed by VIR between July 2014 and December 2015. This was followed by implementation of a QI project including a task-force composed by 1 radiology technician, 3 registered nurses, 2 radiology residents and 1 attending physician, from July 2016 to June 2017. Major problems identified were high number of patients without established follow-up regarding the IVCF, low retrieval rate, lack of standardized follow-up protocol, absence of dedicated personnel, and inadequate patient education. An action plan was implemented, including creation of a shared database including pertinent patient information, standardization of follow-up protocol (3 attempts to contact the patient by phone call, followed by mailed letter, all documented in electronic medical records), creation of educational brochure to be given to the patient or family member when obtaining informed consent, and monthly analysis of the data. The goal was to assure appropriate follow-up for at least 80% of the patients.

RESULTS: Initial retrospective review demonstrated that 180 IVCF were placed from July 2014 to December 2015; 26 were permanent and 154 were retrievable devices. A total of 29 filters were removed, with overall retrieval rate of 18% and 22% retrieval rate in eligible patients. During implementation of the QI project, from June 2016 to June 2017, 97 IVCF were placed, all of them retrievable. Of those, 29 devices were removed, with overall retrieval rate of 30% and 50% retrieval rate in eligible patients. Using the newly established protocol, follow-up was obtained in 99% of the patients.

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CONCLUSION: This QI project demonstrated that creation of a standardized protocol, assignment of dedicated personnel, periodic data analysis, and appropriate patient education can improve follow-up care for patients with IVCF.

(E-060) Wednesday • 7:00–8:00 AM • Hard-copy poster
How a CT Becomes a Dollar: A Health Economics Primer for Radiologists and Trainees

Naiim Ali, MD, *University of Vermont Medical Center, Burlington, VT*;
Robert D'Agostino, MD; James B. Allison, MD (*naiim.ali.md@gmail.com*)

LEARNING OBJECTIVES: - Gain an understanding of basic terminology used in American healthcare economics - Be able to describe the process of payment from performance of study to reimbursement for both government and private payors - Appreciate the history of the reimbursement methods under Medicare and Medicaid and its impacts on the current and anticipated future payment processes

CONTENT DESCRIPTION: Healthcare economics can be a confusing topic not only for radiology trainees but also experienced radiologists. Government legislation and insurance company policies are constantly evolving, sometimes on a day to day basis. A foundational knowledge of healthcare economics is essential to understand these changing nuances. This educational exhibit will outline the essential foundations needed to gain a general understanding of healthcare economics particularly as it relates to radiology. An example claims process for a non-contrast CT head examination will serve as the vehicle for exploring various aspects of clinically relevant healthcare economics. A glossary of terms needed to understand the process will be provided. Since the current American system has been built sequentially, the historical background for Medicare and insurance claims processes will be reviewed. The layers of this system such as the Current Procedural Terminology (CPT) coding system and Relative Value Unit (RVU) scale and how they fit into the claims process will be outlined. The evolving mechanisms of healthcare payments including provisions of the Affordable Care Act (ACA) and Medicare Access and CHIP Re-authorization Act (MACRA) will be discussed.

(E-061) Tuesday • 7:00–8:00 AM • Hard-copy poster
Advanced Payment Models Under the Medicare Access and CHIP Reauthorization Act: Where Does Radiology Fit In?

Naiim Ali, MD, *University of Vermont Medical Center, Burlington, VT*;
James B. Allison, MD; Robert D'Agostino, MD (*naiim.ali.md@gmail.com*)

LEARNING OBJECTIVES: - Describe the provisions of the Alternative Payment Model under the Medicare Access and CHIP Re-authorization Act (MACRA) - Understand the role of radiologists in currently existing and future population health model. - Explore the controversy surrounding the potential impact of Alternative Payment Models on the practice of radiology

CONTENT DESCRIPTION: On April 16, 2015, Congress passed the Medicare Access and CHIP Re-authorization Act (MACRA) establishing two payment schemes: the Merit Based Incentive Payment System (MIPS) and the Alternative Payment Model (APM). For many large multi-specialty practices, including those at academic centers, APMs may be an attractive option. APMs offer a guaranteed bonus in reimbursements, the ability for the practice to determine payments as they see fit, and the opportunity for centralized billing. Many academic radiologists may find themselves part of an APM in the near-future. This educational exhibit will explore the various types of APMs that have been proposed including the Advanced Alternative Payment Model and the Patient-Focused Payment Model. The role of radiologists in existing population based health models such as Accountable Care Organizations, the Bundled Payment for Care Initiative, Comprehensive Care for Joint Replacement, and Oncology Care Model will be assessed. The benefits and drawbacks of radiologist participation in such programs will be evaluated. The implementation of APMs for radiology remains uncertain. Some hypothesize that a radiologist's contribution to ef-

ficiently making a diagnosis early in a patient's care will lead to cost-savings, thus providing radiologists with a central role. Others believe the radiology department, which in many instances serves as a revenue generator in fee-for-service models, will become a significant cost burden in a population health model and thus may be subject to significant cuts. The exhibit will explore this emerging controversy around the impact of APMs on the future practice of radiology.

(E-129) Tuesday • 7:00–7:15 AM • E-poster Station #10
Frequency of Imaging Findings Indeterminate or Suspicious for Malignancy at Three Hospital Types within an Academic Health System

Lauren Comisar, MD; Hanna M. Zafar, MD; Darco Lalevic; Charles E. Kahn, Jr, MD, MS; Mitchell D. Schnall, MD, PhD; Tessa S. Cook, MD, PhD, *Hospital of the University of Pennsylvania, Philadelphia, PA* (*tessa.cook@uphs.upenn.edu*)

PURPOSE: Imaging rates have risen over the past two decades. Imaging findings representing possible cancer are commonly found on these exams and require follow-up. Our objective was to quantify how often imaging findings of possible cancer are found on abdominal and pelvic imaging exams across our health system.

METHOD AND MATERIALS: Our health system uses a coding assessment scheme similar to the Breast Imaging Reporting and Data System (BI-RADS) to classify masses as benign, indeterminate, or suspicious for cancer on all abdominal and pelvic imaging exams. A database was created to study the distribution of these findings at the university hospital, the community hospital, and the Level 1 trauma center within our academic health system.

RESULTS: Masses indeterminate or suspicious for cancer were found in at least one organ in 12% of all abdomen and pelvic computed CT, MRI, and ultrasound exams conducted over the course of a year. Indeterminate and suspicious masses were most commonly found in the liver, pancreas, kidneys, adrenal glands, uterus, and ovaries/adnexa. Scoring patterns for these organs differed across the three hospitals. In five out of the six organs, imaging studies at the community hospital were more likely to identify indeterminate masses than those at the other hospitals. For example, indeterminate lesions were found on 2.9% of all liver exams at the community hospital, compared to 1.9% and 1.8% at the university hospital and the Level 1 trauma center, respectively. Conversely, imaging studies at the community hospital were less likely to show suspicious masses. For example, 0.6% of liver exams assigned at the community hospital identified suspicious lesions, compared to 1.7% and 0.9% at the university hospital and the Level 1 trauma center, respectively.

CONCLUSION: Masses indeterminate or suspicious for cancer occur in 12% of abdominal and pelvic imaging exams. In many organs, imaging studies at the community hospital are more likely to show indeterminate lesions and less likely to show suspicious lesions. Further investigation will be needed to determine the influence of patient case mix, referral patterns, and radiologist characteristics that contribute to these differences.

Informatics

(E-064) Wednesday • 7:00–8:00 AM • Hard-copy poster
Readability of Patient Education Materials From RadiologyInfo.org: Has There Been Progress Over the Past 5 Years?

Paul H. Yi, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; Eric Huh; Ferdinand K. Hui, MD* (*pyi10@jhmi.edu*)

PURPOSE: As patients increasingly turn to the Internet for healthcare information, it is imperative that patient educational materials be written at an appropriate readability level. Although RadiologyInfo.org, a patient education library sponsored by the American College of Radiology (ACR) and Radiological Society of North America, was shown in 2012 to be written at levels too high for the average patient to adequately

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comprehend, it is unclear if progress has been made in the past 5 years. The purpose of this study was to provide a 5-year update on the readability of patient educational materials from RadiologyInfo.org.

METHOD AND MATERIALS: All patient education articles available in 2017 from the ACR and RSNA-sponsored RadiologyInfo.org patient education library were reviewed. We assessed each article for readability using 6 quantitative readability scales: the Flesch-Kincaid (FK) grade level, Flesch Reading Ease, Gunning-Fog Index, Coleman-Liau Index, Automated Readability Index, and the Simple Measure of Gobbledygook (SMOG). The number of articles with readability at or below the 8th grade level (average reading ability of US adults) and the 6th grade level (NIH-recommended level for patient education materials) was determined.

RESULTS: 131 patient education articles were reviewed. The mean readability grade level was greater than the 11th grade reading level for all readability scales. None of the articles were written at or below the 6th or 8th grade levels.

CONCLUSION: Although there has been an increasing awareness of the issue of readability of patient educational materials within the radiological community, the patient educational materials from the ACR and RSNA-sponsored RadiologyInfo.org website are still written at levels too high for the average patient. Future efforts should be made to improve the readability of these patient education materials.

Interventional Radiology

(E-065) Tuesday • 7:00–8:00 AM • Hard-copy poster Trends in Ablative and Surgical Treatment of Hepatic Tumors in the Medicare Population, 2003–2015

Ali B. Syed, MD, *Thomas Jefferson University Hospital, Philadelphia, PA*; David C. Levin, MD; Laurence Parker, PhD; Vijay M. Rao, MD (ali.b.syed@jefferson.edu)

PURPOSE: Percutaneous ablation of liver tumors has become increasingly accepted as a less invasive alternative to open ablation and surgical resection in patients with liver tumors. Our purpose was to assess utilization trends in these procedures in recent years.

METHOD AND MATERIALS: Using the nationwide Medicare Part B databases for 2003–2015, we selected the CPT codes for percutaneous ablation (PA), open ablation (OA), and partial lobectomy (PL) of the liver. Codes for both radiofrequency- and cryoablation were included. The databases provide volumes for each code. Medicare's specialty codes were used to identify the specialty of the provider. Trend lines were plotted for total volumes and volumes by radiologists, surgeons, and all other physicians as a group.

RESULTS: Medicare total PA volume increased from 1221 in 2003 to 2500 in 2015 (+105%), with the most rapid growth occurring from 2012–2015. Radiologists performed 99% of all PAs in 2015. Of the 2500 performed that year, 2345 were radiofrequency ablations, while 155 were cryoablations. OA volume decreased steadily from 835 in 2003 to 434 in 2015 (-48%). The vast majority of OAs were done by surgeons. PL volume increased steadily from 2090 in 2003 to 3247 in 2015 (+55%). Again, the vast majority were done by surgeons.

CONCLUSION: OA use is declining steadily, while use of both PA and PL is increasing. PA growth has been especially strong in recent years. The large majority of PAs use the radiofrequency approach, rather than cryo. Radiologists perform virtually all PAs. The data demonstrate that radiologists have assumed a major role in the treatment of hepatic tumors.

(E-066) Wednesday • 7:00–8:00 AM • Hard-copy poster The Interventional Radiology Symposium: A New Paradigm for Medical Student Outreach?

Paul H. Yi, MD, *Johns Hopkins University School of Medicine, Baltimore, MD*; Won Kyu Choi; Eric Huh; Ferdinand K. Hui, MD* (pyi10@jhmi.edu)

PURPOSE: The Interventional Radiology (IR) Symposium for medical students has been proposed as a forum to encourage medical student

interest in pursuing IR as a career, however, it is unclear if it has been widely adopted. The purpose of this study was to quantify the prevalence of IR symposia advertised on two popular medical student online forums dedicated to IR and to describe the characteristics of these symposia.

METHOD AND MATERIALS: We reviewed all postings made from 2012 to 2016 on the "Interventional Radiology" sections of the Aunt Minnie and Student Doctor Network online forums for posts advertising IR symposia geared towards medical students. For each symposium, we noted sponsoring institution(s), cost, length, and offerings of lectures, hands-on IR demonstration stations, Q&A sessions, and networking opportunities. We also noted the number of faculty and institutions represented.

RESULTS: We identified 37 advertised IR medical student symposia with a yearly increase; 1 symposium was identified in 2012, 3 in 2013, 7 in 2014, and 13 symposia in both 2015 and 2016. There were 22 unique symposia (several symposia were held multiple years) from 23 sponsoring institutions, including Brown, Mount Sinai, and the Massachusetts General Hospital who sponsored 5, 4, and 3 symposia, respectively. All symposia were free and open to any interested medical student. All symposia lasted 1 day except one which lasted 2 days. Regarding course offerings, >75% explicitly offered lectures and hands-on IR stations. Half of symposia offered Q&A sessions, as well as networking opportunities with residents, fellows, and/or faculty. An average of 11 faculty members were present at each symposium (range 6 to 29), representing an average of 3 institutions.

