

## AUR 2007 Scientific Paper Abstracts

AUR scientific presentations are 8 minutes in length, followed by a 2-minute discussion period. RAHSR scientific presentations (Scientific Session 7) are 12 minutes in length, followed by a 3-minute discussion period.

Presenting author is identified by institution, city, state, and country, if not United States or Canada.

Presentations by trainees (residents, medical students, first-year fellows) are noted in purple.

### Wednesday, April 25, 2007 2:30–3:30 PM

#### SS01: AUR Scientific Session 1 CT Research (Papers 1–6)

Location: Centennial F

CT

##### (SS01-01) 2:30 PM

#### Effect of Reconstruction Parameters on Automated Volume Measurements of Pulmonary Nodules: A Phantom Study

James G. Ravenel, MD, *Medical University of South Carolina, Charleston, SC*; William M. Leue, BA; Paul J. Nietert, PhD; Fiona Ginty, PhD; Chris Hammond; Jim Miller; et al

**PURPOSE:** To systematically evaluate the effect of kernel, field of view (FOV), reconstruction grid, and slice thickness on automated volume measurements and select an optimal set of reconstruction parameters.

**METHOD AND MATERIALS:** A commercially available chest phantom was filled with cork to simulate lung parenchyma, and spherical and lobulated nodules ranging in size from 3–15 mm in diameter were added. The phantom was scanned multiple times on a GE LightSpeed 16-slice scanner, initially at 120 kVp, 120 mA, helical pitch 0.532:1, 0.5-second rotation time, and 50-cm FOV, with  $16 \times 0.625$ -mm detector array. Nodule volume was determined from the diameter for spherical nodules and by measuring mass and density for lobulated nodules. The initial set of reconstructions was performed to obtain the best of seven available reconstruction kernels. Subsequent reconstructions were performed using that kernel to evaluate effects of FOV, reconstruction grid, and slice thickness. Automated nodule volumes were obtained using GE VCAR software program.

**RESULTS:** All reconstruction kernels produced regression coefficients approaching one. The bone reconstruction algorithm produced the best compromise and was used for subsequent experiments. Only a modest improvement in precision was seen with decreasing field of view. While volumes were affected by reconstruction grid position, these changes were essentially small and random. Finally, volume accuracy was most affected by slice thickness, particularly for small nodules. For lobulated nodules at 4-mm average diameter, for instance, the standard deviation of the measured volume increased by 3.5 when the slice thickness was increased from 0.625 mm to 2.5 mm, and the mean measured volume showed a 10% upward bias compared to ground truth at 0.625-mm slice thickness. At a minimum, a slice thickness such that at least three measurements along the z-axis are obtained should be used to evaluate nodule volume.

**CONCLUSION:** For small pulmonary nodules, a slice thickness of no more than 1–1.25 mm should be chosen. Other reconstruction parameters have only small effects but should be kept constant when obtaining follow-up measurements.

##### (SS01-02) 2:40 PM

#### Feasibility of Superficial Temporal Artery as Input Artery in Cerebral Perfusion CT

Kiran Sheikh, BA, *University of Michigan Health System, Ann Arbor, MI*; Matthew Schipper, PhD; Ellen G. Hoeffner, MD

**PURPOSE:** Perfusion computed tomography (PCT) allows the generation of quantitative maps of cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT). This technique requires the selection of input variables, including an arterial input function. It has been suggested

that a diseased vessel should not be used as the arterial input; however, this may be problematic if the diseased vessel is not known or if there is multifocal disease. This study was designed to determine if the superficial temporal artery (STA) as the input artery can generate accurate perfusion maps, with significant correlates for CBF, CBV, and MTT, compared to the anterior cerebral artery (ACA) as the input artery.

**METHOD AND MATERIALS:** One hundred perfusion CT examinations performed on 90 patients (51 females, 39 males) were retrospectively reviewed and postprocessed by one investigator at an Advantage Windows workstation using CT perfusion software (GE Medical Systems). From the existing perfusion CT exams, color-coded CBF, CBV, and MTT maps were constructed. Values were derived by varying the input artery (eg, STA vs ACA); and the effects on the mean CBF, CBV, and MTT values in six ROIs (one ROI in each ACA, MCA, and PCA territory) were calculated.

**RESULTS:** All graphs of correlation between ACA and STA input arteries produced significant results, with  $P < .0001$ . There was excellent correlation between ACA and STA in CBF values ( $r = 0.96$ ; concordance correlation coefficient of 0.96), in CBV values ( $r = 0.97$ ; concordance correlation coefficient of 0.97), and in MTT values ( $r = 0.97$ ; concordance correlation coefficient of 0.97). Linear regression lines produced strong agreement between ACA and STA (CBF:  $y = 1.03x + 0.65$ ; CBV:  $y = 1.05x - 0.09$ ; MTT:  $y = 0.92x + 0.21$ ).

**CONCLUSION:** Preliminary results demonstrate that using an extracranial vessel (eg, superficial temporal artery) as the input artery can generate comparable perfusion maps to intracranial vessels (eg, anterior cerebral artery). This can be useful if the proximal intracranial vessels typically used for the arterial input are diffusely diseased (such as with diffuse vasospasm or atherosclerosis) or are not included in the FOV for the perfusion CT.

##### (SS01-03) 2:50 PM

#### Utilization of CT for the Evaluation of Appendicitis in Pregnant Women at an Academic Center

Nancy A. Hammond, MD, *Northwestern University Feinberg School of Medicine, Chicago, IL*; Paul Nikolaidis, MD; Julia Poccia; Lori Goodhart, MD

**PURPOSE:** To assess the appropriateness of utilization of CT for the evaluation of pregnant women with clinically suspected appendicitis.

**METHOD AND MATERIALS:** A computer-aided search of radiology reports was performed to identify all pregnant patients undergoing a CT scan to rule out appendicitis over the past 7 years. Radiology reports, medical records, and clinical data were reviewed for the presence of appendicitis in these patients. In cases where the patient had an ultrasound prior to the CT, images and reports were reviewed.

**RESULTS:** Forty-five pregnant patients were identified who underwent CT for evaluation of clinically suspected appendicitis. A total of five (11%) studies demonstrated findings compatible with acute appendicitis. Four of these patients had surgical and pathologic confirmation of appendicitis. One patient was treated conservatively secondary to suspected perforation. The remaining 40 (89%) studies were interpreted as negative for appendicitis. There was one false-negative study in a patient who was operated on based on clinical suspicion. Fifteen patients in the study underwent a targeted ultrasound of the appendix prior to CT. In 13, the appendix was not visualized; all patients subsequently had a negative CT. Two ultrasound studies were interpreted as positive, and both had subsequent positive CTs.

**CONCLUSION:** At our institution, CT is overutilized as an imaging modality in the evaluation of clinically suspected appendicitis in the pregnant woman. Part of this stems from the clinicians' reluctance to embrace ultrasound as a reliable modality in the diagnosis of appendicitis, despite its proven sensitivity.

**(SS01-04) 3:00 PM****The Role of CT and MR Imaging in Patients with Truncus Arteriosus**

Mike Switzer; Randy Richardson, MD; Mamata Myneni, MD; Jon A. Machayya, MD, *St Joseph's Hospital and Medical Center, Phoenix, AZ*

**PURPOSE:** To demonstrate the role of cardiac CT and MRI in the diagnosis, presurgical planning, and postsurgical follow-up in patients with truncus arteriosus.

**METHOD AND MATERIALS:** A retrospective review of nine patients with truncus arteriosus was performed. All patients underwent cardiac CT and/or MRI prior to surgery. 3D reconstructions of the anatomy were performed using commercially available workstations. An MRI was performed on one of the patients after surgery.

**RESULTS:** The types of truncus arteriosus detected were as follows: 3/9 cases were type 1 forms of truncus arteriosus; 1/9 cases was a type 2 form; 2/9 cases were type 3 forms; 1/9 was a type 4 or pseudotruncus form; and 2/9 cases showed hemitruncus anatomy. All of the patients had associated ventricular septal defects. One patient had total anomalous pulmonary venous return in addition to truncus arteriosus. An aberrant right subclavian artery was seen in one of the patients. Omphalocele was seen in one of the patients. An adult patient presented with severe pulmonary hypertension with Eisenmenger's physiology. No further imaging was required prior to surgical intervention after the CT or MRI study. Postsurgical MRI was performed on one of the patients, and a mild narrowing of the right ventricular outflow tract was shown.

**CONCLUSION:** Cardiac CT and MRI are modalities well suited to detect the different forms of truncus arteriosus. The 3D reconstructions facilitate presurgical planning and clearly demonstrate the anatomy for teaching purposes. Postsurgical follow-up clearly showed mild narrowing of the reconstructed right ventricular outflow tract.

**(SS01-05) 3:10 PM****Can Significant Cardiac Abnormalities Be Identified on Routine Chest CT Scans?**

Sarah Vanderlinde, *University of Rochester School of Medicine, Rochester, NY*; Shweta Bhatt, MBBS; Vikram S. Dogra, MD (vikram\_dogra@urmc.rochester.edu)

**PURPOSE:** To assess significant cardiac abnormalities identified on routine chest CT scans.

**METHOD AND MATERIALS:** We performed a retrospective review of chest CT scans from 2000 to 2006. Over a 6-year period, our medical center completed 41,615 chest CT scans. Of these scans, we reviewed 754 chest CT scans from patients 18 to 101 years of age with positive cardiac findings. Patients with cardiomegaly and pericardial effusions were excluded from the study. We reviewed 382 female studies and 372 male. Significant cardiac abnormalities identified in the chest CT scans were recorded.

**RESULTS:** There were 389 significant cardiac abnormalities, 198 identified in females and 191 in males, among the 754 studies reviewed. The most common cardiac abnormality identified among both males and females was an aberrant right subclavian artery, with 104 cases. The second most common abnormality was pulmonary artery enlargement, present in 55 cases, followed by 32 cases each of the presence of pericardial calcifications and type A aortic dissection. A ventricular aneurysm was identified in 26 studies. Other significant findings identified included Marfan syndrome, coarctation of the aorta, aortic aneurysm, interatrial lipoma, atrial thrombus, coronary artery aneurysm, PDA, septal hypertrophy, VSD, ASD, and pericardial metastases.

**CONCLUSION:** Many significant cardiac abnormalities can be detected on routine CT chest scans. Cardiac evaluation beyond cardiomegaly should be included in the structured reporting of CT chest.

**(SS01-06) 3:20 PM****Correlation of CT Findings in Pelvic Trauma with Pelvic Arteriogram in Anatomical Localization of Bleeding**

Chirag V. Patel, MD, *University of Iowa Hospitals and Clinics, Iowa City, IA*; Shiliang Sun, MD; Fadi Youness, MD; Jafar Golzarian (drchiragvpatel@rediffmail.com shiliang-sun@uiowa.edu)

**PURPOSE:** To determine usefulness of CT in pelvic trauma, for predicting presence and localization of vascular injury and correlated with pelvic angiography.

**METHOD AND MATERIALS:** Fifty patients with pelvic trauma were evaluated with contrast-enhanced CT scan and pelvic angiogram over a period of 3 years. For evaluation, pelvic trauma was broadly classified as osseous injury and soft-tissue injury. Osseous injury was subclassified into anterior ring fractures (pubic symphysis diastasis, pubis fracture, pubic rami fracture), posterior ring fractures (sacroiliac joint diastasis, sacral fracture, ilium fracture), and acetabular fractures. In 30 trauma patients, pelvic hematoma was the indication for pelvic angiogram; in 20 patients, hemodynamic instability was the indication for endovascular management. The arterial injuries were evaluated on angiogram, with selective catheterization of all probable bleeders.

**RESULTS:** For the 50 patients, there were a total of 74 fracture sites on CT scans. Angiography revealed vascular injuries in 48 of 50 patients (96%). Bleeding location and fracture site in posterior ring fractures were well correlated in 61% of patients (27/44). The most common bleeding artery was the iliolumbar artery in these areas. The correlation in anterior ring injuries with bleeding sites, including pubic symphysis diastasis and fractures, was slightly less significant in 50% of patients (15/30), with the common bleeding artery being the internal pudendal artery. For associated soft-tissue injuries, the most common bleeding artery was the superior gluteal artery in 86% of patients (26/30).

**CONCLUSION:** Contrast-enhanced CT is useful in detecting site of arterial injury in pelvic trauma, even though there was no direct sign of bleeding on CT. It is well predicted and confirmed by angiogram in soft-tissue hematoma, posterior ring fractures, and pubic symphysis diastasis. However, there is no significant correlation with fractures of anterior ring and acetabular fractures. CT can be used to triage patients for vascular intervention depending on the site and type of injury.

**SS02: AUR Scientific Session 2  
MR Research (Papers 7-12)****Location: Centennial G****(SS02-07) 2:30 PM****Accuracy of Fast Spin-Echo MR Imaging in Diagnosis of Common Sports Injuries: The Knee**

Scott E. Cassar, MD, *University of Rochester School of Medicine and Dentistry, Rochester, NY*; Igor Mikityansky, MD; Arun Basu; Gwy Suk Seo, MD; Steven Meyers, MD; Johnny U. Monu, MD (johnny\_monu@urmc.rochester.edu)

**PURPOSE:** Some controversy still exists over the utility and accuracy of fast spin-echo (FSE) MRI in the evaluation of pathology in the musculoskeletal system. This study was designed to evaluate the utility of FSE MRI sequences in common sports-related pathologies of the knee.

**METHOD AND MATERIALS:** Reports on 4959 knee MRIs performed over a 3-year period were reviewed and correlated with arthroscopy reports. All MRI studies were performed with optimized FSE sequences in two orthogonal planes. MRI findings with respect to the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial meniscus (MM), and lateral meniscus (LM) were correlated with the arthroscopic observations. The level of agreement between the MRI and arthroscopy finding for each anatomic structure was assessed using kappa ( $\kappa$ ) analysis.

**RESULTS:** Arthroscopic reports were available for 837 patients. 467 MM tears were seen on both MRI and arthroscopy. Twenty-three tears seen at

arthroscopy were not called on MRI, and 43 tears seen at MRI were not seen at arthroscopy. In the LM, 265 tears were seen both at MRI and arthroscopy. 119 LM tears were only seen at arthroscopy, and 19 tears seen on MRI were not called at arthroscopy. MRI called 350 ACL tears that were confirmed at arthroscopy. Six ACL tears were not called on MRI, and nine tears seen on MRI were not confirmed at surgery. Ten PCL tears were seen at both MRI and arthroscopy. There was excellent agreement ( $\kappa > 0.75$ ) between MRI and arthroscopy findings for ACL ( $\kappa = 0.96$ ), MM ( $\kappa = 0.85$ ), and PCL ( $\kappa = 0.91$ ). There was good agreement ( $\kappa > 0.40$ ) between the MRI and arthroscopic observations for LM ( $\kappa = 0.67$ ).

**CONCLUSION:** FSE imaging technique demonstrates excellent diagnostic agreement with arthroscopic findings in sports-related pathologies in the knee, including medial meniscal and cruciate ligament tears, and good diagnostic agreement for lateral meniscal tears. FSE MRI is an accurate imaging sequence and should be used without trepidation in evaluating acute injuries of the knee.

### (SS02-08) 2:40 PM MR Imaging of the Lumbar Spine: Relation of “Back Fat Index” and Body Mass Index

Matthew DeVries, MD, *University of Nebraska Medical Center, Omaha, NE* (mdevries@unmc.edu)

**PURPOSE:** Our purpose was to determine if body mass index (BMI) correlated with the amount of posterior subcutaneous adipose tissue identified on lumbar spine MR imaging. We sought to create a “back fat index” (BFI) that could serve as a substitute for anthropomorphic data.

**METHOD AND MATERIALS:** In a prospective analysis, 50 consecutive patients undergoing lumbar spine MR filled out previously approved standard protocol sheets indicating height, weight, sex, and age. Using the midline sagittal T1 images, four measurements were obtained: (1) AP dimension of the L1 vertebral body (L1); (2) AP dimension of the subcutaneous fat posterior to L1 (L1 fat); (3) widest AP dimension of posterior subcutaneous fat within the lumbosacral spine (LS fat); and (4) average of L1 fat and LS fat (ave fat). Three separate BFIs were calculated: (1) L1 fat/L1; (2) LS fat/L1; and (3) ave fat/L1. Patient BFIs were then correlated with their BMI using linear regression analysis. Sensitivities and specificities for various threshold levels of BFI were calculated.

**RESULTS:** Linear regression correlation coefficients ( $r$ ) for L1 fat/L1, LS fat/L1, and ave fat/L1 were  $r = 0.71, 0.72,$  and  $0.74$ , respectively. At a threshold value of 1.0 for predicting BMI  $> 25$ : L1 fat/L1, sensitivity 68% and specificity 100%; LS fat/L1, sensitivity 100% and specificity 80%; and ave fat/L1, sensitivity 79% and specificity 80%. At a threshold value of 1.0 for predicting BMI  $> 30$ : L1 fat/L1, sensitivity 73% and specificity 78%; LS fat/L1, sensitivity 100% and specificity 44%; and ave fat/L1, sensitivity 80% and specificity 56%. At threshold value of 1.5 for predicting BMI  $> 30$ : L1 fat/L1, sensitivity 47% and specificity 100%; LS fat/L1, sensitivity 60% and specificity 67%; and ave fat/L1, sensitivity 60% and specificity 100%.

**CONCLUSION:** All three methods of calculating the BFI linearly correlated very well with known BMI. Furthermore, the BFI ratio of L1 fat/L1 was highly specific for predicting elevated BMIs, both at a threshold value of 1.0 for BMI  $> 25$ , overweight, and at a threshold value of 1.5 for BMI  $> 30$ , obese.

### (SS02-09) 2:50 PM Is Peritoneal Enhancement a Clinically Significant Finding on MR Imaging?

Jacob A. Livermore, MD, *University of Michigan, Ann Arbor, MI*;  
Saroja Adusumilli, MD\*<sup>†</sup>; Asra Khan, MD; Hero Hussain, MD

**PURPOSE:** Enhancement of the peritoneum on MRI poses a dilemma as to its clinical significance. Our purpose was to determine whether peritoneal enhancement on MRI could predict spontaneous bacterial peritonitis (SBP) or peritoneal carcinomatosis.

**METHOD AND MATERIALS:** Two blinded radiologists (R1, R2) independently reviewed gadolinium-enhanced MR scans of 60 patients (38 males, 22 females; mean age, 58 years) with proof of SBP ( $n = 21$ ), peritoneal carcinomatosis ( $n = 6$ ), or no abnormality ( $n = 33$ ). Readers subjectively graded peritoneal enhancement (1 = normal; 2 = visible but not

avidly enhancing or thickened; 3 = abnormal enhancement, thickened). The presence of ascites and clinical signs of SBP were also recorded. Sensitivity and specificity of each parameter for the final diagnosis of SBP and peritoneal carcinomatosis were calculated, with 95% confidence intervals.

**RESULTS:** For predicting SBP, a peritoneal score of 3 (abnormal enhancement) yielded the following results: sensitivity: R1, 52% (CI: 0.32–0.72), and R2, 38% (CI: 0.21–0.59); specificity: R1, 72% (CI: 0.56–0.84), and R2, 82% (CI: 0.67–0.91). A peritoneal score of 2 or 3 (any enhancement) for diagnosing SBP resulted in sensitivity: R1, 81% (CI: 0.60–0.92), and R2, 48% (CI: 0.28–0.68); specificity: R1, 54% (CI: 0.39–0.68), and R2, 74% (CI: 0.59–0.85). For predicting carcinomatosis, a peritoneal score of 3 yielded sensitivity: R1, 33% (CI: 0.10–0.70), and R2, 33% (CI: 0.10–0.70); specificity: R1, 63% (CI: 0.50–0.75), and R2, 76% (CI: 0.63–0.85). A peritoneal score of 2 or 3 for diagnosing carcinomatosis resulted in sensitivity: R1, 68% (CI: 0.30–0.90), and R2, 50% (CI: 0.19–0.81); specificity: R1, 43% (CI: 0.30–0.55), and R2, 69% (CI: 0.55–0.79). All but one patient had ascites. Clinical signs of SBP had a sensitivity of 91% (CI: 0.71–0.97) and specificity of 59% (CI: 0.43–0.73) for the final diagnosis of SBP.

**CONCLUSION:** As reflected by high interobserver variability, the grading of peritoneal enhancement is subjective. Although the presence of any peritoneal enhancement (score 2 or 3) is nonspecific, it may be an important MR imaging feature that could lower the clinical threshold to further work up unsuspected SBP or carcinomatosis.

### (SS02-10) 3:00 PM Comparison of In Vivo MR Imaging Tumor Enhancement and <sup>15</sup>O-Water PET Blood Flow in Breast Cancer Patients



Peter R. Eby, MD\*<sup>†</sup>, *University of Washington, Seattle, WA*; Savannah C. Partridge, PhD; Constance D. Lehman, MD, PhD\*<sup>†</sup>; Steven White; David A. Mankoff, MD, PhD\*<sup>†</sup> (preby@u.washington.edu)

**PURPOSE:** To determine if there is a correlation between dynamic contrast-enhanced (DCE) MRI kinetics and <sup>15</sup>O-water PET/<sup>18</sup>F-FDG PET blood flow and metabolic parameters for in vivo breast cancer. To improve our understanding of blood flow and capillary permeability as they pertain to the MRI tumor enhancement model and tumor angiogenesis.

**METHOD AND MATERIALS:** Following approval from our institutional review board, we retrospectively identified 24 patients from the existing PET database and MRI records from between 2000 and 2006 with locally advanced breast cancer (LABC) who underwent both <sup>15</sup>O-water/<sup>18</sup>F-FDG PET and DCE breast MRI (with at least two postcontrast sequences) prior to initiating therapy. The <sup>15</sup>O-water PET peak blood flow was measured. The <sup>18</sup>F-FDG transport rate constant from blood to tissue ( $K_1$ ) and metabolic rate in the primary malignancy were calculated. Tumor volume, initial peak enhancement (PE), and delayed phase kinetics (SER) were determined from the DCE breast MRI with a computer-aided evaluation software program. Pearson's correlations were performed.

**RESULTS:** Correlations are significant for <sup>15</sup>O-water blood flow and DCE MRI peak PE ( $r = 0.54$ ;  $P = .03$ ), peak SER ( $r = 0.66$ ;  $P = .004$ ), and tumor volume ( $r = 0.70$ ;  $P = .002$ ). Correlations are significant for  $K_1$  and DCE MRI peak PE ( $r = 0.84$ ;  $P = .001$ ), peak SER ( $r = 0.61$ ;  $P = .04$ ), and tumor volume ( $r = 0.75$ ;  $P = .007$ ). The correlations between the FDG metabolic rate and DCE MRI peak PE ( $r = 0.44$ ;  $P = .051$ ) and SER ( $r = 0.32$ ;  $P = .17$ ) are not significant. In addition, blood flow and  $K_1$  are strongly correlated ( $r = 0.91$ ;  $P = .0002$ ); however, blood flow and metabolic rate are not ( $r = 0.42$ ;  $P = .11$ ).