CONCLUSION: The IR Symposium for medical students has been increasingly adopted for medical student outreach over the past several years. These symposia are open to all interested medical students at no cost. Additionally, the symposia offer a variety of educational and mentoring experiences and facilitate inter-institutional interaction. With the advent of integrated IR residencies, the IR Symposium may prove to play a larger role in IR medical student outreach and recruitment.

(E-130) Tuesday • 7:00–7:15 AM • E-poster Station #7 Management Algorithm of Acute Pulmonary Embolism in a Community-Based Hospital Setting

Jesse Chen, MD, *Staten Island University Hospital, Staten Island, NY*; Dan Shilo

LEARNING OBJECTIVES: The purpose of this educational exhibit is to outline the effective management algorithm used at our community-based hospital for the endovascular treatment of acute pulmonary embolism. Presenting the data of all patients treated with catheter-directed PE thrombolysis from the past 2 years (n=21), we describe the experience of our community based Interventional Radiology department. Ultrasound-facilitated, catheter-directed thrombolytic therapy (CDT) has been demonstrated to improve RV function, decrease pulmonary artery hypertension, and minimize the risk for major bleeding in acute PE. To date, however, there remains no standardized algorithm for risk stratification/inclusion criteria, thrombolytic treatment, and long term follow up in this critical setting. This presentation will allow viewers to: • gain an understanding of the successful pre-procedural assessment and the risk stratification used in our community based hospital • gain knowledge about how CDT is performed, including operator and patient-preferred techniques (e.g. Jugular Vein access) • gain an understanding of the management and duration of thrombolytic infusion, and longitudinal out-patient follow up.

CONTENT DESCRIPTION: The educational exhibit will discuss the following topics: A.) The proper pre-procedural assessment, critical for risk stratification, including: 1. CT of the chest and possible bedside echo, with specific evaluation for right heart strain 2. Laboratory evaluation 3. Vital signs with specific assessment of hemodynamic stability 4. Assessment of bleeding risk. B.) The management decision tree will then be presented, including how do we then decide if patient is a candidate for catheter directed PE thrombolysis. C.) Intra-procedural steps during CDT, including discussion and review of specific catheters and equipment. D.) The rationale for the patient specific thrombolytic infu-

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sion, post-procedural monitoring including repeat echocardiogram, pulmonary artery pressure monitoring, and timing of thrombolytic catheter removal. E.) Post intervention plan including outpatient follow up.

(E-131) Tuesday • 7:40–7:55 AM • E-poster Station #3 The Role of a Medical Physics Consult in Interventional Radiology?

Anouva Kalra-Lall, *Case Western Reserve University, Cleveland, OH*; Kevin Wunderle; Charles Martin III, MD* (axk603@case.edu)

PURPOSE: The Medical Physics Consult is deeply embedded into Radiation Oncology practices but is rarely utilized in Interventional Radiology (IR), by comparison. Additionally, depending on location, this service may not be readily available to Interventional Radiologists.

METHOD AND MATERIALS: Here we review three common indications for a medical physics consult in Interventional Radiology; to obtain 1) an evaluation of radiation delivery to a fetus (pre and post intervention), 2) an analysis of prior radiation exposures before an elective fluoroscopy-guided intervention (FGI) in patients having multiple or staged interventions and 3) a systematic review of technical fluoroscope parameters to optimize image quality and patient radiation dose.

RESULTS: This review will provide detailed information in the form of classic clinical scenarios. In the setting where a medical physics consult may not be readily available, the presented scenarios can serve as benchmark examples.

CONCLUSION: Incorporating this material, in addition to knowledge from the American College of Radiology Practice Guidelines, into the mainstay of conversations with our patients can be of great utility. Discussion of these cases will not only provide reassurance and help inform a patient's decision to pursue an FGI but also contribute in helping to determine the most efficient and effective utilization of imaging techniques to maximize patient benefit and reduce radiation risk. Medical physics is essential in delivering the appropriate radiation dose and image quality at the right time.

(E-132) Tuesday • 7:40–7:55 AM • E-poster Station #6 Transitioning From the VIR Fellowship to the IR Residency: More than Just a Numbers Game

Bill Majdalany, *University of Michigan, Ann Arbor, MI*; Minhaj S. Khaja, MD, MBA; Nishant Patel, MD; Michael R. Cline, MD; Janet E. Bailey, MD; Wael E. Saad (bmajdala@umich.edu)

LEARNING OBJECTIVES: Review the timeline of the VIR Fellowship to IR Residency transition Discuss the importance of pre-planning with respect to clinical service and educational objectives Highlight methods to optimize trainee capacity on the IR service

CONTENT DESCRIPTION: Interventional Radiology (IR) training is undergoing a paradigm shift. VIR Fellowship training programs discontinue soon, the final fellowship match to commence in 2018. Across the country VIR fellowship programs are transitioning into three pathways for trainees: Integrated IR residency (five years combined with DR residency), Independent IR residency (two years following DR residency), and Early Specialization in IR (one year of IR completed during DR residency followed by one-year training in an Independent IR residency). Most IR training programs will utilize a combination of training approaches. Pre-planning of funding sources/budget, interdisciplinary cooperation to arrange required clinical rotations, and recruiting appropriate trainees is necessary for a seamless transition. While superficially comparing the number of graduating VIR fellows nationally (approximately 220 per year) with the trainees entering IR Residency per year (approximately 150 per year) would suggest a drop off in trainee equivalents, using the alternative pathways should help maintain the staffing of IR training programs and a steady state of graduates to fulfill clinical needs in IR nationally. We will describe our program's methods to manage the transition from 2014–2018, including funding models, rotation schedules, clinic experiences, close coordination between the IR and DR residency programs, and the importance of thoughtful leadership.

(E-133) Wednesday • 7:40–7:55 AM • E-poster Station #7 Peripheral Arterial Vascular Imaging Interpretation: A Multimodality Review

Mark A. Sultenfuss, MD*, *Houston Methodist Hospital, Houston, TX* (masultenfuss@houstonmethodist.org)

LEARNING OBJECTIVES: 1. Describe normal arterial anatomy and common anatomic variants involving the lower extremities. 2. Identify normal arterial US-doppler waveforms and pulse volume recordings, and how they are affected by arterial disease. 3. Understand guidelines for interpreting ankle-brachial indices. 4. Correlate arterial disease changes between imaging modalities. 5. Provide a meaningful interpretation of findings for referring physicians.

CONTENT DESCRIPTION: A. Introduction. B. Lower Extremity Arterial Anatomy and Common Variants. C. Overview of Lower Extremity Imaging Studies, including Doppler US, Non-invasive physiologic exams (i.e. PVR, ABI, and Segmental pressures), CTA, and MRA. D. Examples of Peripheral arterial disease using US, Noninvasive physiologic exams, CTA, and MRA, emphasizing key features the help provide meaningful interpretation to referring physician. E. Conclusion.

Musculoskeletal Radiology

(E-068) Wednesday • 7:00–8:00 AM • Hard-copy poster A Pictorial Overview of Soft Tissue Calcifications

Matthew J. Miller, MD, *West Virginia University, Morgantown, WV*; Jennifer Koay, MD (mmille52@hsc.wvu.edu)

LEARNING OBJECTIVES: This educational exhibit provides a review of the different causes and types of soft tissue calcifications. The approach is based on the official ABR Core Exam study guide and is organized by etiology, highlighting imaging findings, while also providing a review of the epidemiology, clinical course, and pathology.

CONTENT DESCRIPTION: This educational exhibit is based upon a teaching file of pathologically and clinically proven cases, encountered at a tertiary referral center. High quality radiographs, computed tomography, and magnetic resonance images illustrate the findings and complement a succinct review of each disease, as outlined by the official ABR Core Exam study guide. The exhibit spans subject matter including more common disorders such as myositis ossificans and chondrocalcinosis, while also including more rare disorders such as dermatomyositis and neoplasms such as synovial osteochondromatosis.

(E-069) Tuesday • 7:00–8:00 AM • Hard-copy poster Intraosseous Hydroxyapatite Deposition: A Mimicker to Remember

Megan Albertson, MD, *University of Nebraska Medical Center, Omaha, NE*; Jeffrey Klug, MD; Melissa Manzer, MD

LEARNING OBJECTIVES: 1. Identify x-ray, CT, MRI, and scintigraphic appearances of intraosseous hydroxyapatite deposition. 2. Summarize the expected clinical course and treatment options for hydroxyapatite deposition disease. 3. Apply understanding of hydroxyapatite deposition to other regions in the body.

CONTENT DESCRIPTION: Hydroxyapatite deposition disease (HADD): - HADD most commonly occurs in the tendons (termed calcific tendinosis) or bursae (termed calcific bursitis) with the most common location involving the rotator cuff. However, the hydroxyapatite can migrate into adjacent bone marrow to become "intraosseous". - HADD can occur as a primary process or secondary to systemic metabolic disorders including end-stage renal disease, collagen vascular disease, or idiopathic calcinosis. - In its early phase, tendinous HADD can be detected on plain radiograph or CT as a hazy globular calcification which eventually evolves into a more solid, well-defined calcification. After a period of months, the calcification may completely resolve. If HADD undergoes intraosseous migration, it can have a variable, yet aggressive appearance in the acute phase. CT may reveal cortical erosion and/or

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a sclerotic intra-medullary lesion. MR often shows cortical irregularity, prominent bone marrow edema, and enhancement. - Treatment may be simple pain control since it is often self-limited. However, 50% of patients reportedly find relief from a steroid injection or needle aspiration with lavage. HADD in other areas of the body will also be shown and discussed. For example: **HADD of the longus colli muscles:** - HADD of the longus colli is nearly exclusive to the C1-3 region and most often occurs in middle-aged patients 30-60 years old. - Patients may present with pain, neck stiffness, or dysphagia. - On CT, HADD of the longus colli may be accompanied by retropharyngeal edema, which can be confused for retropharyngeal abscess. However, the edema associated with HADD can usually be distinguished by a lack of rim enhancement or adjacent fat stranding.

(E-070) Wednesday • 7:00–8:00 AM • Hard-copy poster Preoperative Computed Tomography Angiography (CTA) for Fibular Free Flap Reconstructions

Gaurav Syngal, *University of Texas MD Anderson Cancer Center, Houston, TX*; Colleen M. Costelloe, MD; Behrang Amini, MD, PhD; Tamara M. Haygood, MD; John E. Madewell, MD; Bilal Mujtaba, MD (BMujtaba@mdanderson.org)

LEARNING OBJECTIVES: Review the relevant normal and variant vascular anatomy of the fibular free flap. Describe the methods of computed tomography angiography (CTA) image acquisition. Describe how to report the locations of the fibular perforating arteries that the surgeon must consider for flap harvesting.

CONTENT DESCRIPTION: **Introduction:** The vascularized osteocutaneous fibular free flap is used for reconstruction of complex mandibular, maxillary, and soft tissue defects. Fibular free flap consist of the fibula, the peroneal artery, perforating arteries, and skin islands. **Normal and variant vascular anatomy of the fibular free flap:** There are 10 branching patterns of the popliteal artery, and there are 3 types of perforating arteries (septocutaneous, musculocutaneous, and septomusculocutaneous) that arise from the peroneal artery. Without the knowledge of the peroneal artery course and the location of the perforating arteries, this procedure can be challenging to the surgeons. **CTA Imaging Technique/Reporting:** CTA is a non-invasive and effective tool in preoperative imaging for fibular free flap procedures. There is optimal visualization of the related vascular anatomy and their variants. We will discuss the parameters of the CTA and discuss the important findings to include in the official report. **Computer Assisted Design and Manufacturing (CAD/CAM):** The information obtained from CTA can also be used in CAD/CAM, which can create patient-specific 3D cutting guides that assist the surgeon during the operation. **Limitations:** CTA requires the patient tolerate intravenous contrast administration and exposes patients to ionizing radiation. **Conclusion:** The fibular free flap is used for reconstructive surgery for the head and neck region. Significant variation occurs between individuals for the origin of the peroneal artery and perforating arteries. Our method of performing and reporting CTA for patients undergoing a fibular free flap procedure provides a reproducible method of identifying perforating vessels and effectively communicating their locations. Accurate communication can maximize the success of flap harvesting and preoperative manufacture of custom fibular cutting guides.

(E-071) Wednesday • 7:00–8:00 AM • Hard-copy poster Painful High Five: Radiologist's Guide for Arthritides of the Hand

Larry Mathias, *Scott and White Medical Center, Temple, TX*; Ricardo D. Garza-Gongora, MD

LEARNING OBJECTIVES: 1. Provide an interactive multimedia presentation containing radiographic images and high yield descriptors of common degenerative and inflammatory arthropathies of the hand. 2. Emphasize quick recognition of key radiographic findings of arthritis and learn how to classify the arthropathy using specific criteria.

CONTENT DESCRIPTION: When less common arthritides (inflammatory arthropathies) occur in the hand, correct classification can become a daunting task in the fast pace environment typically encountered in a radiology practice. Applying a simple algorithmic approach for arthropathies of the hand can aid the radiologist in a speedy and accurate diagnosis. An accurate classification is paramount for selecting the appropriate therapy and reducing the associated long-term sequelae accompanying inflammatory arthritides. Utilization of radiographs augmented with ultrasound and magnetic resonance imaging can identify joint distribution patterns and particular arthritic features (such as joint space narrowing, bone repair, periostitis) to facilitate arriving at a specific diagnosis. Diagnostic aid for classification of the common and less common arthropathies afflicting the hand will be accomplished utilizing an image-rich poster presentation.

(E-072) Wednesday • 7:00–8:00 AM • Hard-copy poster Ulnar Collateral Ligament Injuries of the Thumb: A Pictorial Review

Brandon R. Callahan, MD, *Baylor Scott & White, Temple, TX*; Ricardo D. Garza-Gongora, MD

LEARNING OBJECTIVES: 1. Review and illustrate pertinent anatomy regarding the ulnar collateral ligament and MCP joint of the thumb. 2. Discuss common injuries and pathophysiology that leads to ulnar collateral ligament injury and associated Stener lesions. 3. Provide MRI imaging features with case examples of ulnar collateral ligament injuries.

CONTENT DESCRIPTION: Injuries of the ulnar collateral ligament (UCL) of the thumb constitute one of the more frequent injuries to the hand. This common pattern of injury usually arises from valgus stress forces across the thumb metacarpophalangeal (MCP) joint. Acutely, this can occur due to a traumatic event such as a fall on an outstretched hand. Repetitive valgus stress to the thumb MCP joint can also result in chronic UCL injury. MRI remains the most accurate and reliable radiologic modality for evaluation of UCL injury. Aside from assessing for the presence of UCL tears, MRI also allows for assessment of complications such as interposition of the adductor aponeurosis or adductor pollicis muscle between the UCL and thumb MCP joint, an injury pattern commonly known as a Stener lesion. Thorough evaluation for suspected UCL tear and the presence or absence of a Stener lesion remains paramount to the appropriate management of thumb injuries in MRI.

(E-073) Tuesday • 7:00–8:00 AM • Hard-copy poster Chronic Non-Bacterial Osteitis (CNO) Imaging Review and Management Implications

Gaurav Syngal, *University of Texas MD Anderson Cancer Center, Houston, TX*; Bilal Mujtaba, MD (BMujtaba@mdanderson.org)

LEARNING OBJECTIVES: 1) Discuss the etiology, pathophysiology, and clinical features of CNO. 2) Discuss the key imaging findings for this disease. 3) Discuss treatment/management and prognosis.

CONTENT DESCRIPTION: **Introduction:** Chronic Non-Bacterial Osteitis (CNO) was first described in 1972 by Giedion et al. This condition consists of an autoinflammatory bone disorder that results in bone lesions. Patients may suffer from a single to multiple bone lesions that may self-resolve, persist, or recur. **Epidemiology/Pathophysiology:** CNO is a relatively rare bone disease with one study showing an incidence of 0.4/100,000 children. Currently, the pathophysiology of CNO is not well understood, but some recent studies have shown a derangement on inflammatory markers (such as IL-10, IL-6, IL-12, RANTES). **Clinical features/Labs:** Patients are usually young (~7-12 years old), female and present with localized pain +/- swelling. Since this presentation is common in other conditions like bacterial osteomyelitis, bone malignancies, fibrous dysplasia, or Langerhans cell histiocytosis, a delay in diagnosis and appropriate treatment may occur. Initial workup shows that patients have negative bone cultures. Inflammatory markers like ESR and CRP may be normal or moderately increased. **Imaging Findings:** Initial imaging usually consists of radiographs at symptomatic

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sites. Lesions start as osteolytic lesions, then develop sclerosis around the osteolytic lesion, and eventually progress to predominately sclerotic lesions. Lesions are most commonly found in the metaphysis of the clavicle, pelvis, tibia, and femur. If the studies are negative, then MRI is done to look for bone marrow edema (decreased signal on T1 weighted images and increased signal on T2 weighted images). **Treatment options:** First line treatment consists of NSAIDs. Second line agents include TNF- α antagonists, methotrexate, and bisphosphonates. **Prognosis:** Some patients can have persistent symptoms despite treatment. Additionally, patients may develop arthralgias, pathological fractures, limb-length discrepancies, and scoliosis (if there is spinal involvement).

(E-074) Tuesday • 7:00–8:00 AM • Hard-copy poster **Review of Night Float Radiology Resident Variance in Preliminary Reads**

Tudor H. Hughes, MD, FRCR, *University of California San Diego Medical Center, San Diego, CA*; Rozan Bokhari, MBBS; Eman Alqahtani, MD, MPH; Wilbur Wang, MD

LEARNING OBJECTIVES: Review the commonly overlooked musculoskeletal diagnoses in Radiology Resident preliminary overnight reads.

CONTENT DESCRIPTION: At UC San Diego, the Night Float resident performs preliminary reads on cases between the hours of 8pm and 8am. Most of these cases are therefore from a level 1 trauma center and the emergency department. These then have final reads by faculty the following morning. Discrepancies between the initial read and the final read are tagged as CQI cases. These are then presented at the monthly CQI conference for purely educational purposes, with resident anonymity. Both residents and faculty attend this conference. Between Dec 2005 and June 2017 there were 1879 CQI cases recorded. The cases have been subdivided by specialty and here we present the Musculoskeletal section of 434 cases. The emphasis is on an illustrated depiction of the commonly missed conditions as an educational tool for the Radiology resident about to take call.

(E-075) Tuesday • 7:00–8:00 AM • Hard-copy poster **Sequelae of IV Drug Abuse: A Pictorial Review**

Matthew J. Miller, MD, *West Virginia University, Morgantown, WV*; Jennifer Koay, MD (mmille52@hsc.wvu.edu)

LEARNING OBJECTIVES: This educational exhibit provides a review of consequences of intravenous drug abuse. The approach is based on the official ABR Core Exam study guide and is organized by etiology, highlighting imaging findings, while also providing a review of the epidemiology, clinical course, and long term complications.

CONTENT DESCRIPTION: This educational exhibit is based upon a teaching file of pathologically and clinically proven cases, encountered at a tertiary referral center. High quality radiographs, computed tomography, and magnetic resonance images illustrate the findings and complement a succinct review of each disease, as outlined by the official ABR Core Exam study guide. The exhibit spans subject matter including more common disorders such as discitis/osteomyelitis and septic arthritis, while also including more rare disorders such as epidural abscess.

(E-077) Tuesday • 7:00–8:00 AM • Hard-copy poster **You've Been HADD: Calcific Tendinitis Outside the Shoulder, Imaging and Intervention**

Andrew Kanarek, *University of Wisconsin, Madison, WI*; Brian Y. Chan; B. Keegan Markhardt; Donna Blankenbaker; Andrew B. Ross, MD, MPH (akanarek@uwhealth.org)

PURPOSE: Hydroxyapatite deposition disease (HADD) is a common source of periarticular pain that may go unrecognized when presenting at atypical locations. This exhibit highlights imaging findings of HADD at diverse sites throughout the body and familiarizes the learner with the technique for ultrasound guided calcific lavage at sites outside the shoulder.

METHOD AND MATERIALS: Although well-recognized in the shoulder and other common locations such as adjacent to the greater trochan-

ter, HADD can manifest in many areas of the body. If the radiologist is unfamiliar with its imaging appearance in atypical locations, the findings may be missed or misdiagnosed. When conservative management fails, calcific lavage may be used to shorten the duration of symptoms. The technique of calcific lavage to treat HADD has been well-documented in the shoulder. However, to date, little attention has been paid to the possibility of ultrasound-guided calcific lavage at other sites, though this procedure is fast, cost-effective, safe, and may provide significant relief for patients. This exhibit will provide a survey of imaging features of HADD in atypical locations throughout the body across multiple imaging modalities, including radiographs, ultrasound, and magnetic resonance imaging. It will discuss typical imaging features, locations, and diagnostic pitfalls. Case examples will be used to highlight our experience with ultrasound-guided calcific lavage treating calcific tendinitis outside the shoulder and describe our intervention techniques at these various locations.

RESULTS: To date there has been little discussion of the use of calcific lavage to treat calcific tendinitis at sites other than the shoulder. We illustrate HADD findings in different locations across multiple modalities and demonstrate successful use of ultrasound-guided lavage at several sites throughout the body in order to familiarize providers with this therapeutic option.

CONCLUSION: Ultrasound-guided calcific lavage for calcific tendinitis is an underutilized therapeutic intervention despite being safe, effective, and relatively inexpensive. It may be used in sites outside the shoulder by providers familiar with the imaging findings and intervention technique.

(E-078) Wednesday • 7:00–8:00 AM • Hard-copy poster **Complications of Shoulder Arthroplasty**

Joseph M. Limback, MD, *Florida Hospital, Orlando, FL*; Andrew Cibulas; Laura W. Bancroft, MD*; Brandon Runyan; Christopher W. Wasyliw, MD; Kurt F. Scherer, MD (joseph.limback.md@flhosp.org)

PURPOSE: To demonstrate the incidence and breadth of complications that accompany shoulder arthroplasty.

METHOD AND MATERIALS: Increasing number of shoulder arthroplasties are being performed all over the world. However, this results in a greater number and breadth of complications, with a complication rate ranging from 1.9-6.2%. Complication rates are affected by patient risk factors, type of arthroplasty (partial, total, reverse total), and surgical approach. Retrospectively collected images of both common and rare complications that can occur during and after shoulder arthroplasty are presented.

RESULTS: We demonstrate multiple cases of post-shoulder arthroplasty complications, ranging from more common complications to rare complications. Examples include pneumothorax, cutaneous fistula, metaglene screw failure, and spacer dislocation, amongst others.

CONCLUSION: While very safe, there are a number of complications to watch for after shoulder arthroplasty.

(E-079) Tuesday • 7:00–8:00 AM • Hard-copy poster **Opportunistic Screening for Sarcopenia: Novel Approach Using Computed Tomography of the Thigh**

Kyler Harden, *Wake Forest School of Medicine, Winston-Salem, NC*; Josh Tan, MS; Bahram Kiani, MD; Robert D. Boutin, MD; Leon Lenchik, MD (llechik@wakehealth.edu)

LEARNING OBJECTIVES: 1. Review approaches to opportunistic screening for sarcopenia using CT examinations of the chest, abdomen, and pelvis 2. Review lower extremity CT protocols used for planning of robotic-assisted knee replacement surgery 3. Present a novel approach for opportunistic screening for sarcopenia based on pre-operative thigh CT exams 4. Present common pitfalls of muscle measurement encountered on thigh CT exams

CONTENT DESCRIPTION: Opportunistically measuring muscle metrics on CT examinations obtained for other reasons is becoming more common. CT-based diagnosis of sarcopenia is usually made based on

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cross-sectional muscle area and/or muscle attenuation. In the five years, the use of preoperative CT to help guide robotic-assisted knee replacement surgery has been rapidly increasing. In this exhibit, we present a novel approach for opportunistic screening for sarcopenia based on the pre-operative CT exams of the thigh. Specifically, we discuss the appropriate selection of measurement locations in the proximal thigh and distal thigh, present a validated approach to muscle thresholding and muscle segmentation, describe clinically relevant output variables including cross sectional area, skeletal muscle index, and muscle attenuation. In addition, we show examples of common pitfalls of muscle measurement on thigh CT exams. Sarcopenia has been associated with many adverse health outcomes including falls, physical disability, longer hospital stays, post-operative complications, decreased survival. Helping orthopedic surgeons recognize sarcopenia on thigh CT exams obtained for pre-operative planning may lead to improved patient care.

(E-103) Wednesday • 7:00–7:15 AM • E-poster Station #7 Avulsion Injuries of the Knee

Brandon Sonnier, DO, *Temple, TX*; Connie C. So, MD; Cory R. Stephenson, BS; Lowell H. Ellerbrook, MD; Ricardo D. Garza-Gongora, MD; Linda Parman, MD; et al

LEARNING OBJECTIVES: 1. Review the basic anatomy of the knee to include the numerous tendinous, ligamentous, and meniscal attachment sites. 2. Detail clinical and multimodal imaging characteristics associated with avulsion fractures of the lateral knee, medial knee, intercondylar notch, and anterior knee. 3. Discuss common pitfalls in diagnostic imaging including technical challenges and common mimicks.