**CONCLUSION:** The correlation of DCE MRI enhancement kinetics with <sup>15</sup>O-water blood flow and FDG  $K_1$  may lead to a better understanding of angiogenesis and vascular permeability in LABC. The lack of correlation of metabolic rate with blood flow and DCE MRI kinetics suggests that <sup>18</sup>F-FDG PET provides functional information about tumor characteristics which are independent from vascular factors.

**(SS02-11) 3:10 PM****Fetal Central Nervous System Abnormalities: An MR Imaging Pictorial Review**Jennifer C. Lee, MD, *Columbia University, New York, NY*; Tony T. Lee, MD; Sherelle Laifer-Narin, MD

Although ultrasound has traditionally been the standard prenatal screening method for central nervous system (CNS) anomalies, its limitations are well known—such as restricted evaluation of the posterior fossa and detection of parenchymal lesions. Until recently, the use of MRI in prenatal screening has been limited by factors such as lengthy sequence acquisition times and fetal motion. Continued advancements in MRI techniques, however, have allowed it to become a valuable adjunct in cases where sonographic findings are inconclusive. Fetal MRI's higher contrast resolution offers improved visualization of both structural abnormalities and sonographically occult lesions, which can potentially alter patient counseling and management. This review discusses institution-specific MRI protocols and techniques. A pictorial demonstration of the spectrum of CNS abnormalities visualized on MRI is also presented, such as agenesis of the corpus callosum, neural tube defects, and Chiari malformations. Correlation with ultrasound imaging is provided where available.

**(SS02-12) 3:20 PM****Limitations of Chemical Shift Subtraction MR Imaging in Differentiating between Adrenal Adenomas and Malignant Lesions**Tara A. King, *VA Maryland Health Care System, Baltimore, MD*; Faaiza Mahmoud, MD; Khan M. Siddiqui, MD\* (ksidd001@umaryland.edu)

**PURPOSE:** Despite the recent suggestion in the radiology literature that chemical shift subtraction (CSS) MRI is 100% accurate, our experience has been that the technique has reduced efficacy in patients with lipid-poor adenomas. The purpose of this retrospective study was to perform a quantitative assessment of this technique in a variety of adrenal masses.

**METHOD AND MATERIALS:** Twenty-six patients with 35 adrenal masses (six metastases or primary malignancy, 23 nonfunctioning adenomas, and six cysts or hyperplasia) underwent chemical shift MRI using a double-echo, fast low-angle shot sequence. Opposed-phase chemical shift MR images then were subtracted from in-phase images. For quantitative assessment, the signal intensity (SI) values of the adrenal masses were measured with manually defined regions of interest. SI of the adrenal mass on subtraction images and normalized SI index as well as mass/spleen SI ratio for the adrenal mass were calculated. Analysis was performed on SPSS software.

**RESULTS:** Mean signal intensities were significantly different between adenomas and metastases/primary malignancy on subtraction images (94.13 and 35.0, respectively;  $P = .045$ ). Mean mass SI index and mass/spleen SI ratio were also significantly different for adenomas (51.6 and 235.9, respectively) and malignant lesions (-1.88 and 12.83, respectively;  $P = .001$  for both). A difference was also observed between lipid-rich and lipid-poor adenomas (subtraction SI = 101.24 and 19.5, respectively;  $P < .001$ ). However, substantial overlap was noted in SIs between lipid-poor adenomas and metastatic/malignant tumors, with no significant difference in subtraction SI, SI index, and mass/spleen SI ratio ( $P = .2, .15, \text{ and } .65$ , respectively). Accuracy in distinguishing adenomas from metastatic tumors was 91.3% if the cutoff value of the subtraction SI selected was 25.

**CONCLUSION:** CSS MRI is an accurate technique to distinguish adrenal adenomas from adrenal metastases/malignancy. Unfortunately, it is of limited value in distinguishing lipid-poor adenomas from metastatic lesions.

**Wednesday, April 25, 2007  
4:00–6:00 PM****SS03: AUR Scientific Session 3  
Administration and Health Sciences  
(Papers 13–24)****Location: Centennial F****(SS03-13) 4:00 PM****Is E-mail Communication Effective in Changing Ordering Patterns in the Emergency Department: A Case Study of CT for Pulmonary Embolus**Vanessa Hardin, MD, *Medical University of South Carolina, Charleston, SC*; James G. Ravenel, MD; Shaun Nguyen

**PURPOSE:** To assess the effectiveness of e-mail communication of information on the ordering pattern of CT for pulmonary embolus in young patients (<40).

**METHOD AND MATERIALS:** An e-mail was sent to all our ED physicians in response to a series of negative PE studies in young females, which read in part, "The number of PE studies from the ED has been trending upwards, in some cases 5 in one night. It may well be that all are justifiable and indicated, but I fear that it may become the de facto chest radiograph... The doses of a PE study confer between a 5-15% increase in the risk of the development of breast cancer in women under the age of 35... In young women with a negative chest radiograph, I would ask that ordering a V/Q scan be considered." The periods 90 days before and 90 days after were evaluated to assess the total number of PE studies performed in patients under 40, the rate of positivity, and the utilization of d-dimer and V/Q scans during each period.

**RESULTS:** Over the 180-day period, a total of 65 PE studies were ordered in patients under the age of 40 in the ED; 33 patients were before the e-mail and 32 after. Studies were positive in 1/33 (3.0%) and 4/32 (12.5%) ( $P = .343$ ), respectively. There was no difference in the number of d-dimer studies ordered during each period for patients studied with CT. Ventilation/perfusion scanning was not performed on any ED patients under the age of 40 either before or after the e-mail.

**CONCLUSION:** One-time e-mail communication had little effect on ED ordering habits of PE studies. Radiologists should consider other measures, such as requiring d-dimer and Wells criteria scoring prior to imaging, to reduce unnecessary CT PE imaging in young patients.

**(SS03-14) 4:10 PM****The 21st-Century Radiology Web Site: Moving from Static Files to Content Management Systems**Christopher P. Ewing, BA, *University of Washington, Seattle, WA*; Michael L. Richardson, MD; Felix S. K. Chew, MD, MBA (cewing@u.washington.edu)

**PURPOSE:** Radiology Web sites have become a standard tool for publicity, education, and community outreach. However, the resources required to keep a site properly updated can be overwhelming. A properly chosen content management system (CMS) can provide tools to create, update, and maintain a Web site without a need for extensive training or esoteric computer knowledge.

**METHOD AND MATERIALS:** We audited several commercial and open-source content management systems, with a radiology Web site in mind. We looked at the capabilities, special features, strengths, and weaknesses of these systems. We considered both initial purchase price and costs of ongoing maintenance. We examined each system for expected ease of use: Does a system require specialized training to operate, or can the average radiology staff/faculty member create and manage content without difficulty? We looked at security features, as well as the ability to tailor the administration and editing privileges for each user. No current CMS is specifically designed for a radiology department, so we carefully looked

at what it would take to adapt a given system to this use. Finally, we considered the question of power. Radiology Web sites tend to be much more image-intensive than most other medical Web sites. Does a given CMS allow a radiology department to easily store and display a large number of potentially large image files?

**RESULTS:** The leading CMS in our radiology-centric audit was an open-source program called Plone ([www.plone.org](http://www.plone.org)). This program can be freely downloaded and works well with other Web server software, such as Apache and Microsoft IIS. Plone is secure, flexible to configure, and works well with image data. Individual pages can be edited by radiology office staff using a Web-based what-you-see-is-what-you-get (WYSIWYG) editor via their browser. For high-volume sites, Plone can easily be extended by server clusters and caching software to meet high user demands.

**CONCLUSION:** A content management system is the most appropriate tool for creating and maintaining a dynamic, rich, and relevant radiology Web site. Based on our audit of available CMS systems and our departmental needs, we chose Plone, an increasingly popular open-source CMS.

#### (SS03-15) 4:20 PM

##### **A Performance-driven Faculty-Incentive Compensation Plan at a Multicampus University-based Academic Medical Center: Initial Experience**

Robert K. Desai, MD, *University of Massachusetts Memorial Health Center, Worcester, MA*; Paul Lofrumento; M. Elizabeth Oates, MD\*; Douglas W. Fellows, MD

**PURPOSE:** To measure the effectiveness of a performance-driven faculty-incentive compensation plan at a two-campus academic medical center.

**METHOD AND MATERIALS:** Our department has 32 full-time faculty radiologists and 16 radiology residents and operates two campuses. A faculty compensation plan was designed and implemented. The plan assigned clinical productivity values up to  $\pm 100$  points based on professional work relative value units (RVUs); report sign-off times, up to  $\pm 30$  points; up to 30 penalty points were assessed for lack of punctuality and unavailability. Clinical productivity benchmarks, by subspecialty, were developed from SCARD survey data. Points were awarded, in a graded fashion, to those who performed between the 60th–75th percentiles; penalty points were assessed, in a graded fashion, between the 25th–40th percentiles. Report sign-off times of up to 12 hours were rewarded with 30 points, with progressively smaller rewards for signing up to 24 hours and 30 penalty points assessed after 30 hours, with progressively smaller penalties between 24 and 30 hours. We compared clinical productivity and report sign-off times using data from 12 months prior to and 12 months following introduction of the plan. Twenty-one faculty members were included in the plan during the 1st year; 11 were ineligible or opted out during their 1st year of employment. Participants received a monthly scorecard detailing prior month's and year-to-date personal performance.

**RESULTS:** During the 1st year, clinical productivity improved by 48% for the practice as a whole. Twenty-four-hour report sign-off time improved to 84% from 54%. Thirteen participating radiologists achieved positive scores, ranging from +15 to +130 points; six were assessed negative scores, ranging from –15 to –90 points. Two participants scored zero points.

**CONCLUSION:** A well-designed and well-executed faculty-incentive compensation plan can substantially improve group and individual practice performance at a multicampus university-based academic medical center.

#### (SS03-16) 4:30 PM

##### **Simple Method for Preliminary Report Generation, Discrepancy Tracking, Quality Assurance, and Resident Education Using Voice-Recognition Software**

James L. Leach, MD, *University of Cincinnati College of Medicine, Cincinnati, OH*; Achala Vagal, MD; William M. Strub, MD; Jonathan S. Moulton, MD; Thomas Tomsick, MD

**PURPOSE:** Radiology residents typically place preliminary interpretations (RPIs) on overnight examinations without initial staff assessment. For medi-

cal-legal, educational, and quality assurance (QA) reasons, accurate documentation and tracking are necessary. We present our experience with a simple coding process using voice-recognition software (VR) for these purposes.

**METHOD AND MATERIALS:** Starting in October 2005, a preliminary report process was developed for use on all RPIs. Using a VR system, all RPIs were dictated and coded by the unique term “\*\*\*\*Resident Radiologist\*\*\*\*” placed by a voice-activated macro, marking this as a resident interpretation. After staffing, if there was a significant discrepancy, these exams were coded by the term “\*\*\*\*999\*\*\*\*” utilizing a different voice-activated macro. In this macro, required fields for discrepancy details and contact information were filled. The RPI and discrepancy modifier became a permanent part of the medical record. Monthly, the radiology information system (RIS) was searched for the unique terms and discrepancy rates calculated. Simultaneously, our legacy system of paper recording of discrepancies for CT was also used.

**RESULTS:** For the study period, a total of 13,184 conventional radiography (CR), 2258 body CT (BCT), and 4416 neuroradiology CT (NCT) patient studies were interpreted by on-call residents and tracked. A total of 89 BCT (3.9%), 196 NCT (4.4%), and 120 CR (0.9%) discrepancies were identified. Of these, six BCT (0.26%), seven NCT (0.15%), and two CR discrepancies were classified as major. The system correctly identified all discrepancies also documented on the legacy paper system for CT. CR studies were not previously tracked because the large number of studies made a paper system difficult to manage. The results become part of our quarterly QA process and conference.

**CONCLUSION:** We have developed a simple process for tracking RPIs and discrepancies using widely available VR software and standard RIS searching. Acceptance of the system has been excellent. Very-high-volume areas such as CR can now be tracked easily. The information obtained has been utilized for resident quality assurance and continuous improvement initiatives.

#### (SS03-17) 4:40 PM

##### **Communication Practices in the Diagnostic Mammography Suite**

J. Pierre Sasson, MD, *Mount Auburn Hospital, Chestnut Hill, MA*; Beth P. Lown, MD ([psasson@mah.harvard.edu](mailto:psasson@mah.harvard.edu))

**PURPOSE:** Little is known about the communication practices of radiologists who routinely deliver “bad news” to women in the mammography suite. We surveyed radiology residents’ and staff mammographers’ personal practice patterns, confidence, stress, training, and teaching habits when interacting with women about diagnostic mammograms.

**METHOD AND MATERIALS:** We asked the membership of the Association of Program Directors in Radiology to forward two separate surveys to residents and attending mammographers in their institutions. We analyzed response frequencies and correlations.

**RESULTS:** 142 residents (35% female) and 120 mammographers (50% female) responded. While a majority of staff speak with patients, the majority of residents do not. Thirty percent of staff do not allow residents to speak directly to patients, and only 49% allow the resident to observe the staff-patient communication interaction. Fifty-nine percent of residents and 90% of staff rated their skill at communicating with women about abnormal mammograms to be very good or excellent. The majority indicated they had adequate time and private settings for communication. Fifty-two percent of residents and 99% of staff felt confident in their mammographic expertise. While the majority of respondents felt confident in their ability to explain abnormal results, 16% of residents and 4% of staff didn't feel confident communicating with patients who displayed a strong emotional response, and 86% of residents and 81% of staff experienced some or moderate stress communicating the need for biopsy. Opportunities to observe staff communicating are significantly correlated with residents' confidence and self-reported skills communicating abnormal results and handling strong emotions. Sixty percent of residents and 53% of staff hadn't received feedback about their communication skills; 68%–78% of respondents expressed interest in improving their communication skills.

**CONCLUSION:** While respondents felt confident explaining abnormal results, most experienced stress doing so, hadn't received communication training or feedback after medical school, and expressed interest in enhancing their communication.

**(SS03-18) 4:50 PM**  
**Emergency MR Imaging Utilization Trends at a Tertiary-Care Academic Medical Center: Baseline Data**

David Rankey, *University of Cincinnati, Cincinnati, OH*; James L. Leach, MD; Sabrina Leach, MD (james.leach@uc.edu)

**PURPOSE:** Demand for MRI from the emergency department (ED) is increasing and often impacts an already strained system of technologists, radiologists, and resident physicians. Resident training in craniospinal MRI early in residency is often limited. We sought to evaluate emergency MRI utilization in detail in order to identify trends in exam performance, help define the content of initial resident MRI training, assess potential for manpower allocation, and serve as a baseline for further detailed utilization analyses.

**METHOD AND MATERIALS:** All MRI examinations ordered from the ED of a tertiary-care, level-1 trauma academic medical center from January 1, 2001 until December 31, 2005 were identified by electronically searching the radiology information system for ED ordering location. Examination type, exam completion time, and clinical indications were collected. Each examination was categorized and grouped by primary and secondary clinical indication.

**RESULTS:** A total of 2105 examinations were ordered on 1127 patients. Of these, 2071 (98.4%) were craniospinal exams. Overall MRI utilization increased from 2001 until 2005 (125 to 614 exams, 76 to 324 patients), for an increase of almost five times. All of these patients were nonscheduled. 52.8% of the emergency exams were completed between 1700 hours and 0700 hours. Peak time of exam completion was between 1400 and 2300 hours (63.8% of exams). MRI examinations of the spine (30%) and brain (28%), intracranial MR angiography (MRA) (22%), and MRA of the neck (19%) were the most commonly performed. Clinical indications for the exams were extensively reviewed and categorized for training and utilization assessment purposes.

**CONCLUSION:** Emergency MRI utilization has significantly increased at our institution over the past 5 years. These examinations are nonscheduled and can have significant impact on technologist, resident, and staff radiologist workload. Resident training content and staffing decisions can be improved by this information. This will serve as baseline data as we more fully investigate MRI utilization in this setting.

**(SS03-19) 5:00 PM**  
**Quality Improvement Research in Radiology**

Edward J. Mauch, MD, *Wayne State University, Detroit, MI*; Wilbur L. Smith, Jr, MD (emauch@med.wayne.edu)

**PURPOSE:** Quality is a major concern for radiology. We attempted to document the participation of departments of radiology in research in the areas of quality and quality improvement. Our purpose was twofold: (1) to define and categorize the activities in radiology research in quality and quality improvement by review of peer-reviewed published literature; (2) to document the involvement of radiology departments in the production of this literature by scrutinizing the subset of this literature produced in 2005.

**METHOD AND MATERIALS:** We searched the National Library of Medicine database for publications in categories of radiology and quality and radiology and quality improvement. This resulted in a sample of approximately 25 years of peer-reviewed published research. We created taxonomy with definitions of the types of research papers encountered and reviewed all papers from 2005, sorting into the categories of technical, techniques, best radiology practice, and others. Two researchers independently reviewed a subset of 100 peer-reviewed articles for 2005 using the category as definitions, with an interobserver agreement of 95%, suggesting that the categories are defined and reproducible.

**RESULTS:** The overall sample showed that there were 43,752 article citations on medicine and quality, while medicine and quality improvement had 3907 article citations in the National Library of Medicine database. Of these, approximately 25% included imaging in some aspect, reflecting the centrality of imaging in modern medicine. In the year 2005, 906 citations were noted for quality and radiology and 90 citations for quality improvement and radiology. Of these 906, approximately 13% involved the technical development, 29% involved an application of technology as a technique, and 55% involved best practices in radiology.

**CONCLUSION:** Diagnostic radiology is heavily involved in quality and quality assurance, with approximately 25% of the literature in the medical fields involving imaging. In terms of application of the imaging in order to achieve best practices in imaging, only about half of the published studies involved direct participation of the department of radiology.

**(SS03-20) 5:10 PM**  
**A Decentralized Model for Effective Operational Leadership in a Multicampus University Academic Radiology Practice: Initial Experience**

Robert K. Desai, MD, *University of Massachusetts Memorial Health Center, Worcester, MA*; Paul Lofrumento; Douglas W. Fellows, MD; M. Elizabeth Oates, MD\*

**PURPOSE:** To describe a model for radiology operational leadership and present its impact on practice performance following implementation at a multicampus university academic medical center.

**METHOD AND MATERIALS:** Our multicampus academic radiology practice with 32 full-time radiologists faced substantial operational challenges, including financial and service issues. Various operational management options were considered. To take advantage of the unique and complementary skills and experience of the individuals comprising the departmental leadership, a decentralized model of operational decision making was chosen. The management group ("Group") consisted of Vice-Chair of Clinical Operations, Vice-Chair of Technology and Education, Senior Administrative Director of Radiology, and Medical Center Vice-President for Radiology. This model permitted the Department Chair to focus on scholarly and research activities central to the academic mission of the institution. Metrics include practice financial performance (net profit or loss), report turnaround time (24 hours or less), and number of radiologist-related complaints.

**RESULTS:** Following the establishment of the Group, the practice experienced a 31% improvement in financial performance. Report turnaround times improved by 93%. There was a reduction by 44% of radiologist-related complaints. The magnitude of positive outcome is greater than can be explained by the minor technological and personnel changes during the period.

**CONCLUSION:** A decentralized model of operational decision making by a well-chosen and organized management group can result in significant improvement in practice performance in a multicampus university academic medical center.

**(SS03-21) 5:20 PM**  
**Demonstration of the New IHE Teaching File and Clinical Trial Export Profile with a MIRC Toolset**

Fauzia Q. Vandermeer, MD, *University of Maryland School of Medicine, Baltimore, MD*; Jeffrey Whipple\*; Krishna Juluru, MD; Denny Lau\*; Khan M. Siddiqui, MD\*; Eliot L. Siegel, MD\* (fvandermeer@umm.edu)

**PURPOSE:** To demonstrate how teaching file creation can be incorporated into the daily radiology interpretation work flow using Integrating the Healthcare Enterprise (IHE) teaching file and clinical trial export (TCE) profile-compliant PACS and the RSNA Medical Imaging Resource Center (MIRC) toolset. To understand work-flow problems encountered when creating electronic teaching files with nonstandard authoring tools.

**METHOD AND MATERIALS:** Current electronic teaching file systems require a radiologist to export images from PACS and, at a later time, open the authoring software, import images, and complete the authoring process. This two-step process is disruptive to the interpretation work flow and prone to errors. This presentation will demonstrate an easy-to-use, standards-based intuitive way in which the MIRC toolset can be combined with IHE TCE profile-compliant PACS to allow radiologists to select teaching file images, capture relevant notes, and forward them to a MIRC teaching file server—all within the setting of normal interpretation work flow. In addition, we will demonstrate how MIRC software can automatically create teaching files from these, eliminating the need for the creator to log into MIRC. Work-flow steps for standard-based and non-standard-based electronic teaching file creation were documented.

**RESULTS:** We have implemented an easy-to-use, standards-based intuitive way in which the MIRC toolset can be combined with IHE TCE profile-

compliant PACS to allow radiologists to create MIRC teaching file cases within the setting of normal interpretation work flow. Images are selected within PACS. Teaching file-related notes are attached to the images as "key image note (KIN)" object. Using the export manager, the images and KINs are sent to a MIRC teaching file server application (teaching file receiver). In addition to this method, a DICOM structured report (DICOM-SR) can also be exported to a teaching file receiver.

**CONCLUSION:** The recently released IHE TCE profile creates a standard that will make it much easier to create a teaching file or a clinical case or teaching conference case in a one-step process. We anticipate this approach will become the standard one for all PACS within the next few years.

**(SS03-22) 5:30 PM**  
**Barriers to Radiology Turnaround Times in a Level 1 Academic Trauma Center**

David L. Waldman, MD\*, *University of Rochester, Rochester, NY*; Rachel Waldman; Harvey Williams; Lindsay Dakin (David\_waldman@urmc.rochester.edu)

**PURPOSE:** The aim of this study is to evaluate the emergency department imaging sciences turnaround time (TAT) for CT scans and diagnostic x-ray. Phase 2 identifies inefficiencies of the current system at Strong Memorial Hospital. Hospital administration wishes the mean total time for diagnostic x-ray and neuro CT to remain under 2 hours, and under 4 hours for body CT. Currently, the hospital has set a goal of 95% compliance.

**METHOD AND MATERIALS:** Initially, a week of data was used from our radiology information system (RIS) to calculate the mean, median, standard deviation, and the percent of exams that are below the target time during the day (8 AM–5 PM), evening (5 PM–10 PM), and night (10 PM–8 AM) for neuro CT, body CT, and diagnostic x-ray. The second part of the study was observational, where patients, paperwork, and times were tracked through the emergency room imaging department to identify areas of delay.

**RESULTS:** The results of the first part of the study show that means for diagnostic x-ray, neuro CT, and body CT fall mainly below the target times, but the percentage of exams below the target is not satisfactory for any exam. The mean TAT for diagnostic x-ray was 57 min, 1 hr 9 min, and 54 min during the day, evening, and night shifts. There was 91% compliance with the 2-hour target. Neuro CT was 2 hr 5 min, 2 hr 2 min, and 1 hr 15 min, with only 61% compliance to targeted time. Body CT was 3 hr 14 min, 2 hr 2 min, and 3 hr 15 min, with a 68% compliance to the 4-hour target. The observational portion of the study showed similar overall results but pinpointed areas of delay. These delays include transportation, paperwork flow, and physician dictation time. Overall, the overnight systems performed better than other shifts.

**CONCLUSION:** We recommend that mean, median, and percent quota measurements should be used to set the standard. The majority of the delays were out of the control of the imaging department. There is no easy automated system using PACS or RIS software to evaluate TAT. The department needs to work with the emergency department to create realistic goals and efficient systems. Imaging should be part of the solution, not part of the problem.

**(SS03-23) 5:40 PM**  
**The Other Side of Medical Imaging: A Resident's Personal Battle with Colon Cancer**

Jeffrey W. Carezza, MD, *Saint Louis, MO*

**PURPOSE:** With the steadily increasing volume of medical imaging, radiologists can easily become disconnected from patients requiring our services. Only when doctors face serious illness are they forced to identify with the role of the patient. Ultimately, this can serve only to improve the quality of the medical services provided and the level of patient satisfaction. Personal illness reminds physicians of the need to remain lifelong learners, for all patients pursue knowledge of their illness, current staging strategies, and therapeutic options. This personal experience with colon cancer provides a forum to review the disease etiology, histology, staging, and imaging features while impacting fellow radiologists regarding the quality of medical care one should strive to provide.

**METHOD AND MATERIALS:** A reflection of personal experiences is presented to impact the practice of radiology by reminding fellow radiologists of the humanity within medicine.

**RESULTS:** There were no measurable results.

**CONCLUSION:** Personal illness reminds physicians of the need to remain lifelong learners, for all patients pursue knowledge of their illness, current staging strategies, and therapeutic options. This personal experience with colon cancer provides a forum to review the disease etiology, histology, staging, and imaging features while impacting fellow radiologists regarding the quality of medical care one should strive to provide.

**(SS03-24) 5:50 PM**  
**Occult Wrist Injuries: Prevalence and Distribution on MR Imaging**

Brady K. Huang, MD, *University of Rochester School of Medicine and Dentistry, Rochester, NY*; Monika Tidland, MD; Claude Pierre-Jerome, MD, PhD; Johnny U. Monu, MD (johnny\_monu@urmc.rochester.edu)

**PURPOSE:** Persistence of wrist symptoms after trauma in the presence of negative radiographs is a frequent observation. This study analyzed the prevalence and extent of osseous and soft-tissue abnormalities in patients with persistent wrist symptoms following trauma and negative radiographs.

**METHOD AND MATERIALS:** MRI of the wrist was performed in 88 (48 males, 40 females) consecutive acute trauma patients with negative radiographs. The presence, distribution, and prevalence of occult fractures and bone contusions in the wrist and distal forearm were assessed. Soft-tissue lesions, including muscle edema, ligament and cartilage tears, and joint effusions, were also evaluated.

**RESULTS:** The patients were aged between 17 and 89 years. Bone and soft-tissue abnormalities were noted in 67 (76%) wrists. Fifty-six wrists had multiple bone abnormalities. Bone contusions with occult fracture lines were detected in 32 (36%) wrists, and 24 (27%) wrists with contusions did not show any fractures. The most occult fractures were seen in the distal radius (20 cases). Marrow edema was seen in the scaphoid (32 cases), the triquetrum (16 cases), and the hamate (16 cases). Muscle and soft-tissue edema in the thenar and hypothenar areas was present in 42 (48%) wrists. TFCC tears were observed in 23 (26%) wrists. Effusions were present in all 56 wrists with multiple bone lesions and were more often situated in the ulnocarpal joint space—18 (32%) wrists.

**CONCLUSION:** Occult bone and soft-tissue injuries are common in a setting of negative radiographs following wrist trauma and persistent symptoms. MRI should be used more readily to improve diagnosis and initiate prompt and appropriate treatment, thus reducing suffering and morbidity.

**Thursday, April 26, 2007**  
**10:30 AM–12:00 PM**

**SS04: AUR Scientific Session 4**  
**Resident Teaching I (Papers 25–33)**  
**Location: Centennial F**

ED

**(SS04-25) 10:30 AM**  
**Enhancing the Radiology Residency Curriculum: Insights from an Alumni Survey**

Barbara N. Weissman, MD\*, *Brigham and Women's Hospital, Boston, MA*; Justin W. Genant, MD; Eric Handley, MD; Steven E. Seltzer, MD\* (bweissman@partners.org)

**PURPOSE:** To identify areas of knowledge that previous graduates of our radiology residency program felt would have been helpful to have learned during their training.

**METHOD AND MATERIALS:** In an effort to develop a strong and active alumni group, the Brigham and Women's Hospital Radiology Department sent introductory materials describing possible roles and benefits of an alumni foundation to all previous graduates of the radiology and nuclear medicine residency programs for whom contact information could be

found. As part of the registration process, a short survey was included that contained questions about practice choices, leadership positions held, and areas in which continued association with BWH would be desired (eg, recruiting, CME, visiting professorships). We specifically asked former graduates whether it would have been helpful if during residency they had had more exposure to procedural skills, advanced diagnostic imaging, research techniques, career planning, or other areas. Respondents could choose more than one option or enter free text.

**RESULTS:** Two hundred fifty-one surveys were sent by mail (164) or e-mail (87) to graduates of our residency program who trained from its inception in the 1920s to 2006 and for whom contact information could be retrieved. Twenty mailings were returned due to incorrect contact information. This initial attempt provided 57 survey responses (57/231, 24.7%). Of the respondents, 32 (56.1%) pursued private practice and 20 (35.1%) academics. Areas in which additional exposure were desired included advanced imaging techniques (57.8%), career planning (48.9%), procedural skills (46.7%), and research techniques (35.6%). Suggestions included economics of radiology, leadership development skills, medical and business management, and financial and investment advice.

**CONCLUSION:** In addition to didactic, procedural, and research skills, education should include financial and business courses and leadership training. As a result of these initial data, additional continuing education programs for our graduates and new in-house leadership training and financial/business programs for our trainees are being developed.

#### (SS04-26) 10:40 AM

##### Using an OSCE to Assess Clinical Performance of Radiology Residents in Emergency Radiology

Cristian J. Garcia, MD, *Pontificia Universidad Catolica, Santiago, Chile*; Ximena Trivino, MD; Andres O'Brien; Oscar Contreras, MD; Ana C. Wright (cgarcia@med.puc.cl)

**PURPOSE:** At the end of the 2nd year of our radiology residency program, residents begin with overnight in-house calls. An OSCE was incorporated to determine residents' competence in emergency radiology before starting being on call, based on core curriculum of ASER, and consequently to ensure the health care quality.

**METHOD AND MATERIALS:** Residents were informed about the instrument and received objectives during a previous meeting. A pilot with six stations had been developed in 2005. A total of six 2nd-year and six 3rd-year residents were examined. The OSCE had 13 stations, each lasting 10 minutes, including communication skills, history taking, clinical procedures, image interpretation, diagnosis, and treatment. Ten stations had five clinical cases each; one station consisted of performing abdominal US in a simulated and standardized patient, another station was designed for a written report, and one station had a faculty portrayed as a standardized in-call physician. Total OSCE score was 153 points. Scores of 3rd-year residents were compared with the ones obtained in 2005.

**RESULTS:** The maximum, minimum, and average percentages achieved by 2nd- and 3rd-year residents were 71.5%/56.6%/63.3% and 79.5%/60.8%/69.4%, respectively. Two 2nd-year residents scored lower than 60%. In 12 stations, 3rd-year residents obtained the best scores, and they all improved compared to OSCE 2005. In a post-OSCE meeting, every station was discussed, including a teaching session. Feedback was done with the whole group and also individually, and residents found it to be very useful.

**CONCLUSION:** OSCE was not only an evaluation technique but also an excellent teaching tool for our residents and ensures their necessary competence before starting to be on call. Compared to other evaluation instruments, it permits remediation of those in whom a deficit is detected. General and individual feedback is good, and residents find it very useful.

#### (SS04-27) 10:50 AM

##### Gender Differences in Perception of Stress during the Radiology Residency Experience

T. C. Kouo, MD, *University of Maryland School of Medicine, Baltimore, MD*; Stacy E. Smith, MD\* (tjkouo@yahoo.com)

**PURPOSE:** Radiology residency is comprised of unique educational methods and experiences compared to other specialties (ie, advanced tech-

nology and method of training [hot seat; view-box learning]), from which unique stressors arise during training. While all residents share a similar experience, male and female perceptions of stress may differ, and to date, these have not been quantified. The purpose of this study was to delineate and determine gender differences with regards to stress during radiology residency.

**METHOD AND MATERIALS:** An anonymous multiple-choice, Y/N, and free-form question survey of 79 stress-related activities in radiology residency (call, clinical duties, faculty/peer interaction, and research/scholarly activities) was distributed to all PGY2-5 radiology residents at one institution. Levels of stress associated with each activity were assessed on a scale of 1-5 (1 = no stress; 5 = most stressful). Data were evaluated by two radiologists by consensus.

**RESULTS:** Study population included 22 residents (12M; 10F) in years PGY 2-5. Stress was most prominent during call-related activities (avF4, avM2.8). Precall anxiety with initial ER call was noted by 80% F versus 25% M. Gender differences were more pronounced in "standing ground on decisions" (F3.9, M2.5) and refusing nonindicated studies (F4.1, M3.2). Notable educational stressors included presenting conferences to peers/faculty (F4, M3) and taking hot-seat cases in front of peers (F3.7, M2.8). With regard to reporting colleague inappropriateness or harassment, both M and F stress ratings were similarly low. Midrange stress levels occurred when reporting missed findings to peers (F2.1, M2.2) and in dealing with inappropriate behavior/harassment (F2.6, M2.5). Male stress ratings slightly surpassed females in few activities, including working with/learning from those of the opposite gender (F1, M1.3).

**CONCLUSION:** Gender differences in stress perception during residency exist. Women experience and express higher levels of stress compared to their male counterparts in several areas, particularly "on-call" and "hot-seat" situations. Modified training methods based on these findings may enhance resident experience. Focused educational methods may be useful in addressing gender-related differences in perceived stress during residency.

#### (SS04-28) 11:00 AM

##### The Development of an Emergency Radiology Course and Simulating the Resident On-Call Experience

Lori A. Deitte, MD, *University of Florida-Jacksonville, Jacksonville, FL*; Arif S. Kidwai, MD; Daniel A. Siragusa, MD (lori.deitte@jax.ufl.edu)

**PURPOSE:** To develop and implement an emergency radiology resident course which includes medical simulation and to assess resident learning.

**METHOD AND MATERIALS:** A 1-month emergency radiology course including medical simulation was introduced to radiology residents at our institution. The learning objectives were based on the American Society of Emergency Radiology core curriculum. A written pretest consisting of five questions from each conference presenter (70 multiple-choice questions total) was administered. Eighteen conferences were then presented by subspecialty faculty members in their areas of specialization. The curriculum included three sessions at the institution's simulation center. Two sessions were focused on the resident on-call ultrasound experience, utilizing an ultrasound simulator. The third session involved a multidisciplinary approach to the treatment of intravenous contrast reactions and included a didactic lecture, active participation in a simulation scenario using a SimMan simulator, and a debriefing session. At the completion of the emergency radiology course, a posttest will be administered, and the results will be compared with the pretest. A practical examination consisting of representative on-call radiology cases will be given. A resident survey will then be administered to evaluate the curriculum format.

**RESULTS:** The mean pretest scores by year of radiology residency were as follows: 1st year, 56.3%; 2nd year, 62.5%; 3rd year, 70.0%; and 4th year, 81.0%. The individual pretest and posttest scores will be analyzed with a paired *t* test. The data analysis will be performed with a 5% level of significance and 95% confidence interval. Appropriate descriptive statistics will be used to summarize the results from the resident curriculum survey.

**CONCLUSION:** An emergency radiology course including medical simulation was introduced to our residency program. The final results and conclusions will be presented.

**(SS04-29) 11:10 AM**  
**Using Dynamic Web Content to Teach Radiology Anatomy**

Michael L. Richardson, MD, *University of Washington, Seattle, WA*;  
 Cristopher P. Ewing, BA; Felix S. K. Chew, MD, MBA  
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**PURPOSE:** Numerous excellent Web sites have appeared in the past decade to teach human anatomy. However, while these sites have been posting high-quality static images of the body, radiology has moved on to more dynamic methods of image display. PACS workstations now allow radiologists to routinely scroll through large stacks of images. These images can be linked to other images in the same imaging plane or cross-referenced to images in other planes. We have developed Web-based software to allow this same type of dynamic display on a Web site.

**METHOD AND MATERIALS:** We have created two pilot projects that allow dynamic display of sonographic (<http://uwmsk.org/shoulderul/>) and CT (<http://uwmsk.org/schatzker/>) cross-sectional imaging. These projects were written with the platform-independent scripting language, JavaScript (<http://en.wikipedia.org/wiki/JavaScript>). To reduce the tedium of writing such custom JavaScript programs, we have developed several Web-based tools to allow others to more easily create their own dynamic content of this type. Our tools are built using open-source tools such as PHP (<http://www.php.net/>) and ImageMagick (<http://www.imagemagick.org/>), and can be accessed through a modern Web browser such as Firefox (<http://www.getfirefox.com/>).

**RESULTS:** Our residents have found our pilot projects helpful in learning complex anatomic relationships. We ourselves are delighted to have tools to help produce our own new dynamic Web offerings. These tools greatly reduce the amount of time it takes to produce such a Web-based tutorial. They also reduce the tedium and potential errors that result from hand-coding long JavaScript routines.

**CONCLUSION:** We offer these Web-based tools to the rest of the radiology community and hope other educators find them as useful as we have. We hope that these tools will make it easier for both geeks and nongeeks to add dynamic Web content to their radiology teaching sites.

**(SS04-30) 11:20 AM**  
**The Changing Role of Radiology Conferences in Resident Education**

Aria N. Sasaki, MD, *Medical University of South Carolina, Charleston, SC*; Leonie Gordon, MBChB\*; James G. Ravenel, MD (sasaki@muscc.edu)

**PURPOSE:** There are many methods for learning radiology during residency. ACGME requirements for radiology include attendance at weekly general and subspecialty core curriculum conferences with documented participation by both residents and teaching staff. Current radiology residents were surveyed concerning their opinions regarding the various aspects of radiology conferences and the overall educational value.

**METHOD AND MATERIALS:** Radiology residents were surveyed regarding level in training, conference attendance and participation, preferred format, and the role of conference in learning radiology. Residents were asked to rank on a scale of 1–5 the perceived educational value of radiology conferences, subspecialty and interdepartmental conferences, and the frequency of further reading on topics or cases presented in conference.

**RESULTS:** Preliminary results demonstrate the majority of residents (67%) prefer mixed didactic and case-based conferences, while a minority desire purely case-based (25%) or purely lecture-based conferences (8%). Although the majority of residents surveyed (58%) felt attending and participating in conference to be the most effective use of their time, 38% felt that independent study was a more beneficial use of the time allotted for conference. Also, in the group deeming independent study to be a more effective use of time, 44% were 1st-year residents. However, 83% of residents surveyed felt that radiology conferences play a role in their radiology education, ranking a 3–4 out of 5, and 67% reported sometimes reading further on conference topics. Subspecialty and interdepartmental conferences were generally found beneficial as well.

**CONCLUSION:** The survey results correlate the radiology residency requirements for lecture and conference with the opinion of residents concerning the role of conference in their radiology training. Radiology resident conferences continue to play an integral role in the education of residents, though the benefits increase with progression through residency as one acquires a knowledge base.

**(SS04-31) 11:30 AM**  
**Developing a New Conference Format for Teaching Residents**

Andrew G. Bleicher, MD, *University of Pittsburgh Medical Center, Pittsburgh, PA*; Barton F. Branstetter, MD (bleicherag@upmc.edu)

**PURPOSE:** Practice-based learning, one of the six core competencies of the ACGME Outcome Project, emphasizes the ability to analyze sources of information critically and to teach colleagues. This competency is often addressed through journal clubs, where residents present assigned materials. We have developed a new conference in which residents choose their own source material to present to a small group of attendings and peers. This study assesses the acceptance of, and attitudes toward, the new conference format.

**METHOD AND MATERIALS:** In the new conference format, each resident is allotted 5 minutes to present a topic that they read about that week. The audience includes the reading room staff and other residents. Neuro-imaging-related topics may originate from textbooks or the peer-reviewed literature. Visual aids are not permitted, to facilitate a succinct review and to avoid overburdening the residents. This weekly conference is held at a time chosen to minimize work-flow interruption and maximize residents' recall. Participating residents and staff were asked to formally rate aspects of the conference.

**RESULTS:** The conference was highly rated for its ability to encourage independent reading and to develop presentation skills. Residents favored the brief nature, as it minimized preparation time. Staff appreciated the ability to clarify, update, and supplement knowledge on resident-selected topics. The total duration of the conference was consistently less than 30 minutes.

**CONCLUSION:** A conference where residents present recently read information to their peers is a valuable way to address the practice-based learning ACGME competency. This type of conference grants greater autonomy to the residents in selecting material, providing greater ownership in the educational process. It affords a nonconfrontational setting to refine presentation skills. Most importantly, the conference is viewed favorably by both residents and staff as a novel educational opportunity.

**(SS04-32) 11:40 AM**  
**First-Year Radiology Resident OSCE: Correlation with Other Standardized Examinations during Residency**

Donald N. DiSalvo, MD, *Brigham and Women's Hospital, Boston, MA* (ddisalvo@partners.org)

**PURPOSE:** To review our 5-year experience with a Web-based written radiology OSCE (objective structured clinical exam) given to 1st-year residents.

**METHOD AND MATERIALS:** Results from a written Web-based OSCE taken during the 1st year of residency have been compiled and correlated with available results from ACR in-service exams and ABR oral board results, as well as subjective evaluations from the residency program director regarding the individual resident's performances.

**RESULTS:** There is a definite correlation between the 1st-year OSCE results and subsequent performance on other written and oral standardized exams; in some cases, the OSCE can be predictive of early learning problems, but it requires a careful correlation between the written OSCE results, coupled with a one-on-one review of the exam with the resident.

**CONCLUSION:** The 1st-year radiology resident OSCE can be predictive of future resident performance. When coupled with oral review, it can help identify learning problems and thus prompt remediation.

**(SS04-33) 11:50 AM****Resident as a Teacher: Assessing the Benefits**

Vaibhav C. Khasgiwala, MD, *Beth Israel Deaconess Medical Center, Boston, MA*; Phillip Boisselle, MD; Deborah Levine, MD; Karen S. Lee, MD; Larry Barbaras; Herbert Y. Kressel, MD (vkhasgiw@bidmc.harvard.edu)

**PURPOSE:** To assess the perceived educational impact of a case-based "resident-as-teacher" program entitled "Chief's Rounds" on the resident-teacher and an audience of radiology residents, faculty, and technologists.

**METHOD AND MATERIALS:** We conducted an anonymous survey of 2nd–4th-year radiology residents with at least 1 year of participation in Chief's Rounds to determine the educational impact of the program on resident-teachers. Residents ranked their responses on a 5-point scale for questions about the program's impact on their interest in teaching and presentation skills. In addition, we retrospectively reviewed survey data from all attendees of our departmental grand rounds program, collected following each weekly lecture from September 2005–July 2006, to determine the perceived educational benefit of Chief's Rounds in comparison to other components of grand rounds (lectures by invited and local faculty and monthly quality assurance review). This anonymous survey gathered information about the content, delivery, topical interest, practical application, and helpfulness of the format for learning new material, ranked on a 4-point scale. Scores from Chief's Rounds surveys were compared to those from faculty-led grand rounds programs.

**RESULTS:** Nineteen of 27 (70%) residents responded to the Chief's Rounds survey. The following percentages of residents responded that Chief's Rounds slightly or markedly increased their presentation skills (63%) and their interest in teaching (37%). 1006 surveys from 37 grand rounds (four from Chief's Rounds, comprised of 36 resident-teacher presentations) showed that Chief's Rounds rated significantly higher ( $P < .05$ ) than faculty-led sessions for relevance of content (mean, 3.70 vs 3.56;  $P = .027$ ), delivery of content (mean, 3.65 vs 3.49;  $P = .034$ ), topical interest (mean, 3.71 vs 3.46;  $P = .0003$ ), and helpfulness of the format in learning new material (mean, 3.67 vs 3.43;  $P = .0014$ ).

**CONCLUSION:** A case-based resident-as-teacher program has modest perceived academic benefits for participating resident-teachers and statistically significant educational benefit to an audience of radiology residents, faculty, and technologists.

## Thursday, April 26, 2007 4:00–5:30 PM

### SS05: AUR Scientific Session 5 Resident Teaching II (Papers 34–42) Location: Centennial F

ED

**(SS05-34) 4:00 PM****Radiology Resident Interpretations of On-Call Imaging Studies: The Incidence of Clinically Relevant Misses**

Robert Ryu, MD; Tori Cooper, *Northwestern University, Chicago, IL*; Lori Goodhart, MD; Albert A. Nemcek, MD

**PURPOSE:** The demand for 24-hour attending radiology coverage is due to the alleged inability of residents to provide accurate interpretations, resulting in suboptimal outcomes. We hypothesize that resident interpretations are highly accurate and clinically relevant misses are rare. The aim of this study was to determine the incidence and clinical relevance of radiology resident interpretation errors.

**METHOD AND MATERIALS:** A prospectively acquired QA database from a tertiary care academic hospital was reviewed from 1/2000–9/2006. The database is comprised of all imaging studies initially reviewed by an on-call resident who gave a preliminary interpretation. The next day, a board-certified attending radiologist would review the case and then compare the preliminary and final interpretations. A variance form was filled out and entered into the database. All cases were given a variance grade as follows: 0, no variance; 1, variance minor but allowable, with no significant impact on patient management; 2, variance significant but unlikely to seri-

ously impact management; and 3, variance significant, outcome of case was or may be seriously impacted. Cases were divided by resident training level and type of exam. Statistical analysis was performed with chi-square test,  $\alpha = 0.05$ .

**RESULTS:** The database contained 134,671 exams. 26,878 (19.9%) were read by PGY2, 37,836 (28.1%) by PGY3, 41,195 (30.6%) by PGY4, and 28,762 (21.4%) by PGY5 residents. The differences were not significant ( $P = .26$ ). Overall, 98.9% of cases were either variance 0 or 1. There were 1464 (1.09%) variance 2 and 3 exams. There was no difference comparing the incidence of variance 2 and 3 exams among the four training levels ( $P = .21$ ). 181 (0.13%) variance 3 exams were identified. PGY2 residents had a significantly lower incidence of variance 3 exams compared with PGY3–5 ( $P = .015$ ). There was no difference among the four levels regarding the volume of plain film studies ( $P = .51$ ); however, PGY2 residents read fewer CT exams ( $P = .03$ ).

**CONCLUSION:** The vast majority of preliminary resident interpretations are accurate. The incidence of clinically relevant misinterpretations by radiology residents is exceedingly rare, especially for 1st-year residents.