CONTENT DESCRIPTION: It is estimated that more than a million emergency room visits per year in the U.S. are related to acute knee pain with nearly 2 million outpatient primary care visits sharing a similar focus. Knowing pertinent clinical and imaging characteristics related to common acute knee pain etiologies is important for the radiologist to provide accurate and timely information to help direct patient care. Avulsion injuries result when tissue is forcibly removed from a donor site. In the case of avulsion fractures of the knee, a bony fragment is pulled from its donor site by an attached ligament or tendon. Avulsion sites around the knee are predictable based on knowledge of origins and insertions. Knowledge of these locations can guide the radiologist to specific findings in order to make the correct diagnosis. An image-rich multimodal presentation of avulsion injuries of the knee will be presented to reinforce these concepts.

(E-134) Tuesday • 7:00–7:15 AM • E-poster Station #5 Soft Tissue Masses of the Digits: It's Hard to Put Your Finger on the Diagnosis!

Kiran Busireddy, MD, *Creighton Medical Center, Omaha, NE*

LEARNING OBJECTIVES: 1. Focal digit masses are frequently encountered in daily practice and pose a great challenge to the radiologist to arrive at a definitive diagnosis based on the imaging features. 2. MRI is the imaging modality of choice. MR features of various digit masses are well described in the literature, however, they are very non-specific. Therefore, it is crucial to determine the morphology and extent of the lesion based on the MR imaging features and narrow down the differential diagnosis. The definitive diagnosis is almost always arrived after pathological examination. 3. We present various pathology proven benign and malignant digit masses encountered at our institution with relevant imaging and formulate the most reliable differential diagnosis to help aid the clinical management.

CONTENT DESCRIPTION: 1. Classification of digit masses 1. To review the imaging findings on conventional MRI 2. To provide sample cases for each entity and describe the common mimics encountered with similar imaging characteristics. 3. Importance of formulating the most reliable differential diagnosis for each entity. 4. Histological examination of each entity.

(E-135) Tuesday • 7:20–7:35 AM • E-poster Station #3 Where the Sound Don't Shine

Michael V. Friedman, MD, *Washington University School of Medicine, Saint Louis, MO*; Jason Yoon (*mvfriedman@wustl.edu*)

LEARNING OBJECTIVES: 1. Review the diagnostic approach to the patient with a painful shoulder and the utility of available imaging modalities. 2. Discuss the appropriate utilization of shoulder ultrasound, including its technical and anatomic advantages and limitations. 3. Use a case based approach to review many different etiologies of shoulder pain that are inadequately evaluated on shoulder sonography, their typical clinical presentation, and review their appearance on radiographs and MRI.

CONTENT DESCRIPTION: Purpose/Aim: Review the appropriate utilization of shoulder ultrasound, including its technical and anatomic advantages and limitations. We will use a case-based approach to review many different etiologies of shoulder pain that are inadequately evaluated on shoulder sonography, their typical clinical presentation, and review their appearance on radiographs and MRI. **Content Organization:** Review the diagnostic approach to the patient with a painful shoulder. Review the utility of available imaging modalities. • Focus on appropriate utilization of shoulder ultrasound, advantages and limitations Case based illustration of causes of shoulder pain commonly missed on ultrasound such as: • Osteoarthritis • Distal clavicular osteolysis • Labral tear • Biceps pulley lesion • Tumor/metastasis • Neurovascular pathology For each case/etiology: Discuss common clinical presentation; Why ultrasound is limited in that specific case including clinical physics; Preferred imaging modality and respective findings. **Conclusion:** While ultrasound is an excellent tool for rotator cuff pathology evaluation, many entities may coexist or cause similar symptoms that are better evaluated with radiographs and MRI. It is important for the clinician to be aware of the benefits/limitations of these modalities to prevent misdiagnosis and treatment delay.

(E-136) Tuesday • 7:20–7:35 AM • E-poster Station #4 Labral Tears and Femoroacetabular Impingement Syndrome: What Radiology Residents Should Know!

(FDA)

Ahmadreza Ghasemiesfe, MD, *Yale New Haven Health Bridgeport Hospital, Bridgeport, CT*; Pranav Sharma, MBBS, MD; Puneet S. Kochar, MBBS, MD; Scott D. Smith, MD

LEARNING OBJECTIVES: Imaging features of the Femoroacetabular impingement syndrome (FAI). Characteristics of MR arthrogram in diagnosis of common associated labral disease. Learning from real cases.

CONTENT DESCRIPTION: Femoroacetabular impingement syndrome is a relatively new clinical entity to be described in orthopedics, and has been strongly recognized as a major cause of pain and early osteoarthritis (OA) of the hip in young adults. The vast majority of labral tears are from FemoroAcetabular Impingement (FAI). CAM type impingement: young men, average age of 32 years. Pincer type impingement: middle-aged women, average age of 40 years. Types of FAI: CAM Type FAI is characterized by an aspheric femoral head with lack of concavity of the anterolateral head-neck junction, creating a decreased femoral head-neck offset. Pincer Type FAI is characterized by the presence of either focal or generalized acetabular over-coverage of the femoral head. Mixed or Combined Type: both the pincer and CAM types are present.

(E-137) Tuesday • 7:20–7:35 AM • E-poster Station #6 Essential Diagnoses using Musculoskeletal Ultrasound: Sonography Made Easy

Everett Gu, MD, *University of Michigan, Ann Arbor, MI*; Jon A. Jacobson, MD; Nathaniel B. Meyer, MD; Vivek Kalra, MD, MPH

LEARNING OBJECTIVES: After viewing this exhibit, participants should: • Be familiar with the use of ultrasound in musculoskeletal imaging • Understand the advantages of ultrasound versus other imaging modalities • Be able to recognize important anatomic landmarks on

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normal and abnormal ultrasound cases • Be comfortable diagnosing key musculoskeletal pathologies

CONTENT DESCRIPTION: Imaging with ultrasound is highly operator dependent and requires a unique understanding of ultrasound technique, including image optimization and patient positioning, which will be covered in this exhibit. Additionally, normal cases will be shown to highlight key anatomic relationships and normal sonographic appearance of various tissues, including muscles, fat, tendons, ligaments, nerves, and osseous structures. Finally, this exhibit will present key musculoskeletal pathologies that can easily be diagnosed with ultrasound. A few examples, grouped by anatomic location, are listed as follows: • Shoulder: rotator cuff tear, calcific tendinitis • Elbow: medial and lateral epicondylitis, biceps tendon tear, ulnar nerve dislocation, snapping triceps syndrome • Wrist and Hand: carpal tunnel syndrome, gamekeeper thumb, intersection syndrome • Hip and Knee: greater trochanteric bursitis, snapping hip syndrome, iliotibial band syndrome. • Ankle and Foot: achilles tendon tear, Morton neuroma

(E-138) Tuesday • 7:40–7:55 AM • E-poster Station #1 Spine Hardware: What the Radiologist Needs to Know!

Manickam Kumaravel, MD, *University of Texas Houston, Houston, TX* (Manickam.Kumaravel@uth.tmc.edu)

LEARNING OBJECTIVES: Orthopedic hardware in the spine has always challenged the general radiologist. The exhibit aims to educate the reviewer as to • The basics of spine hardware • Discuss the basic principles and physiology of fixation in the spine. • Identify hardware failure and its predisposing conditions • Formulate an accurate radiologic report, which is clinically useful

CONTENT DESCRIPTION: • The exhibit will elucidate the basics of spinal fixation with pictorial representation and gross imaging • The various modalities of imaging used in the evaluation of spine hardware will be demonstrated i.e. plain radiography, CT and MRI • Multiple spinal hardware complications will be demonstrated. Detailed cross-sectional imaging will be provided to augment plain radiography. • Pitfalls and teaching points will be highlighted • Reporting template and model reports will be provided with an emphasis on clinical detail

(E-139) Tuesday • 7:40–7:55 AM • E-poster Station #5 Inflammatory Arthropathies: Beyond Rheumatoid Arthritis

Samuel R. Key, MD, *Emory University, Atlanta, GA*; Adam D. Singer, MD; Felix Gonzalez; Yara Younan (srkey@emory.edu)

LEARNING OBJECTIVES: 1. Inflammatory arthropathies are commonly encountered in radiology. This exhibit will review the patient demographics, clinical presentations, and imaging features of these diseases. 2. There are several types of inflammatory arthropathies. Imaging features classically associated with specific inflammatory arthropathies will be discussed. 3. Radiography is the standard modality used in imaging these diseases, with MRI and ultrasound providing further characterization in certain cases. The reader will become familiar with the utility of these imaging modalities in the evaluation of inflammatory arthropathies.

CONTENT DESCRIPTION: 1. Patient demographics and clinical presentation of inflammatory arthropathies. 2. Imaging features indicative of specific inflammatory arthropathies. 3. The utility of MRI and ultrasound in the evaluation of inflammatory arthropathies.

(E-140) Tuesday • 7:40–7:55 AM • E-poster Station #8 Direct and Indirect Signs of ACL Injury on Radiographic and MR Imaging: A Pictorial Review

Adam Heilala, MD, *Henry Ford Hospital, Detroit, MI*; Priyanka Annigeri, MD (adamh@rad.hfh.edu)

LEARNING OBJECTIVES: 1). Understand the normal anatomy of the ACL 2). Recognize normal imaging features of the ACL. 3.) Recognize direct and indirect signs of ACL tear on both radiography and MR.

CONTENT DESCRIPTION: Injury of the ACL is one of the most frequently encountered knee and ligamentous injuries. ACL tear can be seen

with characteristic mechanisms of injury. Radiographs are usually the first study ordered by clinicians for evaluation, followed by MR to confirm and complete assessment. Understanding the complex anatomy and typical course of the ACL is crucial. The ACL cannot be directly visualized on radiograph. Most injuries show a moderate to large joint effusion. Occasionally deepened notch of the lateral femoral condyle is seen. Segond fracture on the lateral margin of the tibia and arcuate fracture, involving the tip of the fibula may also be seen. Normally the ACL is hypointense on T1 and T2 imaging, taut between its insertion points, and fans out at its tibial insertion. Direct signs which are typically seen on MR include; discontinuity of the ACL, increased signal, and change in the expected course of the ACL. Indirect signs on MR include characteristic bone contusion pattern, anterior tibial translocation, uncovered posterior horn of the lateral meniscus, and reduced PCL angle. Joint effusions and soft tissue swelling again are also associated with ACL tear, however are nonspecific. Identification of these direct and indirect signs are sometimes challenging; however they can aid in recognition of ACL tear.

(E-141) Wednesday • 7:20–7:35 AM • E-poster Station #5 Imaging Indicators for Frailty Syndrome: What the Radiologist Needs to Know

Savya Shukla, MD, MHA, *Aventura Hospital and Medical Center, Aventura, FL*; Edward Missinne, MD; Miriam Zylberglait Lisigurski; Kristina A. Siddall, MD (savya@alethiahealthcare.com)

LEARNING OBJECTIVES: 1. Define frailty syndrome and associations (adiposity, decreased muscle mass and strength) and list negative health outcomes associated with frailty 2. Summarize the use of imaging (DEXA, US, CT and MRI) in the evaluation of sarcopenia and frailty 3. Describe the radiologic measurement techniques used to determine sarcopenia and other indicators of frailty syndrome

CONTENT DESCRIPTION: We define frailty syndrome and sarcopenia and their association with negative health outcomes including mortality after trauma, cancer prognosis, and post-operative complications. We provide an overview of imaging modalities used in the characterization of frail patients with examples including: CT measurement of psoas and masseter muscle areas, DEXA measurements of BMD and SI, MRI measurements of thigh and abdomen, and ultrasound measurements of upper and lower extremities. We discuss the reliability, validity and limitations of the techniques and new approaches to the evaluation of frailty syndrome. We summarize the role that the radiologist plays in the assessment of frailty.

(E-142) Wednesday • 7:20–7:35 AM • E-poster Station #9 Follow-up of Proximal Femur Fractures: What the Radiologist Needs to Know

David W. Robinson, MD, *Wake Forest School of Medicine, Winston-Salem, NC*; Scott D. Wuertzer, MD (dwrobin@wakehealth.edu)

LEARNING OBJECTIVES: 1) Review the radiographic findings of femoral head, femoral neck, intertrochanteric, and subtrochanteric fractures 2) Review the treatment of these fractures, including indications and contraindications for different types of hardware 3) Present an approach to the follow-up radiographs based on the fracture pattern, location, and hardware 4) Apply this approach to case examples to identify normal healing, abnormal healing, and hardware complications

CONTENT DESCRIPTION: An accurate assessment of the post-operative radiograph for proximal femur fractures requires knowledge of typical fracture patterns and locations. These factors, combined with the patient's age and pre-injury walking status, will dictate management of the patient. In this exhibit, we will review the different types of hardware used for operative management as well as the indications and contraindications for using this hardware. Specifically, we will focus on cannulated screws, dynamic hip screws, and cephalomedullary nails. We will discuss the expected radiographic appearance of this hardware and the expected healing response of the bone. We will then provide a systematic approach that incorporates these concepts to case examples. Recognizing normal healing, abnormal healing, and hardware complications will allow the radiologist to effectively

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communicate with the orthopedic surgeon and thereby optimize patient management.