**(SS05-35) 4:10 PM****Current Resident Call Experience in a Major Academic Center, with Emphasis on Improving Faculty Feedback Utilizing a PACS-integrated Feedback Mechanism**

Anis Frayha, *University of Maryland School of Medicine, Baltimore, MD*; Paul Nagy, PhD; Stacy E. Smith, MD; Fauzia Q. Vandermeer, MD (fvandermeer@umm.edu)

**PURPOSE:** To evaluate the resident call experience in a large teaching hospital in which call is performed either supervised by faculty or unsupervised, depending on the time of day or week. We seek to evaluate resident perceptions of the experience, educational value, and faculty feedback rates, with the intent to improve the rotation through the implementation of a PACS-integrated faculty feedback mechanism.

**METHOD AND MATERIALS:** A fill-in-the-blank survey was administered to radiology residents at our institution. Evaluation factors included volume, rates of faculty feedback by modality, perceived level of anxiety, independence, confidence, individual miss rates, and areas of potential weakness. Suggestions for improvement were sought. Answers were provided as percentages, graded 1 to 5, or open-ended. Comparison was made between the two call settings. A PACS-integrated faculty feedback mechanism was then implemented, and the survey was readministered.

**RESULTS:** Overall value of call in terms of learning experience was average (3/5). Satisfaction for current mechanism for faculty feedback was low (1.5/5), with a perceived clinically significant miss rate by residents of 10%. Supervised call, as compared to unsupervised call, resulted in a lower level of anxiety (av, 2.5:3.5), however with a decreased level of independence (av, 3.8:4.8). Higher rates of faculty feedback were noted in all categories in the supervised setting (XR, CT, MR). Residents were most prone to seek final reports on their own in the unsupervised setting for MRI studies than CT and XR (80:60:50). This corresponded to the fact that MRI was identified as the most significant area of potential weakness (60% of residents). As lack of faculty feedback was a common criticism, a PACS-integrated feedback tool was implemented and is now in place; preliminary data show an improvement in rate of faculty feedback, overall value of call, level of anxiety, and confidence levels.

**CONCLUSION:** Low rate of faculty feedback is a primary concern of residents during their call experience. Preliminary data after implementation of a PACS-integrated feedback tool show an improvement in overall rate of faculty feedback and has improved resident perception of the call experience.

**(SS05-36) 4:20 PM****Resident-Faculty On-Call Disagreements: Teaching Opportunities and Effect on Urgent Patient Care**

Jason Conrad, MD, *University of Texas Southwestern Medical School, Dallas, TX*; Julie Champine, MD; Tony Setiawan; Diane M. Twickler, MD (diane.twickler@utsouthwestern.edu)

**PURPOSE:** We analyzed the disagreements of on-call chest CT, body CT, and ultrasound examinations between subspecialty faculty and residents to determine whether differences between impressions constituted teaching points for residents in training or were changes in diagnosis that had the potential to affect treatment in the urgent setting.

**METHOD AND MATERIALS:** Retrospective review of faculty quality assurance forms from body CT, chest CT, and ultrasound examinations given an initial interpretation by radiology residents on call from January–June 2006. Our grading system comprises four levels assessed by subspecialty faculty during overreads within 24 hours of initial interpretation. The two grades reviewed were grade 3 = a minor disagreement with faculty interpretation and grade 4 = a major disagreement with faculty interpretation with potentially profound clinical consequences. Minor and major disagreements were reviewed in detail by two radiologists to determine the presence of a potential impact on the urgent management of the patient. Disagreements were then evaluated to determine whether faculty comments reflected the ACGME competencies of medical knowledge or interpersonal and communications skills.

**RESULTS:** To date, a total of 5709 quality assurance forms were reviewed (2782 body CT, 666 chest CT, 2261 ultrasound), with 334 minor (5.9%) and 23 major (0.4%) disagreements. There is a significant difference ( $P = .00002$ ) between the 357 (6.3%) total disagreements and the 176 (3.1%) cases that were felt to have a potential impact on urgent patient care. Of the 357 disagreements, 320 were teaching points for medical knowledge, and 37 addressed interpersonal and communications skills. Of 23 major disagreements, 22 had a potential impact on urgent patient care.

**CONCLUSION:** Minor disagreements on faculty quality assurance reports with the initial resident impressions on call were teaching points that addressed important clinical competencies and were significantly less likely to have the potential to affect urgent patient care. Major disagreements had the potential to affect urgent patient care the vast majority of the time.

#### **(SS05-37) 4:30 PM Delaying In-House Call for Radiology Residents: Are There Data to Support It?**

Thomas D. Henry, MD, *University of Virginia, Charlottesville, VA*;  
Spencer B. Gay, MD\*

**PURPOSE:** Delaying in-house call to the 2nd year of radiology residency is a step that will greatly affect both residency programs and radiology residents. This issue of 1st-year radiology resident (PGY-2) preparedness for taking overnight call comes forward against a background of increasing pressure from other departments for around-the-clock in-house attending supervision. These demands may be based more on anecdotes and preferences, rather than on any direct evidence of real decreased quality of patient care.

**METHOD AND MATERIALS:** We performed a MEDLINE search of relevant articles since 1990.

**RESULTS:** Several retrospective reports have been published by radiology training programs documenting resident errors in interpretation measured against the subsequent attending overread, but to our knowledge, no data exist to suggest that these PGY-2 residents are insufficiently trained to take call. The only manuscript reported that residents after 6 months of training were equally evaluated as competent on a computer-based precall exam to upper-level residents. Current data support that existing structure of residency provides for residents making only a few errors in diagnosis. Errors that were made were found to almost always not significantly impact patient care. Our own and other's experience teaching and testing residents prior to independent night call with backup appears prudent, and discrepancies have been minimal.

**CONCLUSION:** The cost of making such a change in call structure is that 1st-year residents will have no independent experience and that more senior residents will be doing call when they could be in positions providing more education. The benefit is nebulous because there have been no data published to show that a problem exists. We conclude that a review of the literature provides no data demonstrating a lack of adequate performance of PGY-2 radiology residents taking overnight emergency call.

#### **(SS05-38) 4:40 PM After-Hours Faculty Coverage in Academic Institutions in the United States and Canada**

Rafel Tappouni, MD, *Milton S. Hershey Medical Center, Hershey, PA*;  
Michael A. Bruno, MD; Nabeel Sarwani, MBBS

**PURPOSE:** To sample and analyze the range of after-hours radiology attending staff coverage provided in academic radiology departments across the U.S. and Canada.

**METHOD AND MATERIALS:** A survey was sent to fellowship program directors who are members of the Society of Skeletal Radiology. A simple three-question inquiry was e-mailed to the sample of academic medical centers ( $n = 58$ ). The questions were: (1) Are you providing in-house attending coverage after hours? (2) If so, how is after-hours faculty coverage structured? (3) Is there any added compensation (ie, compensatory time or added pay) provided?

**RESULTS:** A total of 20 ( $n = 20$ ) institutions responded. This was a response rate of 34%. 75% (15/20) indicated their department does provide an in-house faculty presence after 5:00 pm, 5% (1/20) reported after-hours faculty availability via teleradiology until 8:00 pm, and 5% (1/20) had teleradiology attending-level coverage from 5:00 pm through the following morning at 8:00 am. Only 20% (4/20) currently make no provision for routine after-hours faculty coverage. Of the 15 institutions providing in-house faculty after hours, 26.6% (4/15) cover until 8:00–8:30 pm, 6.6% (1/15) provide coverage until 9:30 pm, 26.6% (4/15) cover until 10:00 pm, 26.6% (4/15) provide faculty coverage until 11:00 pm, 6.6% (1/15) provide in-house faculty until midnight, and 6.6% (1/15) provide 24-hour in-house faculty coverage. 26.6% (4/15) institutions provide financial compensation for work after hours, and 33.3% (5/15) provide some sort of compensatory time, usually in the form of a later start time.

**CONCLUSION:** The majority (75%) of academic institutions are providing after-hours in-house radiology faculty coverage. For almost all (90%), this ends at or prior to 11:00 pm. Slightly more than half (55%) are without any specific or linked compensation to the involved faculty, and a minority (20%) of departments in our sample provide added pay. Of note, many of the responders questioned the clinical utility of this coverage and expressed concerns regarding a potential negative impact on resident training. Future study could focus on these related questions.

#### **(SS05-39) 4:50 PM ACGME Case Log System: How to Enter the Data**

Judith K. Amorosa, MD, *UMDNJ/RWJMS, New Brunswick, NJ*;  
Devang Vasani, BS; Mary Ellen Hobler; Tim Chen, MD; Serena McClam, MD; Richard Jiao, MD (amorosa@umdnj.edu)

**PURPOSE:** As of July 2006, each radiology residency program must participate in the ACGME case log system. According to the justification/impact statement from the Radiology RRC, this system will ensure appropriate resident participation in case review, interpretation, and dictation and will be able to track sufficient experience by the resident in each subspecialty. "Compliance will be relatively easy for most programs. Only those programs without a modern RIS will have difficulty compiling this data." We surveyed radiology residency programs to see how they are entering the data.

**METHOD AND MATERIALS:** We contacted radiology program coordinators across the country via e-mail with a brief survey. The survey was used to assess how the residency program was entering the data into the ACGME case log system. The choices were (1) data are entered via RIS, (2) resident enters data, (3) residency coordinator enters data in batch, and (4) other.

**RESULTS:** Fifty-four residency coordinators responded to the survey. 100% of the 54 responders stated that the data were placed into the case log system manually. Five programs are in the process of developing software designed to allow data to be sorted and uploaded to the ACGME Web site automatically. In 21 programs, residents enter the data into the case log system. In 33 programs, the program coordinator or assistant enters the data into the case log system.

**CONCLUSION:** Based on our survey with at least 30% response rate, it seems that a tedious manual entry, either by the residents or the residency

coordinator, is being used instead of RIS transfer of data. It is important that the radiology residency programs, perhaps through APDR and ACGME/RRC, work with radiology information systems to make this potentially excellent method of keeping track a reality rather than a hurdle.

### (SS05-40) 5:00 PM The Value of Anonymous Resident Evaluation of Didactic Radiology Conferences

Jigar B. Patel, BS, MD, *University of Maryland Medical Center, Baltimore, MD*; Rasim C. Oz, MD; Reuben S. Mezrich, MD, PhD; Charles S. Resnik, MD (jpatel@umm.edu)

**PURPOSE:** To analyze our experience with anonymous lecture evaluations and their effect on lecture quality.

**METHOD AND MATERIALS:** In our university-based radiology residency training program, there has been a recent transition to a 2-year didactic lecture cycle consisting of 2-week blocks divided by departmental section. Over 21 months, radiology residents across all classes were asked to complete an anonymous evaluation form at the conclusion of each morning lecture. To facilitate evaluator compliance, the form consisted of a 5-point scale and an optional section for comments. These evaluations were entered into a departmental database and immediately made available to the evaluated speaker. This allows for feedback prior to the next block of lectures given by the section. The evaluations are also used by the department administration as benchmarks in formal faculty assessments and annual teaching awards. The quantitative scores were analyzed retrospectively to assess for overall improvement of the lecture series in general and of individual lecturers. A qualitative analysis was performed on the lowest-rated lectures to identify common themes in critique.

**RESULTS:** Between February 1, 2005 and November 3, 2006, a total of 4478 evaluations were submitted for 263 lectures given by 44 faculty members. Over that time period, the mean numerical score per month demonstrated a statistically significant ( $P < .01$ ) increase from 4.22 to 4.68. The 44 speakers evaluated gave a mean of 5.97 lectures, with a range from 1 to 22. The 36 speakers who gave more than one lecture demonstrated a mean increase of 0.05 points per given lecture. There was a statistically significant trend ( $P < .01$ ) for greater improvement in speakers who were initially rated lower. The qualitative analysis of the 10 worst-rated lectures identified common resident concerns: pace, image quality, clinical relevance, inappropriate for time of year, and repetition.

**CONCLUSION:** Anonymous lecture evaluation provides a medium for effective speaker feedback and a tool for identifying both weak and strong teachers. Our analysis demonstrates an improvement in the quantitative rating of our lectures since the implementation of this feedback process.

### (SS05-41) 5:10 PM Radiology Resident Assessment Examination: Preparing and Evaluating 1st-Year Residents prior to Taking Call Responsibilities

Dino P. Massoglia, MD, *University of Maryland, Baltimore, MD*; Rasim C. Oz, MD; Charles S. Resnik, MD; Lisa A. Miller, MD (dmassoglia@umm.edu)

**PURPOSE:** 1. To explain how chief residents have taken active participation in facilitating radiology review sessions for 1st-year residents prior to taking call. 2. To demonstrate how resident preparation for call by the chief residents relieves resident anxiety and adds confidence. 3. To demonstrate the need for expanding assessment exams to include other decision-making skills requisite for call.

**METHOD AND MATERIALS:** Prior to taking call, 1st-year radiology residents met with the chief residents for 12 interactive case-based review sessions. These subspecialty review sessions consisted of residents taking unknown pathologically proven cases off of the PACS system through chief resident facilitators. After the 1st-year review sessions, all 29 residents in a university-based training program took a 33-question single-best-answer assessment exam developed by the trauma/ER radiology section. An arbitrary score of 80% correct was selected as a passing score. Differences in exam scores between 1st-year and upper-level residents were evaluated. The most common errors identified as "criti-

cal" by the trauma/ER faculty were identified and compared between the two groups.

**RESULTS:** All 29 residents achieved a passing score above 80% (range: 83%–100%). There was a statistically significant ( $P < .05$ ) difference in mean exam scores between 1st-year and upper-level residents. The two most commonly missed "critical" findings, full-thickness bowel injury and intraperitoneal bladder rupture, were missed almost four times more often by 1st-year (3%) than upper-level residents (0.7%).

**CONCLUSION:** First-year resident preparation for call by chief residents relieves anxiety and builds confidence prior to call in a more relaxed setting. "Critical" errors made by 1st-year residents during call preparation need to be addressed to prevent future errors. The lack of similar errors by upper-level residents is likely due to more clinical experience seen during call. Tracking of resident error rate while taking call can ultimately be utilized to assess the efficacy of a precall resident assessment exam.

### AUR Memorial Award

#### (SS05-42) 5:20 PM Learning Radiology: A Survey Investigating Radiology Resident Use of Textbooks, Journals, and the Internet

Douglas R. Kitchin, BS, *Indiana University School of Medicine, Indianapolis, IN*; Kimberly E. Applegate, MD, MS\* (kiappleg@iupui.edu)

**PURPOSE:** We surveyed residents to understand information sources residents use to learn radiology.

**METHOD AND MATERIALS:** A 15-question survey on learning resources was given to radiology residents at one institution. The survey queried residents about their preferences for sources when encountering a question in the reading room and when attempting to learn radiology and about the frequency with which they read radiology/medical journals. Residents ranked Internet sites for these learning purposes. The IRB gave administrative approval for the survey.

**RESULTS:** All residents (60/60) completed the survey. When a question is encountered in the reading room, 50/60 (83%) respondents prefer to use the Internet as a first-line resource; 15% prefer a textbook. When using the Internet, 46/60 (77%) residents use Google as their first source; 12% use eMedicine; 3% use STATdx; 3% use UpToDate; 2% use RSNA online journals. eMedicine was the most popular second resource at 65%. 59/60 (98%) residents prefer to use physician/scientist professional Web sites (eg, eMedicine) rather than consumer/patient-oriented Web sites. When using the Internet to learn radiology, 32% of residents prefer AuntMinnie, 30% use *Edactic.com*, 22% use ACR case-in-point, 3% use *learningradiology.com*, 2% use *radquiz.com*, and 2% use *RadioGraphics* online. On average, residents listed 6.2 Internet sites. For textbook learning, 58% of residents prefer Case Review series books, while 32% prefer traditional textbooks. The mean number of textbooks owned is 5.3, while the mean number of Case Review books is 5.4. Eight of 60 residents own most or all the Case Review books. 28% of residents read radiology textbooks daily, 45% weekly, 8% monthly, and 15% occasionally. 23% of residents read radiology journals monthly, 15% quarterly, 37% occasionally, and 23% never. 2% of residents read medical journals (eg, NEJM) weekly, 3% monthly, 2% quarterly, 48% occasionally, and 45% never.

**CONCLUSION:** Currently, residents prefer the Internet when researching a question, with Google as the Web site most commonly used. Case Review books are more commonly used than textbooks. Radiology resident learning has rapidly shifted from traditional textbooks to the Internet and short case review books.

## SS06: AUR Scientific Session 6 General Research (Papers 43–51) Location: Centennial G

GN

### (SS06-43) 4:00 PM Parathyroid Imaging: A Comparative Study of Nuclear Medicine and US

Abid Irshad, MD, *Medical University of South Carolina, Charleston, SC*; Susan Ackerman, MD; Daniel Nissman, MD; Shaun Nguyen; Munazza Anis, MD (irshada@musc.edu)

**PURPOSE:** To evaluate and compare the accuracy of nuclear medicine and ultrasound imaging for the diagnosis and localization of parathyroid adenoma or hyperplasia, in the clinical setting of hyperparathyroidism.

**METHOD AND MATERIALS:** The database of previous 3 years for parathyroid scans at our institution showed 134 nuclear medicine (NM) Tc-99m sestamibi studies. These were retrospectively reviewed for surgical pathology (SP) and ultrasound (US) correlation. Of these 134 cases, 66 were found to have SP-NM correlation, and 22 had SP-US-NM correlation. The NM and US cases of these were then reviewed for the presence and localization of positive parathyroid findings. The SP notes were then compared for the presence and location of any parathyroid hypercellularity.

**RESULTS:** Out of 134 patients who had NM study performed for parathyroid, 66 had NM-SP correlation. Of these 66 patients, on SP, 31/66 (47%) were positive on right, 24/66 (36.4%) were positive on left, 10/66 (15.1%) showed bilateral disease, and 1/66 (1.5%) was normal. On NM-SP correlation, 51/66 (77.3%) had positive findings on the same side on both NM and SP (true positive); 5/66 (7.6%) had discordant findings, with NM finding on the opposite side of positive SP; 9/66 (13.6%) showed negative NM scans while positive SP; and 1/66 (1.5%) showed negative SP while NM was called positive (false positive). The NM sensitivity for correct localization of the side of abnormality was about 77.3%. NM was accurate in identifying bilateral disease in 6/10 (60%) cases. Among the 22 patients who had US-SP correlation, all (22/22) were positive on surgical pathology. On US-SP correlation, US was positive (true positive) in 12/22 (54.5%) cases and was negative (false negative) in 10/22 (45.5%) cases, with no true-negative or false-positive case. US sensitivity was about 54.5%. In all (12/12) US-positive cases, US accurately localized the lesion to the side of positive SP (no discordant results).

**CONCLUSION:** NM was more sensitive than US for detecting parathyroid abnormality. Its sensitivity in accurately localizing the side of lesion was about 77%. Ultrasound, although it showed lower sensitivity of about 55%, however, more accurately localized the lesion, when seen.

### (SS06-44) 4:10 PM FDG-Avid Nonmalignant Conditions in the Musculo- skeletal System

Richard W. Gong, MD, *University of Rochester School of Medicine and Dentistry, Rochester, NY*; Kalpesh C. Patel, MBBS; Gwy Suk Seo, MD; Johnny U. Monu, MD (johnny\_monu@urmc.rochester.edu)

**PURPOSE:** The role of PET/CT in tumor imaging and staging using 18-fluoro-deoxyglucose (FDG) is well established. However, increased radiotracer uptake may occur in nonmalignant conditions and result in incorrect staging of neoplastic process. These pitfalls in musculoskeletal imaging are not well recognized or documented. This presentation documents our experience with some such pitfalls in the musculoskeletal system.

**METHOD AND MATERIALS:** We reviewed our database over a 26-month period (June 2004–August 2006) for patients who had PET/CT imaging for tumor work-up and who had positive findings in the musculoskeletal system. The PET/CT studies were read by consensus by experienced radiologists who consulted musculoskeletal radiologists when necessary. Each examination was evaluated for the presence or absence of increased uptake on the PET/CT. Specific uptake values (SUVs) were noted as supporting data. The patients' clinical records were reviewed and correlated with other studies, including imaging-guided or excisional biopsy.

**RESULTS:** There were 174 cases that had abnormalities in the musculoskeletal system out of 1783 patients seen in this period. Of the 174 cases, 71 cases had increased uptake in the bone, and 20 had increased soft-tissue uptake related to the patient's primary condition. Seventy-six cases were due to degenerative joint disease. In the soft tissues, two cases of abnormal intraarticular uptake were surgically proved pigmented villonodular synovitis. Extraarticular soft-tissue uptake in 13 cases was considered to represent bursitis, one case was due to soft-tissue hemangioma in the thigh, and another case was calcified tendonitis.

**CONCLUSION:** Practitioners must be aware that there are some benign entities that are FDG avid on PET/CT scan that may confuse musculoskeletal tumor imaging. Tissue diagnosis should be obtained in the setting of unusual soft-tissue radiotracer uptake.

### (SS06-45) 4:20 PM Targeted US in the Evaluation of Suspicious Breast MR Imaging Lesions: Frequency of US Detection Based on Lesion Location and Breast Characteristics

Jennifer E. Ochsner, MD, *Seattle Cancer Care Alliance, Seattle, WA*; Wendy B. DeMartini, MD\*; Constance D. Lehman, MD, PhD\*; Eric L. Rosen, MD; Peter R. Eby, MD\* (ochsner@u.washington.edu)

**PURPOSE:** Ultrasound (US) detection of suspicious breast MRI lesions is valuable, given the advantages of US over MRI-guided biopsy. However, the use of targeted US varies across clinical breast MRI practices. Some sites perform US for all suspicious lesions, while others proceed directly to MRI-guided biopsy. Prior research has shown that masses are more likely to be identified with US than are other types of MRI enhancement. The purpose of this study was to determine the impact of lesion location and breast characteristics on the frequency of US detection.

**METHOD AND MATERIALS:** Retrospective review of our clinical MRI database was performed to identify all nonpalpable, mammographically occult, MRI-detected suspicious breast lesions occurring between 1/1/03 and 12/30/04 for which targeted US and image-guided biopsy were recommended and performed. For the 200 lesions meeting the inclusion criteria, lesion location (depth and shortest skin-to-lesion distance) and breast characteristics (size and mammographic breast density) were recorded. The frequencies of US detection were compared using chi-squared and Fisher's exact tests.

**RESULTS:** Overall, 69/200 (35%) of MRI lesions were identified with targeted US. Lesions in the posterior third of the breast were more frequently detected than those at anterior or middle depths (66%, 32%, and 23%;  $P = .0001$ ). Lesions  $\leq 30$  mm from the skin were more frequently identified with US than those  $>30$  mm from the skin (27%–47% and 18%;  $P = .02$ ). A US correlate was more likely in smaller than in medium or larger sized breasts (58%, 40%, and 23%;  $P = .002$ ). Detection was also more frequent in those with heterogeneously dense and extremely dense breasts than in the group with fatty or scattered fibroglandular densities (43%, 32%, and 11%;  $P = .02$ ).

**CONCLUSION:** Detection of suspicious MRI lesions with targeted US was most frequent for posterior lesions, those  $\leq 30$  mm from the skin, in breasts that were smaller, and in heterogeneously or extremely dense breasts. Such characteristics may warrant consideration when deciding whether to employ targeted ultrasound to facilitate imaging-guided biopsy.

### (SS06-46) 4:30 PM Vertebral Body Access via a Parapedicular Approach

Sharon L. D'Souza, MD, MPH, *University of Oklahoma, Oklahoma City, OK*; Douglas Beall, MD (sharonlisa1222@yahoo.com)

**PURPOSE:** To investigate and illustrate a variation of the traditional percutaneous access to the vertebral body via a parapedicular approach.

**METHOD AND MATERIALS:** An effective parapedicular access technique that could safely and reliably guide the needle tip into the center of the vertebral body was developed from cadaver dissection observations for the purpose of clinical use. Between July 2005 and March 2006, a total of 102 vertebral compression fractures from T4 to L5 were treated via the parapedicular access. Seventy-two patients ranging in age from 17 to 96 underwent treatment.

**RESULTS:** Cadaver dissection revealed a relatively avascular and aneurial portion of the vertebral body along the superior margin of the vertebral body-pedicle junction. A total of 102 vertebral fractures were treated using the parapedicular access technique without any recognized clinical complications from the needle access or the instrumentation.

**CONCLUSION:** Thoracic and lumbar vertebral bodies may be safely, reliably, and reproducibly accessed using a percutaneous parapedicular access technique. The technique presented represents a relatively avascular and aneurial approach to the vertebral body.

#### (SS06-47) 4:40 PM

##### **Pancreatic Tuberculosis: A Clinical and Imaging Review of 32 Cases**

Arpit M. Nagar, MBBS, *Changi General Hospital, Singapore, Singapore*; Abhijit A. Raut, MD; Ajay C. Morani, MD, DNBE (arpitnagar@hotmail.com)

**PURPOSE:** The aim was to study the clinical and imaging features of diagnosed cases of pancreatic tuberculosis.

**METHOD AND MATERIALS:** We analyzed records of diagnosed cases of abdominal tuberculosis from January 1999 to June 2004 for involvement of pancreas. Out of 384 patients detected, 32 patients (8.33%) had pancreatic involvement. This included 22 men and 10 women, with an age range of 19–64 yrs (mean age, 42.5 yrs). We reviewed the clinical, radiologic (ultrasonographic and CT features), and laboratory findings of all patients. The criteria for diagnosis of tuberculosis were based on ascitic fluid adenosine deaminase (ADA) levels in 14 patients, fine-needle aspiration cytology (FNAC) of pancreas and peripancreatic lymph nodes in nine patients, and presence of pulmonary and extrapulmonary tuberculosis, which was found in nine patients. On follow-up, 6 months after antituberculous treatment, 25 patients showed response to AKT, three patients had drug-resistant tuberculosis, two patients expired, and two patients were lost to follow-up.

**RESULTS:** Out of 384 patients with abdominal tuberculosis, 32 patients (8.33%) had pancreatic tuberculosis. The male:female ratio was 2.2:1. Most patients were in the 4th decade (30–39 years). The duration of symptoms was spanning between 2–11 months, with mean duration of 6 months. The commonest symptom was abdominal pain localized to the epigastrium. Sixteen (50%) patients were seropositive for HIV-1 infection. Fourteen (43.75%) patients had previous history of tuberculosis of the lungs, whereas 18 (56.25%) patients had pancreatic and peripancreatic involvement as the primary manifestation. Ultrasonography showed bulky inhomogeneous pancreas in five (15.62%) patients; solitary or multiple hypoechoic collections were observed in seven (21.8%) and 20 (62.5%) patients, respectively. CT findings demonstrated hypodense collections within the pancreas associated with peripancreatic lymphadenopathy in 29 (90.6%) patients. Three (9.4%) patients had a complex pancreatic mass lesion.

**CONCLUSION:** Tuberculosis of pancreas should be considered as a differential diagnosis in patients who present with a pancreatic mass associated with peripancreatic lymphadenopathy.

#### (SS06-48) 4:50 PM

##### **The Safe and Effective Use of Lidocaine with Epinephrine Subcutaneously for Stereotactic Breast Biopsy**

Brendan P. Coleman, MD, *St Vincent's Medical Center, Bridgeport, CT*; Keyla Kleyser-Sugrue; Daniel Passeri; Joseph Gagliardi, MD

**PURPOSE:** It is widely taught that the subcutaneous administration of lidocaine with epinephrine during stereotactic breast biopsy should not be used, due to the risk of skin necrosis secondary to the vasoconstriction from epinephrine. Additionally, the compression used on the breast during these procedures can further reduce blood flow. As a result of this teaching, it is common practice at many institutions to employ various other techniques in an effort to avoid this complication that include avoiding the use of subcutaneous epinephrine. The purpose of our study is to demonstrate that the use of lidocaine with epinephrine subcutaneously during stereotactic breast biopsy is safe and without evidence for skin complications.

**METHOD AND MATERIALS:** We retrospectively reviewed 788 Mamotome breast biopsy cases performed at our institution that utilized 1% lidocaine and epinephrine 1:100,000 subcutaneously.

**RESULTS:** We found no cases of skin necrosis as a complication in both the immediate postbiopsy period and on follow-up patient visits.

**CONCLUSION:** It is our belief that using lidocaine with epinephrine in the subcutaneous tissues during stereotactic breast biopsy is safe, and there is no increased risk of skin necrosis. Furthermore, we believe the use of epinephrine subcutaneously ultimately benefits both the physician and patient. The use of epinephrine decreases bleeding at the skin and thus results in reduced hematoma formation and patient discomfort. Other benefits include better wound approximation of the small incision site because with less bleeding, the skin is drier. Also, and very importantly, better postbiopsy films are obtained, as there is much less hematoma formation, which can obscure the area. The use of epinephrine, even at the skin surface, can help reduce bleeding and hematoma formation, and as a result, the postbiopsy films obtained are likely to be more useful.

#### (SS06-49) 5:00 PM

##### **Pigmented Villonodular Synovitis: An FDG-Avid Tumor in the Knee**

Richard W. Gong, MD, *University of Rochester School of Medicine and Dentistry, Rochester, NY*; Kalpesh C. Patel, MBBS; Gwy Suk Seo, MD; Johnny U. Monu, MD (johnny\_monu@urmc.rochester.edu)

**PURPOSE:** An abnormal MRI of the knee on a patient with a questioned history of an abnormal PET scan at an outside facility and an unsuspected surgically proven diagnosis of nodular synovitis triggered a review of our database. We present two cases of unsuspected intraarticular lesions appearing as a focus of elevated SUV on PET scans and proven to be nodular synovitis.

**METHOD AND MATERIALS:** Our database for PET studies performed over a 26-month period (June 2004–August 2006) as part of tumor work-up was reviewed for abnormal findings related to the MSK system. Positive cases, including cases with elevated SUVs or abnormal radiotracer uptake around joints, soft tissues, and bone, were isolated and analyzed further. The clinical records for cases with abnormal paraarticular soft tissue were reviewed and correlated with other available information, including biopsy results.

**RESULTS:** Six cases demonstrated abnormal paraarticular uptake, with four cases in the knee joint and two in the axilla. Three cases, including the two in the axilla, proved to be related to the patient's known disease. One case was lost to follow-up. Two intraarticular lesions (in one male and one female) proved to be unsuspected pigmented villonodular synovitis. One patient was aged 53 and the other 64, and both had some preexisting malignancy.

**CONCLUSION:** PVNS can be a cause for increased radiotracer uptake or elevated SUV in PET/CT tumor imaging. Intraarticular abnormalities will require tissue diagnosis for appropriate treatment.

#### (SS06-50) 5:10 PM

##### **Effects of Therapeutic Radioactive Iodine on Gonads in Patients with Differentiated Thyroid Cancer**

Navid A. Zenooz, MD, *Case Western Reserve University, Cleveland Heights, OH*; Armaghan F. Esfahani, MD; Mohammad Eftekhari; Babak Fallahi; Mohsen Saghari

**PURPOSE:** To evaluate the side effects of treatment with radioiodine (I-131) on gonads in males and females with follicular or papillary thyroid carcinoma.

**METHOD AND MATERIALS:** 246 patients (159 females, 87 males) were included. In all males, serum levels of follicle-stimulating hormone (FSH), luteinizing hormone (LH), and testosterone were measured before radioiodine treatment and 2, 6, and 12 months afterwards; 53 patients also underwent semen analysis. In females, serum levels of LH, FSH, estrogen, and progesterone were measured. Statistical analysis was performed by SPSS software.

**RESULTS:** In 87.4% of males, there was an increase in serum FSH level after I-131 therapy, and in 20.7% of them, this level remained high during the follow-up period. The average serum level of FSH 2–6 months after each course of treatment was significantly higher than pretreatment level ( $P < .01$ ), with significant correlation between the cumulative dose of received I-131 and increase in the level of FSH ( $P < .001$ ). Reduced sperm count was found in 35.8% of the male patients, with 73.7% also showing decreased sperm motility. In 36.8% of the patients with reduced sperm count (13.2% of all males), this finding was persistent during the follow-up period. Increased level of FSH correlated with reduced sperm count at all doses ( $P < .005$ ). There was no significant correlation between serum levels of LH and testosterone with I-131 therapy in males. In females, no significant correlation between gonadal-hypophysal hormones and treatment with I-131 was found, and there were no signs and symptoms of sexual dysfunction. Infertility was not noticed in any patient. There was no case of abortion.

**CONCLUSION:** Although female gonads are resistant to radioiodine therapy for thyroid cancer, male gonadal function may be impaired by this treatment modality. This impairment is most often transient. Spermatogenesis is especially sensitive to the radiation effects of I-131, and this effect is related to the cumulative radioiodine dose. To reduce gonadal complications, especially in males, I-131 should be administered in the lowest possible doses. Also, all necessary precautions should be taken to reduce radiation dose to gonads.

#### (SS06-51) 5:20 PM

##### **“Roux-en-O” Misconstruction: A Rare but Serious Complication of Roux-en-Y Gastric Bypass Surgery**

Myrosia Mitchell, MD, *University of Chicago, Chicago, IL*; Arunas E. Gasparaitis, MD (mmitchell@radiology.bsd.uchicago.edu)

**PURPOSE:** To present the clinical and imaging findings in “Roux-en-O” misconstruction, a rare complication of Roux-en-Y gastric bypass surgery.

**METHOD AND MATERIALS:** This study was done with IRB approval. From 2002–2004, three RYGB patients were transferred to the University of Chicago Center for the Surgical Treatment of Obesity for treatment of chronic malnutrition and intermittent bilious vomiting. The final diagnosis of “Roux-en-O” misconstruction was not suspected prior to transfer. Imaging work-up consisted of CT scan and/or UGI.

**RESULTS:** In two patients, imaging showed dilatation of the duodenum and Roux limb, with normal-caliber distal bowel. In one of these, barium fluoroscopy showed dilatation of the alimentary limb without mechanical obstruction at the transition point. In the third patient, barium administered via the G-tube showed a normal-caliber biliary limb with contrast preferentially flowing into the alimentary limb, again without mechanical obstruction. Surgical exploration identified two anatomic types of “Roux-en-O” configurations. In all cases, the biliary limb was inadvertently anastomosed to the proximal gastric pouch. In two cases, the common limb communicated with the “Roux-en-O” limb. In one case, the two limbs were completely separated from each other.

**CONCLUSION:** A “Roux-en-O” misconstruction should be suspected in patients with chronic intermittent bilious vomiting following RYGB in whom no mechanical basis for obstruction can be identified. The diagnosis can remain elusive for many months following the initial procedure, resulting in chronic malnutrition. Imaging findings can be misinterpreted if misconstruction is not considered.

**Saturday, April 28, 2007  
10:30 AM–12:00 PM**

#### **SS07: RASHR Scientific Session Administration and Health Services (Papers 52–57)**

**Location: Centennial G**

**Moderator: Elizabeth S. Burnside, MD, MPH, MS**

**GN**

#### **(SS07-52) 10:30 AM**

##### **Data Collection in a Clinical Environment Using Real-time Forms Automation Software and Mobile Hardware**

Elodia B. Cole, MS\*, *University of North Carolina, Chapel Hill, NC*; Gregory Clary, PhD\*; Etta D. Pisano, MD\*; Donglin Zeng, PhD (ecole@unc.edu)

**PURPOSE:** To determine the impact of tablet PC and digital pen electronic devices on the collection of data for clinical trials.

**METHOD AND MATERIALS:** Data entry forms used in an existing clinical trial were converted to electronic format and adapted for two hardware platforms: tablet PC and digital pen. 250 clinical report forms corresponding to 50 patients (five forms each) were completed during the course of this study under one of three collection conditions: conventional paper, tablet PC, or digital pen. Time to complete the forms under each condition and the error rate were the outcomes to be measured. Data captured at point of contact were compared to data stored electronically for each of the three conditions, which took place after an electronic verification step for the tablet PC and digital pen conditions and after secondary manual key-in into a Web database for the paper condition.

**RESULTS:** There were a total of 53 errors in the tablet PC condition: 30.18% of the tablet data discrepancies were user errors; 69.82% of tablet data discrepancies were due to electronic form programming errors. There were 43 errors in the digital pen condition: 76.75% of the data discrepancies were user errors, and 23.25% of the digital pen discrepancies were due to electronic form programming errors. There were 32 errors under the paper condition: 90.63% of the data discrepancies were user errors, and 9.38% of the paper discrepancies were due to electronic form programming errors. Electronic form programming errors were fixable without significant additional programming. No significant time difference is seen between the condition of tablet PC and the digital pen ( $P = .9129$ ) or between the paper condition and the tablet PC ( $P = .0717$ ). No significant accuracy difference was found between the tablet PC and the digital pen ( $P = .2720$ ). There was no significant accuracy difference between tablet PC and paper ( $P = .0504$ ) or digital pen and paper ( $P = .0638$ ).

**CONCLUSION:** Time of data collection at point of contact was the same regardless of condition used to capture clinical trials' data in the clinic. Tablet PCs with real-time forms automation software with appropriate forms testing and user training will likely reduce error rates.

#### **(SS07-53) 10:45 AM**

##### **The Effects of a Clinical History on the Interpretation of Head CT Scans**

Abdul-Rahman Albeiruti, BA, *Wayne State University, Detroit, MI*; Wilbur L. Smith, Jr, MD

**PURPOSE:** When diagnostic radiologists interpret studies from the emergency room, they are often supplied with limited patient history. The aim of this study was to determine how frequently inaccurate patient histories were supplied to radiologists and what the effect of this inaccurate history was upon the radiologist's interpretation and confidence in interpretation.

**METHOD AND MATERIALS:** All noncontrast emergency room head CT studies performed in November and December 2005 were reviewed with respect to (a) initial history given by the requesting physician, (b) “true” history as documented in the requesting physician's emergency

note, and (c) the validity of the patient evaluation as documented by a 6-month clinical follow-up. Based upon these criteria, the initial histories were classified as accurate, somewhat accurate, or not accurate. A random sample representing approximately half of the interpretations was then reinterpreted by the initial interpreting radiologist with a "true" history. The radiologist's assessment of accuracy and confidence in the original interpretation was measured.

**RESULTS:** 32.5% of the initial histories were inaccurate. Approximately 80% of the inaccurate histories were either "altered mental status" or "syncope." In only 8% of the patients where a trauma history was given was this inaccurate. Upon reinterpretation of the studies with correct history, the radiologists were more confident in their original interpretation given a true history but in most instances felt they probably would not have changed their original interpretation in any substantial fashion based upon having a true history.

**CONCLUSION:** Our results demonstrate that in an ER setting, a significant portion of the patient histories provided to the radiologists for CT of the head are in fact not accurate. While the radiologists felt that the complete and accurate history probably did not affect their final interpretation of head CT scans, the results show that they would be more confident in their interpretations when supplied with a true history.

### **(SS07-54) 11:00 AM Lumbar Spine Plain Film in Blunt Trauma: Is It Necessary if an Abdomen and Pelvis CT Is Obtained?**

Sangita Kapur, MD, *University of Cincinnati, Cincinnati, OH*;  
Michael Kreeger, MD; Robert Wissman, MD; Kyuran A. Choe, MD  
(kapur13@hotmail.com)

**PURPOSE:** To retrospectively evaluate the utility of lumbar spine plain film in trauma patients undergoing abdomen and pelvis CT.

**METHOD AND MATERIALS:** Institutional review board approval has been obtained for direct image review. Informed consent was waived. The study is HIPAA compliant. All trauma patients at our institution who underwent lumbar spine plain film and abdomen and pelvis CT within 3 days of injury during a 2-year period were included. The reports of the lumbar spine plain films and abdomen and pelvis CTs were reviewed for the presence or absence of a fracture in the lumbar spine.

**RESULTS:** A total of 91 patients were reviewed. The results were divided into patients with and without lumbar spine fracture, based on either modality. Approximately 180 (9.3%) of the patients had a fracture of the lumbar spine diagnosed by either modality. CT was positive for fracture in 165/180 patients (91.7%), and plain films were positive in 101/180 patients (56.4%). CT and plain films were concordant in 86/180 (47.8%) patients. Therefore, 8.3% of the fractures were missed by CT, while 43.9% were missed by plain film. Out of the 15 (8.3%) that were missed by CT, 11 represented compression deformities of indeterminate age, three were possible transverse process fractures, while one was a superior end-plate fracture.

**CONCLUSION:** A great majority of the lumbar spine fractures in patients with trauma can be detected by routine trauma abdomen and pelvis CT. A small number of mainly compression fractures are, however, missed by CT and will likely be detected if the lateral scout view is carefully examined.

**CLINICAL RELEVANCE/APPLICATION:** Since the majority of lumbar spine fractures can be detected by routine trauma abdomen and pelvis CT, the utility of additional plain radiographs of the lumbar spine is limited.

### **(SS07-55) 11:15 AM Experience with a Dedicated Server and Database for CT Contrast Injection: Implications for Automated Quality Control**

Fauzia Q. Vandermeer, MD, *University of Maryland School of Medicine, Baltimore, MD*; Khan M. Siddiqui, MD\*; Ryan Moffitt\*; Bruce Reiner; Eliot L. Siegel, MD\* (fvandermeer@umm.edu)

**PURPOSE:** To describe experience with and quality control implications of a server and database dedicated to monitoring CT contrast injection.

**METHOD AND MATERIALS:** Two commercial (IRISCT from E-Z-EM) contrast injectors in the CT department were connected via a network to a

server which created a data log. This data log captured contrast volumes, residuals, injection rates, peak and average pressures, and other information and saved it in a database available on the server. A total of 1482 consecutive cases were analyzed using the SPSS statistical package.

**RESULTS:** The average injected volume was 108 ml, with an average residual volume of 9.9 ml. Average injection rate was 2.3 cc/second. Overall average injection pressure was 85 psi, and average maximum injection pressure was 121 psi. There was a correlation (Pearson) of 0.59 between injection rate and average pressure and a correlation of 0.54 between injection rate and maximum pressure. The injector reached the preset maximum pressure threshold (300 psi) in 48 cases (3.2%). Despite the importance, from both a clinical and economic perspective, of excellent quality control/assurance of the injection of contrast in the CT department, relatively few departments monitor this, due to the difficulty and errors associated with the manual entry and extraction of these data. The automated interface described in this paper enables routine collection of these data and extraction into a report that can be easily accessed. These data can be used for local departmental Q/C, including evaluation of technologist and scanner and injector performance. The data can also be utilized for Q/C and research purposes to help fine-tune optimal injection rates possible with catheters routinely used in the department. These data can also be utilized to set national norms for injector performance, since, to our knowledge, published norms do not currently exist.

**CONCLUSION:** An automated data collection system can facilitate routine monitoring of CT contrast injections and can result in both cost savings and improvements in patient safety and overall study quality.

### **(SS07-56) 11:30 AM CT Test-ordering Behavior of College-based and ER Physicians and Its Correspondence to ACR Appropriateness Criteria Guidelines**

Stephen R. Baker, MD, *UMDNJ-New Jersey Medical School, Newark, NJ*; Lawrence Pan, BS; Paul Susman, PhD; Amy Wolaver, PhD; Yelena Vidgop, MD (bakersr@umdnj.edu)

**PURPOSE:** Access to computed tomography (CT) has increased in use for a range of acute abdominal conditions, engendering questions of overutilization. Appropriateness criteria guidelines, developed by the ACR, are an attempt to align technology with clinical presentation so that the best, rather than the most extensive, battery of tests is performed; yet what is suggested by radiologists may not correspond to what is ordered by referring physicians. This study assessed various factors influencing the decision to request or refrain from choosing CT and charted the extent of reliance on CT by emergency and college-based physicians with regard to two acute conditions.

**METHOD AND MATERIALS:** A survey was sent to all college health and emergency physicians seeking anonymous responses to a series of questions related to CT utilization in young patients who presented with either one of two clinical scenarios: (1) right lower quadrant pain, fever, and leukocytosis; or (2) diffuse abdominal pain, no guarding, and normal white count. Respondents were asked to provide information related to factors which influenced their decision to seek a CT study.

**RESULTS:** The response rates were 23.1% and 20.8% for college and emergency physicians, respectively. For patients of both genders presenting with the first clinical scenario, 76% of both physician groups would request CT. The differences in this category were significant for female patients, for which ER physicians were more likely to request CT than college physicians. In patients with the second clinical scenario, 36% of emergency physicians would request CT, but only 11% of college physicians would seek that test. When asked to assess the influence of factors (distinguished as very, some, little, or of no importance), the two respondent groups agreed that physical examination was very important; but a relationship with a radiologist was deemed not important by more than 50% of physicians and very important by less than 6% in both groups.

**CONCLUSION:** The data suggest that the decision to choose CT in these two acute conditions is based upon other factors than radiologist input, suggesting that ACR appropriateness criteria guidelines may not be heeded or even considered by referring physicians.

**(SS07-57) 11:45 AM****Residency Training Level and On-Call Performance in a High-Volume Setting**

Jeffrey D. Kurzon, *University of Texas Southwestern Medical School, Dallas, TX*; Julie Champine, MD; Tony Setiawan; Diane M. Twickler, MD (diane.twickler@utsouthwestern.edu)

**PURPOSE:** We sought to determine whether there is a difference in performance on call between residents with different numbers of months of training.

**METHOD AND MATERIALS:** Our first six rotations of training provide daytime instruction in preparation for the on-call experience. Our on-call experience consists of two residents in house: a junior and a senior. Retrospective review was performed on consecutive chest CT, body CT, and ultrasound examinations interpreted on call by radiology residents from July 2005–July 2006. On-call quality assurance data were grouped based on number of resident training months in radiology prior to the on-call experience: 7–12 months, 13–24 months, and >24 months. Our grading system comprises four levels assessed by subspecialty faculty during overreads within 24 hours of initial interpretation, as follows: grade 1 = excellent interpretation and complete agreement with faculty assessment; grade 2 = significant findings observed and interpreted in agreement with staff radiologist; grade 3 = a minor disagreement with faculty interpretation; grade 4 = a major disagreement with faculty interpretation, with potentially profound clinical consequences. The mean grades assigned in each group were compared to determine whether there were significant differences in resident performance.

**RESULTS:** With 10,811 cases reviewed, comprising 1333 chest CT, 5026 body CT, and 4452 ultrasound examinations, the mean [SD] grade given within each group of residents was as follows: 7–12 months, 1.98 [.04]; 13–24 months, 1.96 [.07]; and >24 months, 1.98 [.05]. No statistically significant difference was observed between any of these values. Major disagreements were seen in 40 of 10,811 cases (0.37%), with no difference seen based on number of months of training.