(E-143) Wednesday • 7:40–7:55 AM • E-poster Station #4 Plantar Fibroma: Uncommon Cause of Foot Pain

Pranav Sharma, MBBS, MD, *Yale New Haven Health Bridgeport Hospital, Bridgeport, CT*; Puneet S. Kochar, MBBS, MD; Rami Sulaiman, MD; Ahmadreza Ghasemiesfe, MD; Scott D. Smith, MD (drpranavsharma29@gmail.com)

LEARNING OBJECTIVES: To review the presenting features and types of fibromatosis. To discuss the radiographic, ultrasound and MRI features of fibromatosis. To discuss the treatment options and post-operative follow-up.

CONTENT DESCRIPTION: The fibromatoses are a group of soft-tissue lesions that occur at different ages & at various anatomic locations. They behave intermediate in aggressiveness with a strong tendency toward local recurrence; however, they never metastasize. The lesions have a well-circumscribed or infiltrative margin. Knowledge of this entity is essential as lesions sometimes mimic malignancy. Fibromatosis are of two types – superficial and deep. Superficial ones are smaller along the fascia or aponeurosis, however, the deep ones are larger and may grow rapidly. Plantar fibromatosis, or Ledderhose disease is a benign fibroblastic proliferation of the plantar fascia of unknown origin and is classified as a type of musculoskeletal fibromatoses seen in both children and adults, most commonly 30-50yrs, with male predilection (M:F of 2:1). Most common location is medial aspect of plantar aponeurosis presenting as multiple firm, fixed nodules which can involve skin or deeper structures. Most are asymptomatic until they increase in size or invade muscles or neurovascular structures. The two main differentials are plantar fasciitis or plantar rupture. Radiographs are usually needed to exclude other diagnosis. The sonographic visualization of the continuity between the lesion and the plantar fascia is the single most useful sign for confidently diagnosing plantar fascial origin and excluding possibility neuroma or other soft tissue tumors. Typically they appear heterogeneous in signal on T1 or T2 WI with signal intensity equal or less than muscle with variable enhancement. In indeterminate cases biopsy may be performed. These are treated conservatively unless markedly symptomatic.

(E-144) Wednesday • 7:40–7:55 AM • E-poster Station #9 Why We Shouldn't Be So Callous About Callus: A Primer for Junior Residents on Fracture Healing

David W. Robinson, MD, *Wake Forest School of Medicine, Winston-Salem, NC*; Scott D. Wuertzer, MD (dwrobins@wakehealth.edu)

LEARNING OBJECTIVES: 1) Review the spectrum of osseous healing from primary to secondary bone healing. 2) Review the different types of fracture fixation from relative to absolute and their role in healing along the spectrum. 3) Review the common definitions and radiographic appearance of union, malunion, and nonunion. 4) Improve interpretive skills of fracture healing by applying the first 3 objectives to case examples.

CONTENT DESCRIPTION: Most fractures heal through a combination of primary (direct) healing and secondary (indirect) healing. The ratio of primary to secondary healing at a fracture site depends on the initial fracture pattern combined with the method of fixation. Absolute stability at a fracture site requires rigid internal fixation to promote primary healing through intimate cortical contact. Simple fracture patterns are more amenable to this type of repair that produces minimal callus. Relative stability at a fracture site can be achieved through more flexible means such as a cast. Complex fracture patterns will respond better to a more flexible fixation that produces more callus. Through case examples, we will review different types of healing based on fracture patterns and hardware. We will review the different types of hardware, discuss their role in promoting absolute or relative stability, and present examples of normal and abnormal healing (nonunion and malunion). With a general knowledge of fixation hardware, the expected type of healing, and potential complications of healing, junior radiology residents will improve their evaluation of fracture follow-up studies.

Nuclear Medicine

(E-080) Tuesday • 7:00–8:00 AM • Hard-copy poster Blind Spots in Nuclear Medicine: Opening the Window to Pathology

David Shlensky, BS, MD, *University of Michigan, Ann Arbor, MI*; Matthew Manganaro, MD; Richard K. Brown, MD

LEARNING OBJECTIVES: 1. Identify locations that are blind spots in Nuclear Medicine, particularly on PET/CT and Bone Scan. 2. Understand how windowing can reveal otherwise hidden pathology on these scans. 3. Incorporate common blind spots and windowing techniques into search patterns to reduce perceptual error and improve patient care.

CONTENT DESCRIPTION: Errors are common in clinical medicine, and radiology is no different. It has been estimated that the daily error rate for radiologists is approximately 3–4%. Delayed or missed diagnosis results in harm to patients, thus creating a need for error reduction techniques. Radiologic errors can be classified as either perceptual, in which a radiologist fails to identify an abnormality, or cognitive, in which the interpretation of an abnormality is incorrect. Several factors lead to perceptual errors including radiologist driven causes (i.e., fatigue, experience, satisfaction of search) and systematic driven causes (i.e., high volume, reading room distractions). In a study of radiologic diagnostic errors by Kim & Mansfield, under-reading (frankly missing a visible lesion) and location (missing a lesion outside the area of interest) resulted in 42% and 7% of errors respectively. Missed lesions (perceptual errors) are commonly retrospectively found in blind spots, which span across modalities and subspecialties, including Nuclear Medicine. Radiologists are liable to repeat the same errors on future cases if no educational change occurs. Certain techniques can be used to limit errors, including standardizing search patterns and optimizing image viewing quality. Search patterns are guided by several factors including habit, experience, anatomy, disease patterns, and the type of abnormality sought. Because of this, identification and incorporation of blind spots into search patterns, templates, or checklists can help reduce error. Other techniques that improve image viewing quality can be employed to make lesions more perceptible, such as windowing changes. This educational exhibit seeks to reduce perceptual error on Nuclear Medicine scans by exemplifying blind spots and exploring windows that make lesions more apparent.

(E-081) Wednesday • 7:00–8:00 AM • Hard-copy poster The Role of ¹⁸F- Fluciclovine PET in Recurrent Prostate Cancer: From Acquisition and Interpretation to Future Directions

Anthony Andres DePalma, *Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ*; Levi Sokol; Jeffrey S. Kempf, MD (JKempf@unvirad.com)

LEARNING OBJECTIVES: 1. To learn the role of ¹⁸F- Fluciclovine PET/CT in patients with recurrent Prostate Cancer. 2. To understand how to acquire and interpret ¹⁸F-Fluciclovine PET scans. 3. To learn future directions of ¹⁸F-Fluciclovine imaging as well as the evolving role of PSMA PET.

CONTENT DESCRIPTION: In this educational exhibit we will review the current role of the recently FDA approved amino acid labeled PET tracer ¹⁸F-Fluciclovine for patients with biochemical recurrence of prostate cancer. We will review acquisition parameters and present normal as well as abnormal examples, potential pitfalls, as well as comparison with other imaging modalities. In addition potential future directions of ¹⁸F-Fluciclovine will be presented along with the developing role of PSMA PET imaging in Prostate Cancer.

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(E-145) Tuesday • 7:00–7:15 AM • E-poster Station #6
The Reconstructed Breast: Recognizing the Spectrum of Imaging Findings on PET-CT

Jennifer E. Caero, MD, *Baylor University Medical Center at Dallas, Dallas, TX*; Umesh D. Oza, MD

LEARNING OBJECTIVES: 1. Recognize the various imaging appearances of the reconstructed breast on PET-CT. 2. Describe complications that may occur in the reconstructed breast, and their appearance on PET-CT. 3. Demonstrate the PET-CT appearance of recurrence in the reconstructed breast.

CONTENT DESCRIPTION: Breast reconstruction is often performed in breast cancer patients after mastectomy to restore symmetry. The reconstructed breast is not routinely imaged mammographically, but patients may present with clinical symptoms prompting dedicated breast imaging. Depending on the extent of their disease, many of these patients undergo staging or restaging PET-CT, which can reveal benign complications, expected post-surgical changes associated with uptake, and recurrent/metastatic disease. It is important for the radiologist to be familiar with both normal, expected, and abnormal appearances of the reconstructed breast for accurate imaging interpretation on PET-CT. Reconstruction techniques may utilize implants, autologous tissue flaps, or both. Implant reconstruction may be performed immediately after a skin-sparing mastectomy, or as a two-step approach, with a soft tissue expander and subsequent placement of a permanent implant. The most common types of flap reconstruction include the transversus rectus abdominis myocutaneous flap, latissimus dorsi flap, deep inferior epigastric perforator flap, superficial inferior epigastric artery flap, and gluteal flap, all of which will be described in this poster. Common benign findings in autologous flap reconstruction include edema, seromas, hematomas, and fibrosis, which are generally not FDG-avid. Radiation therapy may lead to trabecular changes and skin thickening. Fat necrosis may also occur after reconstruction and can be FDG-avid, a potential pitfall when evaluating for recurrence. Local recurrence is often FDG-avid and predominately occurs at the medial aspect of the flap due to lymphatic drainage to the internal mammary node, which is not dissected at the time of reconstruction. Recurrences may also occur within the subcutaneous tissue within the flap or from the chest wall.

(E-146) Wednesday • 7:20–7:35 AM • E-poster Station #3
⁶⁸Ga-DOTATATE Somatostatin Receptor PET/CT Imaging: What the Radiologist Needs to Know

Sarah Pettyjohn, MD, *Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ*; Jeffrey S. Kempf, MD (*JKempf@Univrad.com*)

LEARNING OBJECTIVES: 1) To learn current indications and applications for ⁶⁸Ga-Dotatate PET/CT for neuroendocrine tumors. 2) To describe how to acquire and interpret normal and abnormal ⁶⁸Ga-Dotatate PET/CT imaging studies. 3) To review advantages of ⁶⁸Ga-Dotatate PET/CT imaging over ¹¹¹In-octreotide SPECT imaging. 4) To highlight potential pitfalls in ⁶⁸Ga-Dotatate imaging and what the radiologist needs to know to help avoid them.

CONTENT DESCRIPTION: ⁶⁸Ga-Dotatate was recently approved by the FDA in June 2016 as the first Gallium labeled PET radiopharmaceutical tracer for imaging of neuroendocrine tumors (NETS). In this educational exhibit we will review the clinical indications, acquisition as well as the superiority of ⁶⁸Ga-Dotatate PET/CT over Octreotide SPECT/CT in the evaluation of GI, Pancreatic, and Bronchial NETS. We will present the Krenning Scoring system, NET Grading, as well as the complimentary use of FDG PET in patients with more poorly differentiated tumors. We will also review normal benign ⁶⁸Ga-Dotatate uptake as well as normal variants and potential false positive studies that may lead to interpretative errors for NET identification.

(E-147) Wednesday • 7:20–7:35 AM • E-poster Station #8
Ga-68 DOTATATE: Beyond Neuroendocrine Tumors

Timothy J. Waits, MD, *University of Kentucky, Lexington, KY*; Ravi Jayavarapu, MD; Lowell B. Anthony, MD; Aman Chauhan, MD; M. Elizabeth Oates, MD; Riham El Khouli, MBBS, MD (*timothy.waits@uky.edu*)

LEARNING OBJECTIVES: 1. To understand the physical and biological characteristics of ⁶⁸Ga-DOTATATE for the evaluation of neuroendocrine tumors (NET). 2. To recognize the physiological biodistribution patterns of ⁶⁸Ga-DOTATATE. 3. To identify different ⁶⁸Ga-DOTATATE patterns that can potentially result in false-positive interpretations. 4. To describe ⁶⁸Ga-DOTATATE-avid non-pathological and NET mimickers.

CONTENT DESCRIPTION: 1. Introduction to ⁶⁸Ga-DOTATATE • Physical and biological characteristics • Principles underscoring its value as first-line radiopharmaceutical for NET 2. Physiological biodistribution patterns of ⁶⁸Ga-DOTATATE 3. Potential interpretative pitfalls in ⁶⁸Ga-DOTATATE PET/CT including uncinatate process focal uptake 4. Representative case examples of incidental ⁶⁸Ga-DOTATATE-avid non-pathological and NET mimickers including: • Meningioma • Uterine fibroid • Carotid body paraganglioma • Fibroadenoma

Neuroradiology

(E-082) Wednesday • 7:00–8:00 AM • Hard-copy poster
Cerebrovascular Emergencies and Their Mimics: What On-call Residents Need to Know

Jacqueline Junn, MD, *Emory University School of Medicine, Atlanta, GA*; Tarek N. Hanna, MD; Amanda S. Corey, MD; Matthew E. Zygmunt, MD; Ryan B. Peterson, MD

LEARNING OBJECTIVES: 1. Review cerebrovascular anatomy with a focus on clinically important anatomic variants and mimics of pathology. 2. Be able to identify common cerebrovascular emergencies on multimodality imaging. 3. Understand complications and appropriate grading criteria for these findings.