**CONCLUSION:** Using subspecialty faculty quality assurance overreads, on-call performance was not statistically different between residents based on their number of months of training. The rate of major disagreements was low, similarly unrelated to number of months of training. It can be concluded that our 6-month radiology core rotation system adequately prepares residents to begin in-house call during their 7th month of training.

**Saturday, April 28, 2007****2:00–3:30 PM****SS08: AUR Scientific Session 8  
General Teaching I (Papers 58–66)****Location: Centennial G**

ED

**(SS08-58) 2:00 PM****AMSER-ID: The Development of a Downloadable Image Database for Medical Student Teaching**

Petra J. Lewis, MD, *Dartmouth-Hitchcock Medical Center, Lebanon, NH*; Brian Reid (petra.lewis@hitchcock.org)

**PURPOSE:** Junior radiology faculty are often “asked” to become responsible for medical student education in the department. It can be a daunting task to collect the hundreds of images of common disease processes required to maintain an adequate basic teaching file. It may take many years to obtain multiple examples of these entities. The Alliance of Medical Student Educators in Radiology is developing an image database (AMSER-ID) which will be downloadable for AMSER members and will provide this basic teaching image set.

**METHOD AND MATERIALS:** AMSER-ID is based on a Web server at Dartmouth College. The database is a “no-frills” design with a simple expandable/collapsible file tree, designed purely for download, not specific image searching. This was done to minimize cost and time involved. The images on the server are donated by AMSER members via FTP transfer

protocols. The images include a wide range of common pathologies and modalities, as well as normal studies. Where possible, multiple examples of diseases are provided, and these will hopefully increase in number with time. These images are specifically directed at medical student or 1st-year resident education. The images are bundled as jpg images within zip files, which may contain subfolders within groups (eg, Chest-pneumonias.zip contains subfolders such as RUL, RLL, viral, etc). The zip files are organized for ease of download. Access to the site is by password, which will be provided to AMSER members. The images are unobtrusively watermarked with the AMSER logo, and copyright remains with the original provider, with images to be used only for teaching purposes, not publication by the downloading member.

**RESULTS:** File download statistics from the site will be tracked and AMSER members encouraged to make their own contributions to the image database.

**CONCLUSION:** We believe that AMSER-ID is a valuable tool provided to the medical student education community in radiology and will enable faculty to both develop and extend their teaching portfolios. Access to the site should commence in spring 2007.

**(SS08-59) 2:10 PM****Audience-Response Systems in 1st-Year Medical Student Education: Effects of Attitudes and Behaviors**

Lina Nayak, *Washington University School of Medicine, Saint Louis, MO*; Joseph P. Erinjeri, MD, PhD (joseph.erinjeri@mir.wustl.edu)

**PURPOSE:** To determine how the use of an audience-response system (ARS) in medical student radiology instruction affects student attitudes and behaviors toward the learning process.

**METHOD AND MATERIALS:** Twenty-seven 1st-year medical students enrolled in an elective in the first semester of medical school entitled “Introduction to Clinical Radiology,” which was offered concurrently with gross anatomy. Students were divided into groups of three, and each was given a case file describing the hospital visit of a patient with a common CT diagnosis. Students were provided with a PowerPoint® presentation containing all of the images from the CT examination of the patient, allowing students to scroll through the images as if viewed on a PACS workstation. Students were also provided with emergency department records, admission and discharge summaries, operative notes, pathology reports, and, subsequently, radiology reports. Students received instruction in generating interactive questions and adding audience-response elements to their presentations. As a final project, each group made a presentation on their assigned case to the other students and faculty using ARS. Students’ views of interactive audience response as a teaching method were surveyed using a 5-point scale (1, strongly agree; 2, agree; 3, neither agree nor disagree; 4, disagree; 5, strongly disagree) prior to and following the elective.

**RESULTS:** Students reported that they were more comfortable responding to questions with ARS than verbally (1.1 vs 3.8,  $P < .0001$ ). Students found it easier to gauge their level of mastery of material by answering ARS questions than by listening to questions answered verbally by their classmates (1.7 vs 2.7,  $P < .006$ ). However, there was no significant difference between the students’ reported ability to gauge their level of mastery of material with ARS than with end-of-course examinations (1.7 vs 1.8,  $P < .8$ ). Students reported that answering ARS questions during lecture and end-of-course examinations led to similar levels of insight into how to study for medical school courses (2.4 vs 2.0,  $P < .20$ ).

**CONCLUSION:** Radiology instruction utilizing an audience-response system (ARS) can help build student confidence in the 1st year of medical school. ARS and end-of-course examination have similar effects on student attitudes and behaviors toward learning.

**(SS08-60) 2:20 PM****New Technology to Facilitate the Role of the Program Director in Objective Competency Testing in Radiology Residency**

Mark S. Frank, MD, *Indiana University, Indianapolis, IN*; Jennifer Steele, MS; Richard B. Gunderman, MD, PhD

**PURPOSE:** Provide an education framework in which (1) the program director (PD) and/or designees (“course masters”) can create online curricula

with integrated competency testing and (2) the PD has Web-centric access to detailed results of each learner's performance, including his or her performance relative to that of the peer group.

**METHOD AND MATERIALS:** An online education framework is used to author and deliver curricula with built-in competency-testing tasks such as interactive image interpretation and questions with immediate feedback. Course work follows a "high-stakes" format in which (1) only the learner's first attempt at a task/question is counted, (2) learner is required to find the correct answer in order to proceed with course work or have visibility of what follows, and (3) learner must complete course work in the sequence prescribed by the course master. Participation by each learner (eg, completed vs not-yet-completed exercises) and performance on each and every task and question are tracked and tallied in nearly real time by the Web server. Learners are invited to evaluate the curricula via both Likert-style questions and free-text feedback. A Web-centric PD's module, accessible via secure log-in, provides overviews and multidimensional drill-downs on performance metrics, as well as the learners' evaluations of the course work. Reporting is provided on absolute performance, as well as each learner's performance relative to his or her peer group.

**RESULTS:** Some potential deficiencies in online radiologic education are addressed, with two key improvements being (1) capabilities for educators to provide objective and uniform teacher-directed (high-stakes) competency testing, rather than primarily relying on learner-directed browsing for on-line learning, and (2) built-in capabilities that track and analyze learners' performance, making such metrics securely accessible to personnel such as the PD and chairman. Such capabilities can help the PD discover knowledge deficiencies among residents, as well as teaching deficiencies within the training program.

**CONCLUSION:** We believe that resident education derives several benefits from facilitating the PD's participation in objective competency testing.

#### **(SS08-61) 2:30 PM Whad'ya (Really) Know? New Education Technology to Provide Objective Self-Perspective for Radiology Residents**

Mark S. Frank, MD, *Indiana University, Indianapolis, IN*; Jennifer Steele, MS; Richard B. Gunderman, MD, PhD

**PURPOSE:** Provide radiology residents with an objective, convenient way to assess their knowledge competency within and across radiologic categories and compare themselves to their peers in aggregate.

**METHOD AND MATERIALS:** A Web-centric education framework is used to author and deliver realistic course work composed of both abnormal cases and normal cases. Learners interpret images (eg, clicking abnormalities, if any), respond to embedded interactive questions, study rationales, and periodically encounter quizzes. Sequencing of course work, including individual questions, can be controlled so that participants cannot "look ahead" until completing the challenge at hand. Participation and performance are tracked and continuously tallied by the Web server in order to provide single-click access to perspectives of self vs peer group for each and every question, as well as perspectives of self vs (historical) self when again studying previously completed course work. A performance analysis module for the course master (eg, program director) provides detailed overviews of and drill-downs for each participant's performance, both absolute performance and performance relative to the peer group.

**RESULTS:** Reasons why this approach has been well received by both our chairman and program director as a cornerstone for resident education within our program are (1) residents are tested at distinguishing normal vs abnormal, in addition to being tested on truly abnormal findings; (2) course work provides a realistic and engaging learning environment that simulates point of care; (3) perspectives of self vs peers offer improved objectivity when compared to anecdotal and sporadic evaluation of learning often characteristic of residency training; and (4) the education framework facilitates mass production and delivery of highly customized course work without requiring additional software programming and related costs.

**CONCLUSION:** We believe that new and improved ways to provide objective self-perspective for residents (especially perspective of self relative to peer group) enrich the learning experience and help produce better radiologists.

#### **(SS08-62) 2:40 PM The Novice Learner in Radiology: A Comparison of the Traditional Block Clerkship versus Integrated Curriculum**

Ahmed El-Sherief, MD, *University of Rochester, Rochester, NY*; Theodore R. Hall, MD; Vikram S. Dogra, MD (ahmed\_elsherief@urmc.rochester.edu)

**PURPOSE:** Academic radiology departments around the country are being challenged in their mission to educate medical students in an environment with limited resources and increasing clinical demands. This project involved a comparison between a longitudinal radiology curriculum integrated in existing 3rd-year clinical clerkships and the traditional block format for teaching radiology at the same institution. This study assessed medical students' attitudes and perceptions of their 3rd-year radiology clerkship experience and asked them how they prefer to learn radiology.

**METHOD AND MATERIALS:** Medical student responses to an anonymous Web-based questionnaire regarding their attitudes and perceptions of their 3rd-year radiology clerkship experience, as well as their perceptions of effective teaching methodologies, were collected. Twenty-one common questions were asked of both groups. Thirty-two additional questions were added to the traditional block medical students' survey. 152 students from the longitudinal radiology course and 39 students from the traditional block clerkship were surveyed.

**RESULTS:** Students from both groups felt radiology was an important part of the curriculum. Students from the integrated radiology curriculum rated the overall quality of their clerkship very low. Students from both groups felt that a structured block format with case-based interactive lectures would be the most effective method to teach radiology. However, both groups equally perceived their knowledge in determining the indications, contraindications, and cost-effectiveness of radiological examinations as adequate.

**CONCLUSION:** In developing a radiology curriculum, the adult learning theory for the novice learner should be considered. The results of this survey reflect the need to define and examine effective teaching methodologies in the radiology curriculum—not so much as debating the importance of a traditional block clerkship vs an integrated radiology curriculum. Radiology can be taught either through a traditional block clerkship or an integrated radiology curriculum as long as there is a defined set of educational objectives and if appropriate effective teaching methodologies are implemented.

#### **(SS08-63) 2:50 PM A Computer-based Radiology Simulator as a Learning Tool to Help Prepare 1st-Year Residents for Being on Call**

Alexander J. Towbin, MD, *University of Pittsburgh Medical Center, Pittsburgh, PA*; Brian Paterson; Paul J. Chang, MD\* (towbinaj@upmc.edu)

**PURPOSE:** The start of call can be a stressful time for radiology residents. Traditional teaching files are often not useful for this type of preparation because they focus on the specific image with the abnormality and do not allow the resident to find the abnormality within the case. The purpose of this study is to determine if a computer-based radiology simulator would have an effect on resident confidence level and/or diagnostic abilities.

**METHOD AND MATERIALS:** An HTML-based interface was created to display selected cases in a manner similar to the PACS system at our large urban teaching hospital. Cases thought to be important for call preparation were selected, made anonymous, and entered into the database. The class of 1st-year residents was randomly split into two groups: a control group, and a study group that used the simulator. Each resident was given a survey 1 month before and after the onset of call to measure his or her subjective feelings of preparedness and nervousness. The residents were also measured objectively through the use of discordance levels from their on-call cases.

**RESULTS:** There were 71 cases entered into the simulator: 16 plain films, 46 CTs, and 9 US. Of the 12 residents in the 1st-year class (10 males, 2 females), seven were placed into the study group and five into the control group. Two residents in the study group did not use the simulator. For the residents who used the simulator, their usage ranged from 11%–58% of the

cases. The residents in both groups claimed they felt more prepared and less nervous 1 month after starting call. The differences at survey were not significant. There was also no statistical difference in the discordance rates for on-call cases between the two groups.

**CONCLUSION:** While statistical significance was not reached between the users of the radiology simulator and the control group, there was a subjective feeling that the simulator was useful for both call preparation and as an interactive learning tool. A larger sample study group size may show statistical significance.

### (SS08-64) 3:00 PM Efficient Capture of Radiology Lectures for the Web

Cristopher P. Ewing, BA, *University of Washington, Seattle, WA*;  
Michael L. Richardson, MD; Felix S. K. Chew, MD, MBA  
(cewing@u.washington.edu)

**PURPOSE:** One of the strongest challenges facing online radiology education is the difficulty and expense of developing content. Despite the advantages of Web-based educational materials, not all faculty are motivated to create such Web-based materials on their own. To ease this process, we have developed a system for efficiently capturing live lectures for online presentation.

**METHOD AND MATERIALS:** First, we videotape a lecture. We then obtain the original PowerPoint slides and any additional explanatory text or useful hyperlinks from the lecturer. These are all combined into an online format based on Flash ActionScript technology combined with XML, in a platform-neutral format. Rather than displaying raw video, we decided to focus on optimizing the appearance of the lecture slides and the speaker's audio quality. This results in much smaller files to download. When this file is viewed on the Web, one's browser automatically loads a Flash-based media player which plays back the lecture in a manner that is totally under the control of the viewer. The player can fast-forward and rewind over content, jump immediately to any of a list of locations in a lecture, pause and resume playback, and even provide a magnified view of slide content. This production process has been streamlined and currently requires 2 hours of production time to get a 1-hour lecture online.

**RESULTS:** This technique has been used extensively at our institution to capture a wide variety of lectures recorded live at CME seminars and medical school lectures. These lectures are distributed to medical students throughout our medical school's five-state area and to CME users worldwide (<http://uwcmc.org>).

**CONCLUSION:** Our process efficiently captures existing lectures for online display. This capture can be achieved with a relatively small initial investment in equipment and a minor commitment of employee time. Once our faculty members have created and presented a lecture, no additional effort on their part is required to get their talk online.

### (SS08-65) 3:10 PM Impact of Author Contribution Requirements on Number of Authors per Article in Leading Radiology Journals

Julia R. Kallmes, *Mayo Clinic, Rochester, MN*; Timothy J. Kaufmann, MD; David F. Kallmes, MD\* (kallmes.david@mayo.edu)

**PURPOSE:** The medical literature has shown ongoing increases in numbers of authors per article, prompting many leading journals to institute authorship contribution disclosures. We tested the hypothesis that author contribution requirements for the journal *Radiology*, which were instituted in 1998, would slow the rate of increase of authors per article, as compared to *AJR*, which has no such authorship contribution requirement.

**METHOD AND MATERIALS:** We recorded the number of authors per article for *Radiology* and *AJR* for the years 1996–97 and 2004–05. For articles in the journal *Radiology*, we also catalogued the following subtypes: international vs American authors, number of patients in the study, preclinical vs clinical papers, and radiology subspecialty type. We compared interval change in numbers of authors per article from the early to late time period using Fisher's exact test for categorical data and Wilcoxon rank sum test for continuous data.

**RESULTS:** We reviewed a total of 3848 articles ( $n = 1102$  and 896 articles for *AJR* in 1996–97 and 2004–05, respectively;  $n = 1000$  and 850 articles for *Radiology* in 1996–97 and 2004–05, respectively). Both *AJR* and *Radiology* showed statistically significant increases in mean numbers of authors per paper between 1996–97 and 2004–05. *AJR* increased by 1.00 authors per article (95% CI: 0.77–1.23;  $P < .0001$ ), from 4.62 authors to 5.63 authors per article, representing an increase of 21.6%. *Radiology* changed by nearly an identical amount as compared to *AJR*, increasing by 1.08 authors per article (95% CI: 0.84–1.31;  $P < .0001$ ), from 5.85 to 6.93 authors per article, representing an increase of 18.4%. The difference in interval change in mean number of authors per article over time between *AJR* and *Radiology* was not statistically significant ( $P = .64$ ). All subgroups with the *Radiology* cohort showed statistically significant increases in author numbers between 1996–97 and 2004–05 ( $P < .0001$  for all subtypes).

**CONCLUSION:** Since 1996–97, the number of authors per paper in radiology journals has increased markedly. As compared to a similar journal without such requirements, author contribution requirements in the journal *Radiology* have failed to impact the rate of increase in mean number of authors per paper.

### (SS08-66) 3:20 PM Automated CME for Just-in-Time Online Learning

Michael L. Richardson, MD, *University of Washington, Seattle, WA*;  
Cristopher P. Ewing, BA; Felix S. K. Chew, MD, MBA  
(mrich@u.washington.edu)

**PURPOSE:** The aim of continuing medical education (CME) is to improve clinical practice or patient outcome. However, few studies have shown an association between conventional lecture-based CME activities and these goals. We feel that a more relevant type of CME is the multiple just-in-time (JIT) learning activities most radiologists perform every day, while researching answers to imaging problems in their daily practice. Our goal was to create an online system to automatically log these JIT activities for potential CME documentation.

**METHOD AND MATERIALS:** We have built a simple Web-based portal to automatically record JIT learning activities. This system is written in PHP, an HTML-embedded scripting language. This system stores its information on a MySQL database. The portal allows each user to create a unique account. Any online searches performed via our portal are then logged for that user, including date, time, and topic. At the end of each search, we ask each user to answer the following questions: 1. What is your primary clinical question? 2. Did the information from this search help you in answering your clinical question? 3. Did the information from this search cause you to change your primary diagnosis? 4. Do you feel the information from this search will lead to a change in treatment for your patient? 5. Do you feel that the information from this search will lead to a change in outcome for your patient? A user may consult our system at any time to view their own records and print them for potential CME documentation.

**RESULTS:** Preliminary feedback from users has been favorable, and the records from our system are currently used to document *AMA PRA Category 2 Credit™*. We are currently negotiating with our university CME department and hope to eventually offer our users *AMA PRA Category 1 Credit™* for searches performed via our portal.

**CONCLUSION:** We have created an automated online system to assist radiologists and other providers in performing and documenting structured, self-directed online learning for potential CME credit. We feel that this type of JIT learning is more likely to result in improved patient outcomes than traditional course-based CME.

## GERRAF Mini-Retreat (RAHSR Joint Session)

Location: Centennial F

Moderator: Ronald L. Arenson, MD

RS

### Cost-effectiveness of Coronary Artery CTA versus Catheter Angiography

Aine M. Kelly, MD, MS\*, *University of Michigan Medical Center, Ann Arbor, MI*

**PURPOSE:** (1) To determine patient preferences for coronary CT angiography (CTA) when compared to conventional catheter angiography (CCA). (2) To incorporate patient preferences into a decision model in order to calculate cost-effectiveness of CCA versus CTA. (3) To determine the impact of CTA on surgical decision making compared to CCA alone.

**METHOD AND MATERIALS:** (1) 100 consecutive patients who have had CTA and CCA for clinical reasons will be retrospectively surveyed. The CTA and CCA should have been performed within the last 6 months to avoid recall bias. Potential survey participants will be identified using radiology databases. A postcard will be sent to patients asking them to call an 800 number (to opt in) or send the postcard back (to opt out). Surveys will be administered over the phone by a research assistant. The survey will include a wait trade-off method (with a time trade-off for baseline level of anxiety) as well as a direct rating scale (including baseline anxiety) and a paper standard gamble. IRB approval is expected in January 2007. (2) Using a base case of a 40-year-old male who is screened for coronary artery disease, a decision model will be constructed to compare the strategies of CCA, CTA, exercise ECG, and SPECT. Patients will be screened every 5 years in this Markov model. This will incorporate patient preferences for the tests CCA and CTA obtained in (1) above. (3) Thirty patients who have had both CTA and CCA performed will have both sets of images de-identified. Case mix will include normal coronary arteries, insignificant coronary artery disease, and significant coronary artery disease. Three cardiothoracic surgeons will review the images of one or other modality. They will rate the presence of disease and their confidence in this decision. They will also rate their management plan and their confidence in this decision. At an interval of at least 10 weeks later, the surgeons will review the images of the other modality. The decisions they make will be compared to each other for each modality to assess confidence levels and degree of interobserver agreement.

**RESULTS:** (1) To date, the surveys have been devised, research assistant nominated, and IRB approval is expected in January 2007. (2) Currently, disease, cost, and clinical estimates for the decision model are being calculated. (3) IRB approval is obtained. The electronic radiology information database has been searched for suitable cases. Images obtained have been reconstructed and de-identified. The cardiothoracic surgeons will have their first image-reading session in January 2007.

### MR-guided Focused Ultrasound Surgery of Uterine Fibroids: Assessment of an Emerging Technology

Fiona M. Fennessy, MD, PhD\*, *Brigham and Women's Hospital, Boston, MA* (ffennessy@partners.org)

**PURPOSE:** To perform a preemptive technology assessment of an emerging treatment of uterine fibroids, magnetic resonance-guided focused ultrasound surgery (MRgFUS), with an established treatment for uterine fibroids, uterine artery embolization (UAE).

**METHOD AND MATERIALS:** A Markov decision model was developed to compare treatment with UAE to that of MRgFUS. The outcomes used were costs and quality-adjusted life-years. Measurements included calculation of net health benefit (NHB) and threshold analysis, and combinations of costs and effectiveness that would make MRgFUS a cost-effective alternative to UAE were determined. Sensitivity (one-way and two-way) analyses were used to evaluate the effect of treatment cost, probability of treatment success, probability of technical success, and utilities post procedure.

**RESULTS:** UAE is the preferred strategy when the probability of success of MRgFUS is less than 0.8. Currently, the probability of treatment success with FUS is defined as 0.7. MRgFUS needs to have both a high probability

of technical success and a high probability of a successful treatment outcome before it will be considered the preferred strategy.

**CONCLUSION:** MRgFUS has the potential to be the preferred strategy, at its current cost or even at a higher cost, if its probability of a successful treatment outcome increases.

### Somatostatin Receptor Scintigraphy for Surveillance of Pediatric Brain Tumors

FDA

Geetika Khanna, MD\*, *University of Iowa Hospitals and Clinics, Iowa City, IA*; M. Sue O'Dorisio, MD, PhD

**PURPOSE:** Conventional MRI has limited ability in differentiating residual or recurrent tumor from posttherapy changes such as radiation necrosis. High densities of somatostatin receptors (SSTR) have been identified in pediatric brain tumors such as embryonal tumors. Our primary aim is to determine if somatostatin receptor scintigraphy (SRS) can improve the accuracy of surveillance scanning in SSTR-positive brain tumors of childhood.

**METHOD AND MATERIALS:** The study was approved by our institutional review board. A total of 62 SRS scans were performed on 20 children (mean age, 9 years) with brain malignancies (14 embryonal tumors, 3 ependymomas, 1 anaplastic astrocytoma, 1 pilocytic astrocytoma, and 1 papillary tumor of the pineal). The scans were reviewed by two blinded readers. The sensitivity and specificity of SRS for surveillance scanning were compared to MRI using patient outcome as the reference standard. The level of interobserver agreement for SRS was determined using the Cohen  $\kappa$  coefficient.

**RESULTS:** SRS was true-positive (TP) in 5/5 cases with residual tumor after surgery and in 10/11 cases with residual or recurrent tumor during follow-up, including two with negative MRI and two where MRI was equivocal for distinguishing between radiation necrosis and recurrent tumor. SRS was TP in 7/7 tumors with documented SSTR expression and negative in 1/1 tumor with no SSTR expression. SRS had similar sensitivity to MRI (0.87 vs 0.92) and appeared to result in improved specificity compared to MRI (0.97 vs 0.86). The interobserver agreement for SRS was high, with a  $\kappa$  coefficient of 0.76.

**CONCLUSION:** 1. SRS is complementary to MRI for follow-up of SSTR-positive brain malignancies of children and can improve accuracy of surveillance scanning. 2. SRS is a useful problem-solving tool in cases where MRI findings are equivocal.

### Efficacy of MR Imaging for Breast Cancer Surveillance in BRCA1 Gene Mutation Carriers

Janie M. Lee, MD, MS\*, *Massachusetts General Hospital Institute for Technology Assessment, Boston, MA*

**PURPOSE:** To evaluate the clinical consequences of MRI surveillance for breast cancer in women at increased risk due to *BRCA1* gene mutations.

**METHOD AND MATERIALS:** A Markov Monte Carlo simulation model of breast cancer was developed to compare three annual breast imaging surveillance strategies versus clinically based surveillance (no imaging): (1) mammography only, (2) MRI only, (3) combined MRI and mammography. Input parameters were based on information from the published medical literature, existing databases, and expert opinion. Estimates of unobservable parameters were estimated via model calibration to targets obtained from SEER data on breast cancers diagnosed prior to the introduction of mammographic screening (1975–1980).

**RESULTS:** For a cohort of 25-year-old asymptomatic *BRCA1* gene mutation carriers, the model estimates that 63% of women will develop breast cancer during their lifetimes, approximating published penetrance estimates. With a strategy of clinically based surveillance, the median diameter of invasive cancers at presentation is 2.6 cm. Life expectancy for the cohort is 71.15 yrs. With the introduction of annual surveillance strategies of mammography, MRI, or combined mammography and MRI, median invasive tumor diameter at diagnosis decreases to 1.9 cm, 1.3 cm, and 1.1 cm, respectively. Program sensitivity is >50% only with MRI strategies. Cohort life expectancy with

surveillance increases to 71.95 yrs, 72.21 yrs, and 82.53 yrs, respectively. Application of surveillance decreases breast cancer mortality by 17%, 16%, and 22%, respectively. The vast majority of women undergoing surveillance will have  $\geq 1$  false-positive screening examination during their lifetime (54%, 80%, and 84%, respectively). Many women also will undergo  $\geq 1$  false-positive biopsy (11%, 26%, and 30%, respectively). Results were sensitive to *BRCA1* penetrance estimates and to MRI sensitivity for detecting DCIS.

**CONCLUSION:** Surveillance with annual combined mammography and MRI provides *BRCA1* mutation carriers with the greatest life expectancy gain and breast cancer mortality benefit. However, an important trade-off of this strategy is a high rate of false-positive screening test results for the majority of women undergoing surveillance.

### Development and Application of a Predictive Model for Breast Carcinoma Using MR Imaging Features and Patient Characteristics

Wendy B. DeMartini, MD\*, *Seattle Cancer Care Alliance, Seattle, WA*; Constance D. Lehman, MD, PhD\*; C. Craig Blackmore, MD

**PURPOSE:** MRI is an important new tool for the detection and characterization of breast carcinoma. We hypothesize that combinations of Breast Imaging Reporting and Data System (BI-RADS) magnetic resonance imaging (MRI) features and patient characteristics can be used to predict the probability of malignancy for lesions identified on breast MRI. Our objectives are to develop and apply a multivariate model which predicts the probability of lesion malignancy using MRI morphologic and kinetic imaging features and patient clinical characteristics.

**METHOD AND MATERIALS:** This retrospective cohort study will utilize prospectively obtained information from our established breast MRI database. The subjects will be consecutive patients who underwent breast MRI from 5/03 to 6/06 and were found to have an incidental breast MRI lesion assessed to be BI-RADS 3 (probably benign), BI-RADS 4 (suspect abnormality), or BI-RADS 5 (highly suggestive of malignancy). BI-RADS 3 lesions will have undergone at least 6 months of MRI follow-up or imaging-guided or surgical biopsy. BI-RADS 4 and 5 lesions will have undergone imaging-guided or surgical biopsy. The following variables will be recorded for each subject: (1) lesion MRI features of size, morphology, and computer-aided evaluation program-assessed kinetics; (2) patient characteristics of clinical indication leading to MRI, age, and mammographic breast density; and (3) outcome of benign or malignant. The frequencies of variables associated with benign versus malignant outcomes will be compared. Initial univariate analyses will identify variables that are strongly associated with malignancy. Subsequent multivariate analyses will control for confounding variables and allow development of a predictive model.

**RESULTS:** Data collection is nearly complete. Approximately 550 lesions will comprise the study data set. Initial data analysis will soon be performed.

**CONCLUSION:** Multivariate predictive models for malignancy which allow the integration of lesion morphology, lesion kinetics, and patient characteristics have the potential to improve the diagnostic accuracy of breast MRI.

### Hyperpolarized $^3\text{He}$ MR Imaging Evaluation of Asthma in Young Adults: Assessment of Technology, Evaluation of Functional Ventilatory Status, and Direct Clinical Application

Edward Y. Lee, MD\*, *Children's Hospital, Boston, MA*

**PURPOSE:** Asthma is a highly prevalent chronic disease affecting approximately 20 million people in the United States alone. The currently available standard pulmonary function test (PFT) captures only general pulmonary function without identifying specific areas of impaired ventilation. There is a recognized need for new imaging technologies to obtain accurate anatomic and functional information, which, in turn, should facilitate early diagnosis and improved treatments. However, currently available imaging modalities (eg, computed tomography and radioisotope scintigraphy) not only have limited ability to evaluate functional ventilation status but also deliver potentially harmful ionizing radiation. Novel hyperpolarized  $^3\text{He}$  magnetic resonance imaging ( $^3\text{He}$  MRI) is free of ionizing radiation and is noninvasive. Further, recent preliminary results in adults have established that  $^3\text{He}$  MRI provides

accurate anatomic and functional information. The purpose of this research project is to evaluate prospectively  $^3\text{He}$  MRI for its ability to facilitate early diagnosis, identify areas of impaired ventilation, assess disease activity, and aid in treating young adults with asthma. Our specific aims and hypotheses are as follows: *Specific Aim #1:* To compare the distribution of ventilation in the lungs of healthy young adults vs that in young adults with asthma using hyperpolarized  $^3\text{He}$  MRI. *Hypothesis Addressing Specific Aim #1:* Hyperpolarized  $^3\text{He}$  MRI is a noninvasive and novel imaging modality that can identify areas of impaired pulmonary ventilation in young adults with asthma. *Specific Aim #2:* To compare the regional pulmonary ventilation function with hyperpolarized  $^3\text{He}$  MRI in young adults with asthma during the acute phase vs the recovery phase. *Hypothesis Addressing Specific Aim #2:* Hyperpolarized  $^3\text{He}$  MRI can show the interval changes in the areas of impaired pulmonary ventilation in young adults with asthma during an acute phase compared to the recovery phase from asthma exacerbation. *Specific Aim #3:* To correlate quantitative functional data of hyperpolarized  $^3\text{He}$  MRI findings (percentage of ventilated portion of the lungs) with the results of the standard PFT in healthy and asthmatic young adult patients; this study will include patients with asthma in both the acute and the recovery phases. *Hypothesis Addressing Specific Aim #3:* Hyperpolarized  $^3\text{He}$  MRI findings (percentage of ventilated portion of the lungs) will correlate well with the results from the PFT in both healthy and asthmatic young adult patients, including those in the acute and the recovery phases of asthma.

**METHOD AND MATERIALS:** Twenty healthy and 20 asthmatic young adult patients will undergo hyperpolarized  $^3\text{He}$  MRI and PFT. We will, first, compare the ventilation status of the patients with and without asthma; second, evaluate ventilation function in asthma patients; and third, compare the MRI results to those produced by PFT. We will perform data analysis with respect to ventilation function using the Student's *t*-test or Mann-Whitney *U*-test, as appropriate. We will compare asthma patients during the acute phase vs the recovery phase using a paired-sample approach (paired *t* or Wilcoxon signed-ranks test); and we will compare ventilation function between patients and controls and to evaluate the correlation between  $^3\text{He}$  MRI and PFTs using the Kolmogorov-Smirnov test.

**RESULTS: Potential Results:** We anticipate hyperpolarized  $^3\text{He}$  MRI will prove equal or superior to PFT in (1) assessing areas of impaired lung function, (2) evaluating the degree of disease activity, and (3) facilitating early diagnosis and treatment without exposure to the potentially harmful effects of ionizing radiation. Assuming feasibility is established, we ultimately aim to transfer this promising technology from young adults to children with asthma and other lung diseases, which is our overarching goal.

### Cost-effectiveness of Screening for Hepatocellular Carcinoma in Cirrhotic Patients

Cynthia S. Santillan, MD\*, *University of California San Diego, San Diego, CA*; Theodore G. Ganiats, MD; Tarek Hassanein, MD; Giovanna Casola, MD; Claude Sirlin, MD (csantillan@ucsd.edu)

**PURPOSE:** To determine the cost-effectiveness of screening for hepatocellular carcinoma (HCC) in patients with cirrhosis using different imaging modalities while adhering to current clinical practice guidelines.

**METHOD AND MATERIALS:** A Markov model was developed to simulate screening of a population of patients with cirrhosis secondary to hepatitis C virus (HCV) infection. The model will initially be used to evaluate screening with ultrasound, computed tomography, or magnetic resonance imaging in comparison with no screening. The patients will undergo screening every 6 months. Patients who are found to have an HCC that is not in an advanced stage may undergo local ablative therapies (such as radiofrequency ablation or transarterial chemoembolization), have a resection, have continued close follow-up, and/or receive a liver transplant. Patients with advanced disease may undergo palliative therapies. Those patients with stage T2 HCC on presentation or who can be down-staged to stage T2 using local treatment will also receive priority on the transplant waiting list for a liver transplant. Patients who do not have evidence of HCC on initial screening will be re-screened in 6 months. Throughout the model, the patients will also continue to experience morbidity and mortality due to their underlying cirrhosis, as well as be eligible for transplant based solely on the severity of their cirrhosis.

**RESULTS:** The "no screening" arm of the model currently under development will undergo validation utilizing previously published estimates of the

incidence of HCC, morbidity and mortality due to HCC, and morbidity and mortality due to cirrhosis. The model will also account for various health states associated with combinations of the different stages of cirrhosis and the different stages of HCC.

**CONCLUSION:** A Markov model for screening a population of patients with cirrhosis due to HCV for HCC has been developed. Ongoing work will focus on refining the screening arm of the model, which can then be used to produce estimates of the costs and cost-effectiveness of the various screening strategies.

### Multiparametric Prostate MR Imaging at 3 T: Impact on Pretreatment Evaluation of Clinically Localized Prostate Cancer

Jingbo Zhang, MD\*, *Memorial Sloan-Kettering Cancer Center, New York, NY*

**PURPOSE:** To assess the value of MRI/MR spectroscopic imaging (MRSI), dynamic contrast-enhanced (DCE) MRI, and diffusion-weighted imaging (DWI) at 3 Tesla, independently and in combination, for noninvasive pretreatment detection, localization, and staging of prostate cancer and the evaluation of prostate cancer aggressiveness.

**PROGRESS REPORT:** *Obtaining Prerequisite Devices and Approvals for Endorectal MR at 3 T:* A protocol for prospective evaluation of prostate MR at 3 T was submitted for IRB review and approved in August 2006. The acquisition software for endorectal MRI/MRSI at 3 T was obtained in June 2006. The endorectal coil compatible with 3 T was approved by the FDA in August 2006. An adaptor for the endorectal coil that allows it to function on the long-bore 3-T MR scanner at Cornell Imaging Center was made available by the manufacturer in November 2006. *Developing In-House Data Processing Software:* To perform multiparametric endorectal prostate MR, it is essential to correct for signal nonuniformity associated with phased-array and endorectal coils. In-house software was developed to acquire signal ratios from quick calibration scans obtained with a body coil and a phased-array coil or an endorectal coil for automated correction of field inhomogeneity. This in-house software will also be used for quantitative MRSI combining data from all coil elements. *Performing Phantom Studies:* Phantom studies were done to validate the in-house software for signal nonuniformity correction, as well as for performing quantitative MRSI with combined data from all coil elements. Phantoms representative of healthy and neoplastic prostate tissue were also used to optimize echo time (TE) in order to minimize the J-modulation effect on citrate peaks at 3 T. *Imaging Human Subjects with an Endorectal Coil at 3 T:* In January 2007, we started imaging volunteers (to test the imaging parameters and in-house software developed on phantom studies) as well as patients. After the patients undergo radical prostatectomy, whole-mount step-section pathology maps will be generated and used as the gold standard to measure the accuracy of endorectal prostate MR in the detection, localization, and staging of prostate cancer and in the evaluation of prostate cancer aggressiveness.

**Saturday, April 28, 2007**

**4:00–5:30 PM**

### SS09: AUR Scientific Session 9 General Teaching II (Papers 67–75)

**Location: Centennial G**

ED

**AUR Joseph E. and Nancy O. Whitley Award**

**(SS09-67) 4:00 PM**

### Dedicated Core Clerkship in Radiology for Medical Students: Development, Implementation, Evaluation, and Comparison with Distributed Clerkship

Annemarie Relyea-Chew, JD, MS, *University of Washington, Seattle, WA*; Felix S. K. Chew, MD, MBA

**PURPOSE:** The authors performed this study to develop, implement, and evaluate a dedicated core clerkship in radiology for the required clinical clerkship year of medical school and to compare it with the distributed core clerkship that it replaced.

**METHOD AND MATERIALS:** A dedicated 5-day clerkship was added to the clinical core year of medical school. The course offered a variety of learning experiences, including lectures, clinical observation, case discussions, and team project. Learner achievement was measured by posttest and compared with a control group. Student satisfaction was determined by structured and unstructured surveys. Faculty comment was elicited by survey, and administrative staff perspective was established through interviews. The evaluation of the dedicated clerkship was compared with the distributed clerkship along the dimensions of learner achievement, student satisfaction, faculty comment, and administrative staff perspective.

**RESULTS:** The dedicated clerkship was developed and implemented successfully. Compared with the distributed clerkship, there was no significant difference in learner achievement or student satisfaction for the dedicated clerkship, but the dedicated clerkship was easier to conduct for faculty and administrative staff.

**CONCLUSION:** The dedicated clerkship was advantageous for faculty and administrative staff while maintaining a comparable level of learner achievement and student satisfaction as the distributed clerkship.

**AUR Joseph E. and Nancy O. Whitley Award**

**(SS09-68) 4:10 PM**

### Learning and Retaining Normal Radiographic Chest Anatomy: Does Preclinical Exposure Improve Student Performance?

David S. Feigin, MD; Donna Magid, MD, MEd, *Johns Hopkins Medical Institutions, Baltimore, MD*; James G. Smirniotopoulos, MD; Susan J. Carboognin, Capt, USAF, MC

**PURPOSE:** While most would concur that preclinical exposure to radiology is a desirable goal, specific learning objectives have been more difficult to delineate. It is also important to assess what is learned and to determine how well it is retained or "retrievable." This study was developed in an attempt to document the extent to which specific measures of preclinically acquired knowledge may be retained and retrieved for later clinical application.

**METHOD AND MATERIALS:** The Anatomic Structure Identification Quiz (ASIQ), previously described by Feigin et al (*Academic Radiology* 2005), was administered to 236 medical students at the conclusion of the required 2nd-year course, as a 10-item written quiz based on a projected frontal and lateral chest image. The 10-item quiz was also administered to 555 senior medical students (194 of whom had been included in the previous project) on the 1st day of the USUHS Basic Radiology elective. Finally, the identical quiz was completed by 74 of these 555 senior medical students at the conclusion of the academic portion of the elective, approximately 3 weeks after the administration of the first quiz.

**RESULTS:** The 2nd-year students scored a mean of 7.15 points out of a possible 10 points, with a standard deviation (SD) of 1.42. The senior students completing the quiz at the beginning of the elective scored an average of 4.42 (SD, 1.34) compared to a score of 8.65 (SD, 1.24) 3 weeks later.

**CONCLUSION:** Long-term recall of specific radiologic structures learned in the 2nd year of medical school was poor despite evidence documenting good initial (short-term) retention of tested information. However, after a brief review consisting of the quiz itself followed by 3 weeks of general radiology emphasizing abnormal chest imaging, the senior students demonstrated a near doubling of their ability to correctly identify these structures, as well as an improvement compared to scores obtained during the 2nd year. Thus, the value of a preclinical course in radiology may be not only to teach principles of radiology and to stimulate interest in the discipline but also, by repetition and reinforcement, to facilitate and possibly improve later recall and retention of important radiographic material.

**(SS09-69) 4:20 PM**  
**Does Lifestyle Really Matter?**

Vaishali S. Lafita, MD, *Loyola University Medical Center, Maywood, IL*; Kimberly E. Applegate, MD, MS\* (vlafita@lumc.edu)

**PURPOSE:** To determine beliefs, perceptions, and current rules related to part-time work, maternity leave, and fluoroscopy for residents who are pregnant or possibly pregnant, child-care issues, and flexible schedules for radiologists.

**METHOD AND MATERIALS:** One could potentially think of radiology as a women-friendly specialty. However, data show that radiology is male dominated, with stagnant numbers of women choosing radiology careers. Women are paid less compared to their male counterparts. We surveyed residents at one institution and the 2006 AFIP about specific lifestyle issues that may influence future career choice. The survey was compiled and analyzed for trends.

**RESULTS:** Seventy-three radiology residents at various stages of training level completed the 20-question survey (63% males, 37% females). 40% of the residents claimed that they moonlight to earn extra money for their families. 55% (39/71) had children, with 24% having one, 21% having two, 7% having three, and 3% having four children. 36% (14/39) of the residents with children and 16% (5/32) of the residents without children stated that having child(ren) will influence their choice between academic radiology and private practice. 45% (33/73) of the participants did not know if their institution had a written policy for pregnant residents. 40% (29/73) reported any time was the best year for pregnancy during radiology residency. While 48% (35/73) of participants were okay with residents becoming pregnant during residency, 27% were concerned about coworkers ending up with unfairly redistributed duties when working with a pregnant resident. 73% (53/73) were agreeable to cover a fluoroscopy/IR rotation for a pregnant coworker. 89% (65/73) of participants were well satisfied with their career choice of radiology. Written comments from participants will be discussed.

**CONCLUSION:** While pregnancy is perceived as a taboo during residency, more than half of our participants had children. Ironically, nearly half did not know if their institution had a written policy for pregnant residents. It seems that even though the residents are okay with pregnant coworkers, there are concerns about redistributed call and duties.

**(SS09-70) 4:30 PM**  
**The Electronic Learning Portfolio: Documentation and Assessment of the ACGME Competencies in Radiology Residents**

Lori A. Deitte, MD, *University of Florida-Jacksonville, Jacksonville, FL* (lori.deitte@jax.ufl.edu)

**PURPOSE:** To develop, implement, and assess a competency-based electronic learning portfolio for radiology residents.

**METHOD AND MATERIALS:** An electronic learning portfolio was developed based on the ACGME competencies and radiology RRC requirements with input from faculty members with a formal background in medical education. A focus session was then held with radiology residents at our institution to review the learning portfolio and address any questions or concerns. Residents were requested to record time spent on portfolio preparation. A learning portfolio template with instructions was forwarded electronically to all radiology residents ( $n = 21$ ). Updated portfolios were reviewed 2 months later with the resident mentor, and a resident survey regarding the initial learning portfolio experience was then administered. Individual portfolios will again be reviewed with mentors at the semiannual resident review. A final survey will then be administered to the residents and mentors.

**RESULTS:** Fifteen of 21 residents completed the initial portfolio survey, consisting of seven questions assessing the residents' level of understanding of the components of the learning portfolio. The majority (9/15) of the respondents requested further clarification of the portfolio requirements, particularly regarding the development of an individualized learning plan and the determination of a systems-based practice project for QA presentation. Residents reported a range of 30 minutes to 20 hours spent on portfolio preparation, with a mean preparation time of 3.3 hours. The final survey

will be administered after the semiannual resident review, and the results will be summarized with appropriate descriptive statistics.

**CONCLUSION:** A competency-based electronic learning portfolio was implemented in our radiology residency program. The learning portfolio template, final survey results, and conclusions will be presented.

**(SS09-71) 4:40 PM**  
**Effective Use of Audience-Response Systems in Radiology Education**

Michael L. Richardson, MD, *University of Washington, Seattle, WA*; Felix S. K. Chew, MD, MBA; Christopher P. Ewing, BA (mrich@u.washington.edu)

**PURPOSE:** While didactic lectures and case conferences have long been standard tools for radiologic education, they offer relatively little interaction between the speaker and audience, especially with large classes. Audience-response system (ARS) technology provides an inexpensive solution to this problem and allows every student the ability to interact with the instructor on every concept and every case. Our goal has been to explore ARS technology to see how it can be optimized for the particularly image-intensive education of radiology students.

**METHOD AND MATERIALS:** We obtained an inexpensive (\$1300) ARS, with a radiofrequency (RF) handheld remote unit for each student. Our ARS is controlled via stand-alone platform-independent software or via a PowerPoint (PPT) plug-in. The PPT plug-in allows an instructor to embed questions in a talk by means of a custom PPT palette. Traditional question types, such as multiple-choice, true/false, numeric answers, and short text answers, can be added to one's talk. A small RF receiver is connected to the lecturer's computer via the USB port. When a query slide is encountered during the lecture, the audience members log their answers via their remotes. These answers are then automatically tallied by the ARS and summarized on the screen. Controversial questions can be repolled following discussion. The ARS saves all answers into a database.

**RESULTS:** Our residents appreciate the ability for everyone to interact on every question. The ARS makes it immediately clear to the lecturer when the audience has grasped a particular concept and allows one to move on efficiently to other concepts. When the ARS reveals widely differing answers, additional discussion can be provided. Most of our questions require the audience to form a differential diagnosis or pick the best diagnosis. "Count the number of findings" questions have also appealed to our residents.

**CONCLUSION:** Inexpensive audience-response technology allows radiology educators the ability to add considerable interactivity to their teaching sessions and hopefully increase retention of knowledge by their audience. There is also great potential for using such systems as a tool to gather data for educational research.

**(SS09-72) 4:50 PM**  
**Aligning Residency and Fellowship Training Goals and Learning Objectives with the Six ACGME General Competencies: An Integrated Matrix Approach**

M. Elizabeth Oates, MD\*, *University of Massachusetts Memorial Medical Center, Worcester, MA*; Robert Desai, MD; Douglas W. Fellows, MD (oatese@ummhc.org)

**PURPOSE:** To construct a general matrix framework that aligns radiology training goals and learning objectives with the six ACGME general competencies. The template is adaptable to each required residency and fellowship experience. The rotation-specific matrices reflect progressive expectations appropriate to that clinical service. Each goals-and-objectives matrix is supplemented by a rotation-specific interpretive and procedural skill-set matrix.