CONTENT DESCRIPTION: Cerebrovascular emergencies require a timely diagnosis for prompt and appropriate intervention. It is important for on-call residents to understand the neurovascular anatomy to accurately describe and relay the location and findings to the clinicians. We shall first provide a basic overview of arterial and venous anatomy of the brain and cervical spine, focusing on clinically important variants and highlighting anatomic details which residents may not be familiar. We shall then review both traumatic and non-traumatic vascular emergencies. The following traumatic and non-traumatic entities will be covered: Carotid/Vertebral artery dissection, Pseudoaneurysm, ruptured intracranial aneurysm (SAH Hunt-Hess grading system), Denver grading system for blunt cerebrovascular injury. Mimickers include carotid webs or shelves following endarterectomy. Imaging will primarily entail CTA. However, in certain cases findings will be reviewed on non-contrast CT, ultrasound, and MRI/MRA. Recommendations for follow-up imaging will be detailed.

(E-083) Tuesday • 7:00–8:00 AM • Hard-copy poster
Graph Theory: What Radiologists Need to Know for the Understanding of Resting State fMRI

Millie Yu, BS, MS; Quan Nguyen, MS, BS; Jeremy B. Nguyen, MD, MS, *Tulane University Hospital and Clinics, New Orleans, LA*; Yu-Ping Wang, PhD; Enrique Palacios, MD; Mandy Crause Weidenhaft, MD (*jnguye2@tulane.edu*)

LEARNING OBJECTIVES: • Describe the basic principles of resting state fMRI • Describe the functional connectivity of the brain based on resting state fMRI principles • Describe the organization of the brain networks based on functional connectivity • Describe the basic concepts and properties of graph theory such as vertex, edge, graph types, trees, connectivity and transversability • Describe the applications of some important concepts in graph theory for the analysis of brain networks, including clustering-coefficient, characteristic path length, node degree and degree distribution, centrality and modularity

* Faculty financial disclosures are located in the Faculty Index.

CONTENT DESCRIPTION: Functional magnetic resonance imaging (fMRI) is a neuroimaging technique using MRI technology that measures brain activity by detecting blood oxygenation and flow that occur in response to neural activity when performing an explicit task. Resting state functional MRI (R-fMRI) is a method for evaluating regional interactions that occur when a subject is not performing an explicit task. Human brains form an integrative network in which information is continuously processed and transferred between structurally and functionally linked brain regions. Using resting state fMRI, pioneering studies have shown that a high level of functional connectivity existing between regions of functional networks. Graph theory is concerned with the relationships of nodes and lines. Functional brain networks can be defined as a graph with the collection of nodes reflecting the brain regions, and lines reflecting the connections between these brain regions. A graph representation of the functional brain network allows for the examination of its organization using graph theory. This tutorial presents some important concepts of graph theory as applicable to the understanding of resting state fMRI, hence the understanding of brain networks. The reader will learn basic properties of graph theory needed for the characterization of brain networks. Important concepts for the understanding of fMRI functional connectivity such as clustering-coefficient, characteristic path length, node degree and degree distribution, centrality and modularity will be explained in details.

**(E-084) Wednesday • 7:00–8:00 AM • Hard-copy poster
Common Sellar and Parasellar Pathology: A Pictorial Review**

Cory A. Smith, DO, *West Virginia University, Morgantown, WV*

LEARNING OBJECTIVES: 1. Review and be able to diagnose common sellar and parasellar pathology in adults. 2. Review and be able to diagnose common sellar and parasellar pathology in children. 3. Understand the specific MRI sequences utilized when evaluating the sellar region.

CONTENT DESCRIPTION: To begin, a short summary of the commonly used MRI sequences to evaluate the sella will be provided. A pictorial review of the common imaging features of meningioma, adenoma, Rathke cleft cyst, and internal carotid artery aneurysm will be reviewed for adults to include pathologically proven MRI cases. A pictorial review of the common imaging features of craniopharyngioma and hypothalamic hamartoma for pediatrics will also be provided. Discussion of common imaging features will include a current review of the literature.

**(E-085) Tuesday • 7:00–8:00 AM • Hard-copy poster
Multinodular and Vacuolating Neuronal Tumor: A Newly Described WHO Grade 1 Seizure Related Brain Tumor**

Jeffrey Klug, MD, *University of Nebraska Medical Center, Omaha, NE*;
Jason T. Helvey, MD

LEARNING OBJECTIVES: 1. Identify common MRI characteristics of a multinodular vacuolating neuronal tumor (MVNT). 2. Differentiate a MVNT from other more common and similar appearing brain tumors.

CONTENT DESCRIPTION: - MVNT is a newly described benign grade 1 brain tumor in the 2016 WHO classification. It was first described in 2013 with approximately 15 described cases in the literature since then. It typically presents with seizures and/or headaches in adults. - The typical appearance on MRI is a slightly expansile lesion containing multiple cystic spaces which are hyper-intense on T2 and T2-FLAIR weighted imaging. It is typically within the temporal lobe and characteristically demonstrates a transmantle component spanning from the periventricular white matter to the juxtacortical u-fibers. It is most commonly hypo-intense on T1 weighted imaging and typically does not demonstrate post-gadolinium enhancement or restricted diffusion. - Imaging characteristics typically allow for a narrow differential with definitive diagnosis provided by pathologic specimen. Other lesions which are commonly included in the differential include dysembryoplastic neuroepithelial tumors (DNET), focal cortical dysplasia, and low grade glioma. Specific ways to differentiate these lesions will be described. - The long term growth potential of this tumor is not yet known.

**(E-086) Wednesday • 7:00–8:00 AM • Hard-copy poster
Extramedullary Hematopoiesis: Imaging and Clinical Implications**

Millie Yu, BS, MS; Juan S. Gomez, MD; Enrique Palacios, MD; Jeremy B. Nguyen, MD, MS, *Tulane University Hospital and Clinics, New Orleans, LA*; Lorena Garza Garcia, MD (*jnguye2@tulane.edu*)

LEARNING OBJECTIVES: • Describe the process of hematopoiesis. • Discuss the etiology and pathophysiology of extramedullary hematopoiesis (EMH). • Describe the characteristic imaging appearance of EMH. • Discuss the multiple clinical presentations of EMH. • Provide the different types of management for treatment.

CONTENT DESCRIPTION: Extramedullary Hematopoiesis is the production of blood cells outside of the normal location of the bone marrow. In the fetus, the primary sites of hematopoiesis are the yolk sac, liver, spleen, and bone marrow. After birth, hematopoiesis should occur only in the bone marrow and any extramedullary location is considered abnormal. EMH occurs when bone marrow is no longer able to support normal hematopoiesis. EMH can occur under conditions of local production of hematopoietic factors that maintain and induce differentiation of the stem and progenitor cells, when there are supporting cells, and when there is accommodation of hematopoietic progenitors. The cascade begins with displacement and mobilization of stem and progenitor cells. Consequently, hematopoietic stem and progenitor cells occupy other locations as alternative sites of hematopoiesis. EMH mostly occurs in the liver and spleen, with the remaining of cases occurring in almost every tissue in the human body, including the adrenal gland, thymus, kidney, pleura, lung, breast, skin, and gastrointestinal tract. Very rarely, EMH can develop in the CNS, head and neck, and spine. Symptoms for the majority of patients with non-hepatosplenic EMH (63%) will be site-specific. EMH has high risk for hemorrhage complications and paraspinous lesions may affect the spinal cord and peripheral nerves, causing symptoms such as weakness and radiculopathy. The treatment for EMH depends on a number of factors, including the size of the mass, severity of symptoms, the clinical condition of the patient, and previous treatment methods. Excisional biopsy, radiation therapy, and frequent blood transfusions to limit hematopoietic stimulus are some treatment options. Therapy may be required in cases such as EMH manifestations in the spinal canal causing spinal cord compression, and asymptomatic cases may require no therapy.

**(E-087) Tuesday • 7:00–8:00 AM • Hard-copy poster
Catastrophic Cervical Spine Injuries in Low-Energy Trauma**

Ross T. Christopher, MD, *Emory University School of Medicine, Atlanta, GA*; Jacqueline Junn, MD; Tarek N. Hanna, MD; Amanda S. Corey, MD; Matthew E. Zygmunt, MD; Ryan B. Peterson, MD

LEARNING OBJECTIVES: 1. Understand the spectrum and mechanisms of cervical spine injury. Learn to use the verbiage of the Subaxial Injury and Classification (SLIC) and severity score where appropriate. 2. Review changes to the osseous and ligamentous cervical spine that can occur with a spectrum of chronic diseases. 3. Discussion of disease entities that predispose to catastrophic cervical spine injury with low energy trauma.

CONTENT DESCRIPTION: Cervical spine trauma is common with injuries ranging from minor ligamentous disruption to detrimental cord injuries. When patients have an underlying disease that affects the intrinsic flexibility or shock-resistance of the cervical spine, even a minor impact trauma can have devastating consequences. It is important for clinicians to be more cognizant of possible severe cervical spine injury when patients present with these conditions. We shall first briefly review common mechanisms and patterns of cervical spine injuries. Subsequently, we will focus our attention on conditions that affect the cervical spine that predispose patients to catastrophic injury with low energy trauma. These following conditions will be discussed in detail with examples of post traumatic injuries in the setting of low mechanism trauma: Ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis, rheumatoid arthritis, Gorham syndrome, malignant involvement of

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the cervical spine, congenitally or degeneratively narrowed spinal canal, osteogenesis imperfecta, and osteopetrosis.

(E-088)
WITHDRAWN

(E-089) Tuesday • 7:00–8:00 AM • Hard-copy poster
Cranial Foramina: A Concise Cross-sectional Pictorial Review

Ryan Kuhnlein, MD; Charles Marcus, MD, *West Virginia University, Morgantown, WV*; Rashi Mehta, MD; Jeffery Hogg, MD (*charles.marcus@hsc.wvu.edu*)

LEARNING OBJECTIVES: 1. The main objective of this poster is to review the cross-sectional anatomy of the skull base foramina and neurovascular structures that pass through each. 2. Review the relationship of the structures passing through each foramen. 3. Present few examples of pathology and imaging characteristics that can occur related to the foramina. 4. Assist learners identify pathology based on the clinical symptoms and accurate anatomic localization of the structures affected.

CONTENT DESCRIPTION: The request for many radiological tests in Neuroradiology is to rule out cranial nerve pathology and the exhaustive knowledge of the anatomy in the form of pictorial representations can be very helpful to practising radiologists and residents. Radiologists play a critical role in the evaluation of pathology related to these structures. This poster reviews the numerous skull base foramina in a systematic and concise format with labelled cross-sectional (CT and MRI) images to assist prompt identification. The structures passing through the cranial foramina and their associated anatomic relationships will be depicted in these images. Case examples of pathology that can occur in these structures will be illustrated. For example the jugular foramen is a large aperture in the base of the skull located behind the carotid canal (green arrow) and is formed by the petrous portion of the temporal bone and the occipital bone, posteriorly. The foramen is divided by the jugular spine (yellow arrow) into an anteromedial pars nervosa (blue arrow), containing the inferior petrosal sinus and cranial nerve IX and posterolateral pars vascularis (red arrow), containing the jugular bulb, cranial nerves X and XI. Glomus jugulare is a paraganglioma of the head and neck that is confined to the jugular fossa (orange arrow) adjacent to the foramen and the clinical presentation depends on the degree of middle ear involvement (Figure1). In addition, potential pitfalls in the identification of structures related to the foramen will be depicted.

(E-090) Wednesday • 7:00–8:00 AM • Hard-copy poster
Don't Forget This Amnesia (Transient Global Amnesia): A Diagnosis You Can Suggest to a Clinician

Manav Bhalla, MD, *Medical College of Wisconsin, Milwaukee, WI*; John Ulmer, MD*; Andrew P. Klein, MD; Leighton P. Mark, MD; Stephen A. Quinet, MD; Namrata Bhalla, MD (*mbhalla@mcw.edu*)

LEARNING OBJECTIVES: 1. Neuroanatomy and Neurophysiology of memory circuit, and locations involved in Transient Global Amnesia (TGA). 2. Applicable information for a Radiologist - Clinical entity of TGA, its diagnostic criteria, epidemiology, review of postulated pathophysiology, and association with various risk factors. 3. Optimal DWI imaging protocol. 4. Imaging key points that can differentiate TGA from its top mimickers (e.g., TIA, epilepsy). 5. Clarifying myths related to TGA.

CONTENT DESCRIPTION: 1. Neuroanatomy and Neurophysiology of memory. Why and which areas of hippocampus are vulnerable. 2. TGA and other amnesic disorders. 3. Diagnostic criteria for TGA – understanding clinician's perspective and concerns. 4. Epidemiology and clinical presentation of TGA. 6. TGA Mimicking conditions: transient ischemic attack, transient epileptic amnesia, and psychogenic amnesia. 5. Imaging TGA (DWI, PET, SPECT). 6. DWI imaging characteristics of TGA lesions. 7. Communicating information that a clinician would want to know.

(E-148) Tuesday • 7:00–7:15 AM • E-poster Station #1
Ecchordosis Physaliphora and Other Foes of the Clivus

Megan Albertson, MD, *University of Nebraska Medical Center, Omaha, NE*; Mark Keiper, MD; Jason T. Helvey, MD

LEARNING OBJECTIVES: 1. The learner will understand the origin and prognosis of Ecchordosis Physaliphora. 2. The learner will be able to recognize the MRI and CT characteristics of Ecchordosis Physaliphora. 3. The learner will become familiar with the differential diagnoses of clival lesions.

CONTENT DESCRIPTION: What is Ecchordosis Physaliphora (EP)? EP is a benign intradural nodule found in the retroclival prepontine cistern with histologic features very similar to a chordoma. It can technically occur anywhere along the axial skeleton from the dorsal sella to the coccyx. What is the typical imaging appearance? The dural nodule may not be seen on CT since it has similar attenuation levels to CSF. However, most will produce scalloping of the clivus with a thin sclerotic rim. Sometimes there is also an ossified stalk projecting from the clivus. When present, this calcified stalk is a hallmark of EP since this finding is not present in other differential diagnoses of the clivus. On MRI, the lesion will demonstrate homogenous T2 signal hyperintensity, no contrast enhancement, and sometimes restricted diffusion. The calcified stalk is not visible in all MR cases, but is best demonstrated on sagittal T2WI. What is the prognosis of EP? EP lesions are almost always incidental (found in 2% of autopsies) with very little growth over time. Surgical intervention is usually only considered in cases of brainstem compression (as in our case). What is the differential for clival lesions? Metastasis, chordoma, chondrosarcoma, epidermoid, and others (examples will be shown and explained). What should radiologists remember about EP? 1) Include EP in your differential when there is a nodule in the prepontine cistern with homogenous high T2 signal and no enhancement. 2) If there is an ossified stalk arising from the posterior midline clivus on CT, favor a diagnosis of EP. 3) EP has similar MR characteristics of an epidermoid cyst and could look like a chordoma, EXCEPT midline retroclival epidermoids are rare and a chordoma will usually enhance.

(E-149) Tuesday • 7:20–7:35 AM • E-poster Station #5
CNS Imaging Related to Pediatric Neurointerventional Radiology

William C. Goodman, DO, *Virginia Commonwealth University Health System, Richmond, VA*; Yang Tang, MD, PhD*

LEARNING OBJECTIVES: The objective of this electronic exhibit is, first, to introduce the learner to various pediatric neurological disorders that can benefit from neurointerventional radiology. The classic radiographic appearance of will be shown of several neurological disorders that are amenable to endovascular treatment. Finally, typical endovascular treatments for these lesions will be explained through a case format. The goal of the presentation is to form a clearer understanding of these pathologies, their imaging characteristics, potential methods of treatment, and other findings that are important for the neurointerventionalist to know.

CONTENT DESCRIPTION: This exhibit will cover the pathophysiology of numerous pediatric neurological disorders such as neurovascular diseases, hypervascular brain and head/neck tumors, facial hemangiomas and other vascular lesions. Understanding the imaging characteristics of these conditions is critical to the clinical practice of neurointerventionalists, surgeons and neurologists. This presentation will focus on the MRI/CT appearance of a variety of pediatric neurological disorders that are amenable to endovascular treatment, as well as other conditions that are pertinent to the neurointerventionalist.

* Faculty financial disclosures are located in the Faculty Index.

(E-150) Tuesday • 7:20–7:35 AM • E-poster Station #9 Sulci and Gyri Identification Made Easy: Utilization of Various Signs on MR Imaging

Puneet S. Kochar, MBBS, MD, *Yale New Haven Health Bridgeport Hospital, Bridgeport, CT*; Harpreet Sawhney, MBBS, MD; Pranav Sharma, MBBS, MD; Scott D. Smith, MD (*drkochar.puneet@gmail.com*)

LEARNING OBJECTIVES: The aim of this exhibit is to: 1. Explore various described signs for localization of major sulci and gyri on MRI imaging. 2. Familiarize with cerebral cortical anatomy on axial MRI. 3. To impart the trainee radiologist with the skill to identify and interpret these signs to localize brain lesions. 4. To utilize this knowledge in performing and interpreting fiber tracking (Diffusion Tensor Imaging).

CONTENT DESCRIPTION: With advent of high quality imaging techniques like CT and MRI, expectation to accurately localize brain lesions has significantly increased. This is especially challenging when it comes to presurgical planning. To meet these expectations, in depth knowledge of various signs to localize sulci and gyri is warranted. These signs include SFS-Pre SC sign, sigmoid hook sign, thin post central gyrus sign, pars bracket sign, Macdonald sign, etc. Careful evaluation and identification of these signs can help accurately localize intracranial lesions.

(E-151) Wednesday • 7:00–7:15 AM • E-poster Station #4 Neuroradiology Physics: An Interactive Case Based Approach to Understanding the Physics of Neuro MR

Sowmya Mahalingam, MBBS, MD, *New Haven, CT*

LEARNING OBJECTIVES: The purpose of this exhibit is to increase resident comfort level in Neuroradiology with an interactive and fun filled case based review utilizing common encountered pathologies to illustrate MRI sequences, their identification and the physics behind it with cartoons. Learning objectives are to: 1. Identify everyday pathologies in Neuroradiology- the Aunt Minnie's and the near Aunt Minnie's. 2. Instantaneously recognize each MRI sequence, their significance and the pathology they highlight. 3. Understand the physics behind each sequence, which will enable each resident to trouble shoot and optimize sequences.

CONTENT DESCRIPTION: Interactive learning has been proven to be superior to didactic learning as it engages the learner. Visual imagery has an additional 'vivid' contribution to memory. The exhibit will exploit these proven educational techniques to familiarize radiology residents and general radiologists with Neuro MR, a specialty which creates a significant amount of apprehension in residents. The review will quiz the viewer regarding the diagnosis and the physics behind the sequence. Each correct or wrong answer will allow the pop of an associated image based on the choice. For example, the first case will demonstrate multiple bright lesions in the periventricular white matter radiating away from the corpus callosum. Choices would include differentials including metastasis, small vessel ischemic disease and demyelination. The physics question would ask about the sequence that is displayed with choices including FLAIR, T2 FS, STIR and post contrast T1 weighted imaging. Each choice will be illustrated with the appropriate diagrammatic representation of the physics contributing to the formation of the image. The exhibit will cover: 1. Routine sequences such as T1, T2, FLAIR, DWI, ADC, pre and post contrast T1. 2. Custom built sequences such as CISS or SWI. 3. Angiographic techniques such as time of flight (TOF), phase contrast (PC), and contrast MRA and advanced techniques such as functional imaging. After reviewing the exhibit the reviewer will be confident in the basics of MRI and specifically with Neuroradiology.

(E-152) Wednesday • 7:00–7:15 AM • E-poster Station #5 Tips and Tricks for Diagnosing Cerebral Venous Thrombosis: What Residents Should Know

David M. Miller, MD, MS, *University of Michigan, Ann Arbor, MI*

LEARNING OBJECTIVES: The three primary learning objectives of this presentation are: 1. Recognize the signs of early cerebral venous thrombosis on a non-contrast head CT. 2. Recognize the signs of early

cerebral venous thrombosis on a routine brain MRI without and with contrast. 3. Recognize the signs of parenchymal changes from delayed diagnosis of cerebral venous thrombosis.

CONTENT DESCRIPTION: Often symptoms of cerebral venous thrombosis are non-specific and the clinicians are unsuspecting. Undiagnosed and untreated cerebral venous thrombosis may lead to severe morbidity and mortality. It is therefore paramount that radiologists be keen at making the diagnosis and look for signs of cerebral venous thrombosis on every routine CT head and MRI brain study performed. MR or CT venogram can then be recommended for indeterminate findings to increase diagnostic yield in some cases. The following topics will be covered: 1. Clinical manifestations of cerebral venous thrombosis. 2. Signs of cerebral venous thrombosis on non-contrast head CT, such as hyperdense clot or vasogenic edema. 3. Signs of cerebral venous thrombosis on routine brain MRI sequences such as absent flow fluid on T2-weighted imaging, hyperintense clot on unenhanced T1-weighted imaging, filling defects on enhanced gradient echo imaging, restricted diffusion on diffusion weighted imaging, and blooming artifact on T2* imaging. 4. Avoiding pitfalls such as hypoplastic sinuses and arachnoid granulations. 5. When to recommend MR or CT venogram. 6. Signs of brain parenchymal changes from delayed diagnosis such as venous infarct and hemorrhage.

Pediatric Radiology

(E-092) Wednesday • 7:00–8:00 AM • Hard-copy poster Transverse Colonic Volvulus in Children: Report of Four Cases with Review of Radiologic Findings

Shyann Renfroe, MD, *University of Arkansas for Medical Sciences, Little Rock, AR*; Robert F. Buchmann, DO; Amy Rowell, MD

LEARNING OBJECTIVES: 1. Radiological Signs of Transverse Colonic Volvulus 2. Medical History lending to Transverse Colonic Volvulus 3. Review of Treatment for Transverse Colonic Volvulus

CONTENT DESCRIPTION: Colonic obstruction secondary to volvulus is uncommon accounting for 3-5% of all colonic obstructions. Many studies report 3x the mortality risk with transverse colon volvulus compared to other large bowel volvulus. Multiple etiologies have been proposed that dispose to a transverse colon volvulus including anatomical/congenital variation with elongation/redundancy of the transverse colon, a narrow mesenteric attachment, or lack of fixation of the colon. Patients with a past medical history of Hirshsprung's disease, cerebral palsy, other disease with motility disorders, and mental retardation which all lend to constipation. Presenting symptoms varied from the subacute progressive to the acute with abdominal pain, abdominal distention, vomiting, constipation, and abdominal tenderness. Radiographs typically demonstrated proximal colonic dilation with a relatively collapsed distal colon and often air filled dilated transverse colon. Some sources describe an inverted coffee bean in the left upper quadrant. Barium enema is the considered the gold standard of diagnosis with a pathognomonic 'bird's beak' at the site of obstruction. Definitive treatment in most cases involved laparotomy with resection of the redundant colon and end to end anastomosis. We present four different instances of transverse colon volvulus in three different patients at our institution alone, one of which is centered around a gastrostomy tube. All cases demonstrated a similar "inverted coffee bean" centered in the left upper quadrant on radiographs; two of the four instances demonstrate evidence of transverse colon volvulus on CT. All cases have corresponding diagnostic barium enema and surgical documentation of a volvulus involving the transverse colon. Our goal is to educate others about the "inverted coffee bean sign" on abdominal radiographs as a step toward earlier diagnosis and to describe findings as seen on CT. We will review the four cases of transverse colonic volvulus at our institution and how it was diagnosed.

* Faculty financial disclosures are located in the Faculty Index.

Women's Imaging

(E-094) Wednesday • 7:00–8:00 AM • Hard-copy poster Imaging and Management of Breast Lesions: A Guide for Radiology Resident on Call

Xiaoqin J. Wang, MD, *University of Kentucky, Lexington, KY*; Barbara K. Pawley, MD; Nanditha George, BS, MD; Richard Gibbs, BS, MD
(Xiaoqin.wang@uky.edu)

LEARNING OBJECTIVES: The purpose of this exhibit is to: 1. Review the clinical presentation and characteristic imaging features of breast emergencies 2. Demonstrate the common incidental breast findings on images of patients present in Emergency Department (ED) 3. Familiarize radiology residents with the usual presentation, management, and appropriate follow-up of the acute and incidental breast entities in the ED

CONTENT DESCRIPTION: **1. Introduction:** Radiology residents normally won't have breast imaging rotation before they take emergency calls. It is very important for radiology residents to understand the limitations of the breast imaging in ED and know the usual presentation, characteristic imaging features, and appropriate management of the breast entities while on call. **2. Infection:** clinical presentation and sonographic appearance of puerperal and nonpuerperal mastitis and abscess; clinical and/or imaging follow-up till resolution often needed **3. Inflammatory breast conditions:** granulomatous mastitis and inflammatory breast cancer need further workup in the breast center. **4. Trauma:** contusion, penetration injury, and fat necrosis **5. Implant complication:** silicon and saline implant ruptures and implant infection **6. Post-intervention complications:** post biopsy pseudoaneurysm and hematoma; infection after surgery or biopsy **7. Incidental breast findings on ED imaging:** forgotten breast on the chest x ray and CT. **8. Table:** summary of the presentation, imaging and management of the above breast entities

(E-095) Tuesday • 7:00–8:00 AM • Hard-copy poster Making a Convenient, Low-Cost Phantom with a Previously Unreported Material for Practicing Ultrasound-Guided Breast Procedures

Xiaoqin J. Wang, MD, *University of Kentucky, Lexington, KY*; Angie Xiao; Richard Gibbs, BS, MD; Margaret Szabunio, MD (Xiaoqin.Wang@uky.edu)

PURPOSE: Ultrasound-guided breast procedures, which would include core biopsy and needle localization, require excellent hand-eye coordination. Residents should gain this important skill with a phantom before performing the procedures on a patient to reduce potential complications. Alternatives currently include commercial phantoms, which are expensive, or homemade phantoms, which may have technical limitations. We propose a method for making an easily made, inexpensive, long lasting, tissue-like ultrasound biopsy phantom using a previously unreported material. The sonographic appearance of the needle within the new phantom will be compared with breast tissue, a gelatin phantom, a turkey breast, and a commercial phantom. The target lesions will be produced with a variety of readily available materials.

METHOD AND MATERIALS: The new phantom is prepared using only one low-cost material (mung bean starch) which is commonly available. The starch and water ratio is 1: 6 or 1:9. The texture and opaqueness of the phantom can be modified by changing the starch and water ratio in the mixture. Targets to mimic lesions can be created with gummy bears, peanuts, olive, or grapes. Heat and stir the starch and water mixture till it boils. Then, pour it into a bowl and place the mimics in the desired locations.

RESULTS: This simple phantom can be made quickly (in less than 10 minutes) at very low cost with a single material. The echotexture of the phantom simulates a commercial phantom. The sonographic conspicuity of the needle in our new phantom is comparable in both the breast parenchyma and the commercial phantom. The phantom has an appropriate, realistic, texture for easy target lesion placement at any desired location or depth without further preparation. Examples include a grape

to mimic a complex cystic mass or cyst, a gummy bear with calcium supplement to mimic a calcified lesion, or a peanut to mimic a shadowing mass. These targets remain immobile during biopsy.

CONCLUSION: This new easily-produced and low-cost homemade ultrasound phantom can be utilized for practicing ultrasound guided breast procedures, including core biopsies and needle localizations.

(E-154) Tuesday • 7:40–7:55 AM • E-poster Station #7 What Lies Beneath: An Insidious Case of Primary Angiosarcoma with Breast Implants

Mariam Viqar, DO, *Mount Sinai Medical Center, Miami Beach, FL*; Ahsan Khan, DO

LEARNING OBJECTIVES: The goals of this presentation will be to initially review breast implant anatomy and provide a concise overview of the most common complications that follow breast augmentation. In addition to the most common complications, there will be a case discussion of a rare complication demonstrating a discrete primary angiosarcoma of the breast in a patient with longstanding breast implants. The pathophysiology, histology, clinical presentation, and risk factors of primary angiosarcoma of the breast will be identified. Moreover, the relationship, if any, between chronic implant use and angiosarcoma will be examined.

CONTENT DESCRIPTION: Breast augmentation is one of the most popular cosmetic procedures in the United States. However, with increasing popularity, a rising number of complications have ensued. Breast implants are essentially foreign bodies, which mount a long-standing pathophysiologic reaction within the surrounding breast tissue. Although rare of an occurrence, and no direct causality is currently proven, neoplastic disease has been shown to occur with longstanding breast implants with or without any other concurrent implant complications. We will discuss an interesting case of a patient with chronic history of breast implants for decades, who presented with a palpable lump, secondary to an implant rupture. However when treated, a radiologic-guided core biopsy was obtained, which showed a case of primary angiosarcoma. Although extensive research has been performed in the analysis of carcinogenesis and breast implant use, most studies have focused on the most common type of breast cancer, adenocarcinoma; sarcomas have been seldomly addressed. Although a causal link cannot be ascertained, the demonstration of this case report highlights a potential occult risk of breast implants.

(E-155) Wednesday • 7:00–7:15 AM • E-poster Station #2 SAVI SCOUT® Radar Technology Pre-Operative Localization of Breast Lesions: A Non-Radioactive Audible Alternative

Cherie M. Kuzmiak, DO*, *University of North Carolina, Chapel Hill, NC*; Sheila S. Lee, MD*; Sheryl G. Jordan, MD; Marcia Koomen, MD; Michael Hwang, DO (cherie_kuzmiak@med.unc.edu)

LEARNING OBJECTIVES: After completion of this exhibit, the learner should be able to: 1. Comprehend and explain the technology of the SAVI SCOUT® preoperative localization device for surgical excision of a non-palpable breast lesion. 2. Understand and discuss the similarities and differences between the SAVI SCOUT® device and other current methods of preoperative localization of lesions, including wire and radioactive seed placement. 3. Understand and describe the image-guidance methods for placement of the SAVI SCOUT® device.

CONTENT DESCRIPTION: 1. Background: Pre-operative needle localization with wire deployment for non-palpable breast lesions has been used for almost 40 years in clinical practice, but has limitations. Consequently, other methods of lesion localization continue to be developed. 2. Introduction: SAVI SCOUT® radar technology, a non-radioactive alternative. 3. Pros and cons of the available methods of breast lesion localization, including wire and radioactive seed placement. 4. Image-guided technique for placement of the SAVI SCOUT® device with helpful hints and tricks: Case examples. 5. Initial experience with the new technology.

* Faculty financial disclosures are located in the Faculty Index.

**(E-156) Wednesday • 7:20–7:35 AM • E-poster Station #2
Troubleshooting on Combined 2D/3D Stereotactic/
Tomosynthesis Breast Biopsy Units**

Miral Patel, MD, *University of Texas M.D. Anderson Cancer Center, Houston, TX*; Debora Dawson, RT; Beatriz Adrada, MD; Deanna L. Lane, MD; Lumarie Santiago, MD (mpatel6@mdanderson.org)

LEARNING OBJECTIVES: 1. Recognize the appearance of various guidance errors on combined 2D/3D upright biopsy units 2. Manual correction of x-errors, y-errors and z-errors 3. Understand the method to retarget as well as benefits and drawbacks of retargeting

CONTENT DESCRIPTION: The traditionally taught principles for recognition and correction of guidance errors on the prone stereotactic biopsy unit are not directly applicable to the new combined 2D/3D upright breast biopsy units. As combined 2D/3D upright biopsy units become increasingly utilized, it is important to recognize the different appearance of targeting errors (x-errors, y-errors and z-errors) using this technique and to know methods to manually correct for these errors. A review of how to recognize these errors during a biopsy procedure with step-by-step instructions on manual correction of x-error, y-errors and z-errors will be discussed. Additionally, the basic approach to re-targeting, along with the benefits and drawbacks of re-targeting, will be reviewed with sample cases from clinical experience.

**(E-157) Wednesday • 7:40–7:55 AM • E-poster Station #1
Breaking Bad News in the Breast Imaging Setting:
A Guide for Radiologists**

Samia Sayegh, DO, *NSLIJ, Scarsdale, NY*; Priya Shah; Monica M. Sheth, MD (ssayegh@northwell.edu)

LEARNING OBJECTIVES: The subspecialty of breast imaging is unique in that radiologists frequently interact with patients and their families. The task of delivering bad news to patients regarding their exam or biopsy results, including cancer, is increasingly performed by breast imaging radiologists. Unfortunately most radiologists have little if any formal training on how to deliver difficult news to patients. Studies have shown a direct relationship between the ability of a woman with breast cancer to adjust to illness 6 months after diagnosis and the perception of how the bad news was delivered. We must therefore choose our words carefully as they have a considerable impact on the patient's future quality of life. The purpose of this educational exhibit is to review and provide examples of useful communication techniques and tips for delivering challenging news to patients. Educational Goals/Teaching Points include: -Review various methods on how to appropriately prepare a patient for bad news. -Recognize techniques to gauge the mental and emotional ability of a patient to process bad news upfront versus the need to deliver a "warning shot". -Review the Do's & Don'ts of giving bad news to patients. -Discussing the BREAKS protocol and how to use this approach during bad news delivery. -Understanding patient responses and appropriate ways to ease the situation/comfort them.

CONTENT DESCRIPTION: Patients are often unable to process the full details of a difficult diagnosis or suspicious finding after the first few sentences. Specifically, the word cancer can cause shock and a cognitive disruption. The radiologists approach, choice in words, and how these words are said can have considerable impact on a patient's emotions, as well as their perception of patient care. Careful choice of language, ability to understand a patient's emotional response and ability to digest difficult news is a key to conducting a successful empathetic dialogue. Breaking bad news in the breast imaging setting although challenging, and at times uncomfortable, for both the patient and physician, is a learned skill.

**(E-158) Wednesday • 7:40–7:55 AM • E-poster Station #5
Stereotactic Breast Biopsy Practicum for Residents**

Prapti Y. Shingala, MD, *Rutgers-Robert Wood Johnson Medical School, New Brunswick, NJ*; Te-Jung Tsai, MD; Lina F. Paster, MD; Jeffrey S. Kempf, MD (prapti.shingala@univrad.com)

LEARNING OBJECTIVES: The purpose of this exhibit is: 1. To educate the viewer on how to set up a breast biopsy practicum for residents using bologna with gravel to simulate calcifications as a breast phantom. 2. To review the principles and indications of stereotactic biopsies. 3. To review how to troubleshoot needle position errors. 4. Explain the usefulness of educating residents to perform stereotactic-guided biopsies using phantoms made of bologna and gravel.

CONTENT DESCRIPTION: Becoming proficient in performing stereotactic breast biopsies requires hands-on experience. Our breast-imaging department has developed an annual stereotactic breast biopsy practicum, which aids in the development of procedural skills and knowledge regarding stereotactic biopsy equipment. The practicum is a half-day training session with 2-3 residents per session. Each resident group works with a breast imaging attending and an ultrasound technician. This set-up provides residents with the opportunity to learn about stereotactic biopsies in a setting, which is both relaxed and conducive to learning. The materials and methods used to teach residents will be discussed. Bologna and gravel are used to simulate breast calcifications in a breast phantom. Also, targeting techniques and recognizing and correcting for x, y, and z-axis errors will be reviewed. Post-survey results demonstrated that 100% of residents strongly agreed or agreed that they felt more confident with stereotactic-guided biopsies. This practicum is a useful educational which provides residents with hands-on instruction.

**(E-159) Wednesday • 7:40–7:55 AM • E-poster Station #8
Breast Imaging in the Pediatric and Adolescent Patient**

Sheila Venkatesh, MD, *Rochester General Hospital, Rochester, NY*; Donnette A. Dabydeen, MD, PhD (sheila.venkatesh@rochesterregional.org)

LEARNING OBJECTIVES: To apply current recommendations for screening and diagnostic examinations in the pediatric and adolescent patient. To review imaging modalities and indications for imaging. To understand normal breast development and benign and malignant processes of the breast with clinical presentation, treatment and management, radiological examples, and pathological correlation.

CONTENT DESCRIPTION: Ultrasound is the imaging modality of choice in the pediatric and adolescent patient. Ultrasound has a 99.5% negative predictive value in distinguishing between benign and malignant masses. Mammography is less sensitive due to increased breast density. For radiation exposure to be as low as reasonably achievable, mammography is only used when absolutely necessary. Routine screening mammograms are not recommended. In patients with chest irradiation, genetic mutations, or strong family history, screening with mammogram and breast MRI is recommended. The clinical indications for breast imaging are pain, palpable mass, nipple discharge, and breast infection. Normal breast development and physiologic processes will be discussed. There will be a review of benign and malignant processes of the breast with clinical presentation, treatment and management, radiological examples, and pathological correlation. Benign breast processes, such as gynecomastia, fibroadenoma, pseudoangiomatous stromal hyperplasia, breast cyst, traumatic lesion, abscess, galactocele, intraductal papilloma, and juvenile papillomatosis will be covered. Malignant breast processes, such as phyllodes tumor, metastatic disease, and primary breast carcinoma will be reviewed. Phyllodes tumor is a rare, rapidly enlarging fibroepithelial tumor. Metastatic disease is more common than primary breast cancer, and the most common primaries are lymphoma, leukemia, and rhabdomyosarcoma. Primary breast carcinoma is extremely rare and accounts for less than 1% of childhood cancers. Knowledge of the various diagnoses, the imaging modalities, and radiological features will aid in treatment of patients and provide the best outcome for patients.

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