**METHOD AND MATERIALS:** The general matrix template consists of four columns identifying the time on service (first rotation, second rotation, third rotation, fourth rotation) and six rows comprised of the ACGME general competencies (patient care, medical knowledge, interpersonal and communication skills, practice-based learning and improvement, professionalism, systems-based practice). Matrices were developed for each required residency rotation and adapted for the various radiology fellowship

programs. Each rotation-specific matrix contains progressive expectations tailored to that service across the number of required rotations during the training program and is supplemented by a specific, progressive interpretive and procedural skill-set matrix.

**RESULTS:** Aligning rotation-specific training goals and learning objectives with the six general competencies reinforces those fundamental ACGME principles in an “at-a-glance” table format. The matrices are adaptable, simple to follow and understand, readily accepted by trainees and faculty, and viewed favorably by our institution’s Office for Graduate Medical Education. The components easily lend themselves for use in a structured, objective evaluation system providing timely feedback to trainees.

**CONCLUSION:** This integrated matrix approach readily aligns key training goals and learning objectives with the six ACGME general competencies and provides a core structure for evaluation of the educational progress of radiology residents and fellows.

### **(SS09-73) 5:00 PM**

#### **Automating Academic Podcasting: Further Ninja Tips**

Michael L. Richardson, MD; Felix S. K. Chew, MD, MBA; Christopher P. Ewing, BA, *University of Washington, Seattle, WA* (mrich@u.washington.edu)

**PURPOSE:** Podcasting allows dissemination of audio and video files across the Web to personal audio players such as the Apple iPod. Tools for producing educational podcasts for radiology are now inexpensive and widely available. However, producing such podcasts can be rather tedious and time-consuming, even for avid and experienced podcasters. Furthermore, once produced, how does one most effectively disseminate these files?

**METHOD AND MATERIALS:** We first produce a script that contains the text of our podcast. These scripts are often ported from existing PowerPoint slide presentations or scientific papers but usually require some editing to optimize this text for reading aloud. To reduce the time needed by our faculty to produce podcasts, we currently employ text-to-speech technology. This technology allows us to create reasonably natural-sounding audio versions of our text with a minimum of human intervention. Regionalized versions of this software are also available for multilingual and international podcasting. We have also created podcasts using animated video “actors” to “read” our text. We have experimented with a variety of software and hosting options for our podcasts and currently host these files on our own departmental Web server. To ensure that our audience can automatically find and download new podcasts, we use software which automatically creates appropriate RSS feeds as we upload our new podcasts.

**RESULTS:** Podcasting has helped extend the reach of our educational files to “interstitial learners,” who listen while driving or flying. Our server log audits suggest that files with a podcast version get more “hits” than a similar file without a podcast. Our automated software has greatly reduced the tedium and time required to produce these files. For our own particular podcasting needs, it has made the most sense to run our own Web server and host our own content.

**CONCLUSION:** Podcasting provides yet another format for disseminating educational materials online. It allows us to reach new audiences and increase the number of visits to our Web site. Automated software can facilitate the production and hosting of these files.

### **(SS09-74) 5:10 PM**

#### **Link to Normal Anatomy**

Joshua A. Becker, MD\*, *New York University Medical Center, New York, NY*; Siddharth Govindan; Brianne Blumenthal; Scott Cameron, MD; David Spiner (joshua.becker@med.nyu.edu)

**PURPOSE:** Many medical students have restricted skills in the imaging of normal anatomy. A recent AMSER survey noted the varied learning experiences in anatomy courses. Little, if any, reinforcement exists in the 2nd year, with limited retained knowledge prior to clinical rotations. Anatomy imaging sessions in transitional courses at the end of the 2nd year rarely fill the gap. When placed in challenging learning experiences with imaging studies, the students are handicapped in the analysis of images. Whether

alone or in small-group learning exercises, online access to appropriate normal imaged anatomy supports the educational exercises.

**METHOD AND MATERIALS:** Prepared learning modules illustrating classical imaging (eg, CT of liver cirrhosis with gastric varices, bronchiectasis, etc) have both images and text on the frame. There is online availability of comparative normal images. When the link icon is clicked, the image frame is split-screened, with labeled normal anatomy replacing the text associated with a problem case. The normal anatomy resource is from the elective’s radiographic anatomy program. The connection was originally done in PowerPoint with the hyperlink program. This worked well at the individual computer stations. However, this format was not adaptable to a Web-based program. Subsequently, the process was redone with code writing for a Web-based tutorial and is online with a normal anatomy link.

**RESULTS:** Tutorials, part of the radiology elective, present challenging clinical exercises with supporting images. It is a digital exercise and Web based. The students readily appreciate the change from the normal in their analysis of the pathology illustrated. In addition, the online comparison assists their understanding of the pathology process from an imaging perspective.

**CONCLUSION:** An online normal anatomy resource is a major asset when students are challenged with tutorials of imaged pathology.

### **(SS09-75) 5:20 PM**

#### **Repetition Is the Mother of Learning**

Joshua A. Becker, MD\*, *New York University Medical Center, New York, NY* (joshua.becker@med.nyu.edu)

**PURPOSE:** A one-time contact with learning material may well be forgotten in a short interval. With repetition, retention is known to increase. However, it is important that a single format is not repeated over and over and there are a variety of patterns for participation.

**METHOD AND MATERIALS:** A learning format consisting of five dedicated sessions, 10 minutes each, for a specific subject (eg, gastrointestinal imaging) is one of the tutorials in the imaging elective. The student, alone, previews the Web-based assigned tutorial the evening before the scheduled class. The student develops a diagnosis. The day of the session, small groups (3–6 students, dependent upon course registration) are organized and review the tutorials. The “never saw it before” experience does not exist. There is a group diagnosis consensus. In 1 hour, all students have seen all images for the second time. The students then assemble in the student conference room, where the specialty attending quizzes the students sequentially as to what is their group’s diagnosis. The attending reviews the case. The student(s) can request from the secretary coordinator a re-review, where the case material is supplemented with the attending’s discussion in a PowerPoint tutorial. Thus, the student will see the material at least three times and possibly four times, each as a different interface.

**RESULTS:** Students demonstrated a higher-level learning than formal lectures, self-study, clinical rotations, and other activities. In a preliminary survey, the group consensus was more likely to be correct than the solo decision. Sharing various opinions, discussion, and consensus building are more likely to come to a correct conclusion than solo challenge. The lively discussion in the group sessions has the students debating with their peers and sharing information. The understanding of the learning session is confirmed in examinations given during the 4 weeks. In the course evaluation, this cycle of review and re-review is consistently acknowledged as the most popular learning format.

**CONCLUSION:** The design of presenting and re-presenting information in different formats yields better retained information and is, very importantly, enjoyable.

## AUR 2007 Scientific Poster Abstracts

Scientific posters are located in Centennial D. Each poster will be presented by its author during one of four AMA PRA Category 1 Credit™ poster sessions scheduled for Thursday and Friday. The day and time follow the presentation number.

Presenting author is identified by institution, city, state, and country, if not United States or Canada.

Presentations by trainees (residents, medical students, first-year fellows) are noted in purple.

### (P-01) Thursday • 10:00AM

#### Factors Leading to Radiology Career Selection: Results of the 2004 National Physician Survey

Luke Maj, BS; Mark O. Baerlocher, MD; Joseph R. Grajo, BS, *North-eastern Ohio Universities College of Medicine, Akron, OH*

**PURPOSE:** The purpose of this study was to determine when and why radiologists choose radiology as a career specialty.

**METHOD AND MATERIALS:** We analyzed data from the 2004 National Physician Survey database. As part of this survey, radiologists currently in Canadian practice were asked three questions: (1) When did you decide on your current field of medical practice? (2) Of all the areas in medicine, what led you to select your current career? (3) Indicate the most important factor that led to career selection. Respondents were presented with a series of options and were asked to check off only one for each of questions 1 and 3, and as many as were applicable for question 2.

**RESULTS:** A total of 1910 radiologists were surveyed in Canada, with 33.8% (646) response rate. Most radiologists (32.7%) decided to go into the field of radiology during their clerkship period of medical school. Some 41.7% chose radiology after having initially spent some time training (16.3%) or practicing (25.4%) in another field. Only a minority (2.5%) chose radiology as a planned career before medical school and followed through on this early decision. The top three decision factors to pursue radiology were intellectual stimulation/challenge (85.1%), workload flexibility and/or predictability (55%), and influence from a mentor (33.3%). Practicing radiologists stated that the single most influential factor in their decision to pursue radiology was intellectual stimulation/challenge (52.9%), flexibility and/or predictability (14.9%), and influence of a mentor (5.9%). Factors such as earning potential, ability to pursue non-work-related interests, influence of family, availability of training opportunities, teaching opportunities, prestige, and research opportunities proved to be less influential.

**CONCLUSION:** These results illustrate that the most important factors in one's decision to pursue radiology were intellectual stimulation and challenge, and workload flexibility. Current trainees who have not yet made the decision on which specialty to pursue may be interested in these results and which aspects of the field were most appealing to its current practitioners.

### (P-02) Thursday • 3:30 PM

#### A Review of Radiation Effects and Safety Measures

Sharon L. D'Souza, MD, MPH, *University of Oklahoma, Oklahoma City, OK* (sharonlisa1222@yahoo.com)

**PURPOSE:** To provide a review of pertinent literature, research, and recommendations regarding radiation, radiation safety, and the methods by which radiologists and other practitioners can reduce the risk of radiation-induced sequelae to both themselves and their patients.

**METHOD AND MATERIALS:** Much of the data that we have concerning radiation biology is a result of information acquired from victims of Chernobyl or Hiroshima. This information concerning acute high-radiation-dose effects has been used to extrapolate the expected effects of chronic low-dose radiation. Chronic low-dose radiation is what radiologists, radiology residents, and other operators of radiology equipment will be exposed to in the course of their careers. As such, this is a topic that is of prime importance to those in this field.

**RESULTS:** In regard to radiation effects on a cellular level, several well-established assumptions can be made. Additionally, several models have been used to explain the effects of radiation exposure and have used the

well-established effects of high-dose radiation to extrapolate low-dose-range effects, which are often not reliably detected. Following a review of pertinent literature, research, and recommendations regarding radiation exposure, various methods of decreasing patient exposure as well as operator exposure will be discussed.

**CONCLUSION:** As radiologists, we need to be aware of the inherent dangers of radiation and often need to act as advocates for our patients, ensuring that they receive high-quality examinations which will serve to further their medical treatment while at the same time considering the associated risks. Just as important is the need to ensure our own safety, as our chosen career will entail continued radiation exposure.

### (P-03) Friday • 10:00 AM

#### λ-Light-Chain Multiple Myeloma Manifested as an Extrasosseous Mass in the Cervicothoracic Spinal Canal: First Reported Case

Sangit B. Malliah, MD; Joshua D. Brody, DO, *Cooper University Hospital, Camden, NJ* (drsangit@yahoo.com)

**PURPOSE:** To our knowledge, this is the first report of a λ-light-chain myeloma manifesting as an epidural extrasosseous soft-tissue mass in the spinal canal. We describe MRI findings and correlate these findings with a review of the literature.

**METHOD AND MATERIALS:** MRI findings in this case were reviewed with the pathologic diagnosis. A PubMed search of extramedullary extrasosseous multiple myeloma was then performed, and these results were then correlated.

**RESULTS:** Extramedullary extrasosseous multiple myeloma is a rare entity. We present a case of light-chain multiple myeloma presenting as a soft-tissue mass in the epidural cervicothoracic spinal canal. A soft-tissue mass arising from the bone is often reported with the vertebral body fracture. On rare occasions, an epidural soft-tissue mass associated with multiple myeloma may form in the spinal canal wholly independent of bone. Review of the world literature reveals only nine such cases. Ours is the first describing light-chain myeloma producing such a phenomenon. Findings at MRI were only reported in five of the nine cases. MRI findings in our case are quite similar to the findings reported by Palmbach (1996), with isointensity on T1, heterogeneous hyperintensity on T2 with respect to spinal cord, and predominantly homogeneous enhancement. Kim (1992) and Itoh (2003) reported similar findings, with the only difference being hyperintensity on T2. Wantanabe's case differed, with isointensity noted on both T1 and T2 and no enhancement (2000). The majority of cases report isointensity to spinal cord on T1 and heterogeneous to homogeneous hyperintensity on T2. This suggests that epidural extramedullary extrasosseous multiple myeloma arising in the spinal canal will most commonly be isointense to cord on T1, heterogeneously to homogeneously hyperintense on T2, and display contrast enhancement.

**CONCLUSION:** This is the first report of a λ-light-chain myeloma manifesting as an epidural extrasosseous soft-tissue mass in the spinal canal. MRI findings in this case and review of the literature suggest extrasosseous extramedullary multiple myeloma will typically be isointense to spinal cord on T1, heterogeneously to homogeneously hyperintense on T2, and demonstrate contrast enhancement.

**(P-04) Friday • 3:30 PM**  
**Imaging Spectrum of Portal Vein Aneurysm**

Nicole Roy, MD, *University of Utah, Salt Lake City, UT*; Allene S. Burdette, MD; Akram M. Shaaban, MD; William R. Hutson, MD; Jason Schwartz, MD; Anne M. Kennedy, MD; et al (nicole.roy@hsc.utah.edu)

**PURPOSE:** To illustrate the imaging appearance of portal vein aneurysm and describe the implications of portal vein aneurysm in both asymptomatic patients and those who are transplant candidates.

**METHOD AND MATERIALS:** Methods include a retrospective review of confirmed cases and a literature review.

**RESULTS:** Intrahepatic and extrahepatic portal vein aneurysm is an uncommon vascular abnormality which was originally felt to be a sequela of portal hypertension and therefore was seen primarily in those with liver disease. This entity is becoming increasingly recognized in patients without liver disease as the use of cross-sectional imaging increases in the general population and as the number of patients with advanced hepatic disease rises. We describe the ultrasound and radiographic (CT, MRI, and MR angiography) features of portal vein aneurysm. A discussion of the implications of portal vein aneurysm in both potential transplant patients and asymptomatic patients is provided, including operative considerations in pretransplant patients, treatment options for symptomatic patients, and recommendations for surveillance in asymptomatic patients with incidentally discovered portal vein aneurysm.

**CONCLUSION:** Portal vein aneurysm can be associated with portal hypertension and hepatic disease but is equally common in asymptomatic patients. Recognizing and describing this abnormality on pretransplant imaging may have important surgical implications. The general consensus for management of asymptomatic patients with incidentally discovered portal vein aneurysm is continued surveillance with ultrasound. Intervention is recommended in those patients whose ultrasound demonstrates enlargement of the aneurysm or those who develop symptoms of portal hypertension.

**(P-05) Thursday • 10:00 AM**  
**Development and Implementation of a Diagnostic Radiology Resident's Learning Portfolio**

Linda A. Deloney, EdD, *University of Arkansas, Little Rock, AR*; Robert F. Buchmann, DO (deloneylinda@uams.edu)

**PURPOSE:** We designed a learning portfolio based on the authentic experience of the radiology resident and intended to (1) document resident achievement of the general competencies, (2) encourage autonomous and reflective learning, which is an integral part of a professional education, and (3) enable the resident to connect theory with practice. The portfolio is expected to be a process for both formative and summative assessment, as well as a product for the resident to use when interviewing for a fellowship and/or professional position.

**METHOD AND MATERIALS:** We conducted a literature review and consulted with medical educators who had experience with portfolios. To identify portfolio requirements and determine what exhibits would be allowed, we examined the ACGME and RRC requirements and reviewed the learning objectives for our clinical rotations. Because portfolios include both content and a reflective component, we had to decide how many exhibits residents could complete per year, with concern for their existing time requirements. Although portfolio content would be unique to each resident, an assessment protocol and criteria for judging merit (scoring) entries were needed. After the portfolio content and process were determined, we trained our first cohort of residents (PGY2s) who will be assessed with this method.

**RESULTS:** During each year of training, residents are expected to maintain all required documentation (ACGME, RRC, college's GME Committee, program) in their portfolios. Additionally, residents will annually create six self-reflection exhibits, one for each general competency. Finally, the portfolio of a graduating resident must include a current CV and at least one example of scholarly activity (abstract, poster, manuscript).

**CONCLUSION:** The general competencies incorporate technical, intellectual, and emotional aspects of medical practice. Some of these are not easily measured, but we believe the portfolio is a tool that can improve the competency-based assessment of a resident. Furthermore, the portfolio may

provide more specific information about what residents actually do than the traditional faculty global ratings or in-training examination scores indicate.

**(P-06) Thursday • 3:30 PM**  
**Rib Fusion Following Thoracotomy for Ligation of Patent Ductus Arteriosus**

Stephen Thomas, MD, *University of Pittsburgh, Pittsburgh, PA*; Stefano C. Bartoletti (stthomas@hotmail.com)

**PURPOSE:** Surgical patent ductus arteriosus (PDA) ligation has been classically approached via a lateral thoracotomy. Currently, the procedure is performed using video-assisted thoracoscopic surgery. Several postoperative musculoskeletal sequelae have been reported following thoracotomy done for tracheoesophageal fistula repair, including partial paralysis of the latissimus dorsi muscle, atrophy of the serratus anterior muscle, scoliosis, and rib abnormalities. The purpose of this study is to examine rib fusion abnormalities following thoracotomy for PDA repair.

**METHOD AND MATERIALS:** Chest radiographs from  $n = 34$  patients with rib abnormalities and postsurgical changes from PDA ligation were selected. A metallic clip in the location of the ductus arteriosus was used to identify PDA ligation. The mean patient age was 7.3 years, ranging from 3 months to 34 years. The data were analyzed for the most frequently fused ribs and the area of fusion. In five patients who had serial pre- and postoperative chest radiographs, the average time for rib fusion following surgery was determined.

**RESULTS:** In 30 patients (88%), the surgery was via a left thoracotomy and in four (12%) cases with a right aortic arch via a right incision. The area of rib fusion was posterolateral in 28 (82%) and lateral in six (18%) cases. In descending order of frequency, rib fusion was found between the following ribs: fourth and fifth, 47% (16); third and fourth, 23% (8); fifth and sixth, 18% (6); sixth and seventh, 6% (2); second and third, 3% (1); and seventh and eighth, 3% (1). The average time for rib fusion following thoracotomy was 4.2 months (five patients).

**CONCLUSION:** PDA ligation performed via a lateral thoracotomy affects normal development of the thoracic cage and is associated with rib fusion. In most patients, the rib fusion occurred posterolaterally between the fourth and fifth ribs. The average time for fusion was 4.2 months from the time of surgery.

**(P-07) Friday • 10:00 AM**  
**Teaching Maintenance of Certification: Is It Adequate?**

Peter B. Romano, MD, *Medical University of South Carolina, Charleston, SC*; Leonie Gordon, MBChB\* (romano@musc.edu)

**PURPOSE:** The American Board of Medical Specialties has mandated that all physicians participate in maintenance of certification (MOC), with the goal to improve the quality of health care through physician-initiated learning and quality improvement. The American Board of Radiology (ABR) introduced MOC in 2005 and plans formal implementation of parts I-IV in 2007. With the adoption of new policies, it is important that radiologists with time-limited certificates be made aware of changes in a timely fashion. The goal of this study was to determine if radiologists are educated and prepared for the maintenance of certification process.

**METHOD AND MATERIALS:** Radiologists with time-limited certificates were surveyed. Questions pertinent to the MOC process were asked.

**RESULTS:** Preliminary research has shown that less than 25% of radiologists were aware of the MOC practice improvement project requirement, and an even smaller percentage had developed a project topic. Less than 40% felt they had been properly informed of the requirements involving MOC by the ABR. Less than 10% had completed a self-assessment module (SAM). Finally, no radiologist polled could name the four components or six competencies which form the basis of maintenance of certification.

**CONCLUSION:** This research shows that more education on the maintenance of certification process is needed in the radiology community. This teaching should be addressed immediately and performed at national radiology meetings, in journals, and emphasized in curricula designed for residents in radiology training programs.

**(P-08) Friday • 3:30 PM**  
**Nontraumatic Pneumorrhachis in an Asthmatic Patient with Pneumomediastinum**

Nicholas A. Lazzaro, MD, *Oakwood Hospital, Dearborn, MI*; Sharon R. Helmer, MD

**PURPOSE:** To describe an unusual case and review the medical literature of a rare entity, pneumorrhachis, which is also called aerorachia or epidural pneumatosis.

**METHOD AND MATERIALS:** Computerized tomography and magnetic resonance imaging were performed on a patient presenting to the emergency department with pneumomediastinum. A review of the medical literature was performed using the following search terms: pneumorrhachis, aerorachia, and epidural pneumatosis.

**RESULTS:** Computerized tomography of the thorax demonstrated pneumomediastinum and small collections of epidural gas within the thoracic spine. In addition, follow-up magnetic resonance imaging of the thoracic spine demonstrated hypointense signal on T1 and T2 sequences within the extradural compartment of the thoracic spine, corresponding to epidural gas.

**CONCLUSION:** Pneumorrhachis is a rare benign condition that can occur in patients with pneumomediastinum.

**(P-09) Thursday • 10:00 AM**  
**The Association of “Wavy” Patella Tendon with Anterior Cruciate Ligament Tear**



Huan N. Pham, MD, *University of California Davis Medical Center, Sacramento, CA*; Eva M. Escobedo, MD; John C. Hunter, MD

**PURPOSE:** To find out whether there is an association between “wavy” appearance of the patella tendon and anterior cruciate ligament (ACL) tear.

**METHOD AND MATERIALS:** We retrospectively reviewed 474 random MRIs of adult (at least 18 years old) knees within the last 4 years at our institution for the “wavy” appearance of the patella tendons and then determined if there was any association with ACL tears on MRI reports and arthroscopic reports, if available. The “wavy” appearance of the patella tendon was defined as change in the tendon direction at least twice. Two MSK radiologists independently evaluated the cases and were blinded to the ACL appearances and reports. The ACL images were concealed from the radiologists as much as possible without compromising the evaluation of the patella tendons. Consensus between the two radiologists was obtained for equivocal cases. Severe postoperative changes, total knee arthroplasties, and ACL reconstructions were excluded.

**RESULTS:** We found 41 knee MRIs with “wavy” patella tendons from the total of 474 random knee MRIs (8.6% of total). Among these 41 knee MRIs with wavy patella tendons, there were eight ACL tears identified on MRI (19.5% of total), and five of them had available arthroscopic confirmations. Thirty-three out of 41 knee MRIs with wavy patella tendons had no ACL tears on MRI (80.5% of total), three of which had available arthroscopic confirmations. There were 433 of the total 474 knee MRIs without wavy patella tendons (91.4% of total), and among them, 38 had ACL tears on MRI reports (8.8% of total), of which 16 were confirmed with available arthroscopies.

**CONCLUSION:** From this study, we concluded that the “wavy” appearance of the patella tendon in random knee MRI examination is not common (8.6% in our study). However, if there is a “wavy” patella tendon, it is approximately one-fifth of the time associated with ACL tear, which is at least twice as common (19.5% vs 8.8%) when comparing with knee MRI examination without the “wavy” patella tendon sign.

**(P-10) Friday • 10:00 AM**  
**Value of PET Imaging in Characterizing Pleural Diseases**



Sidhartha Chaudhry, MD, *University of Washington, Seattle, WA* (sidhartha.chaudhry@gmail.com)

**PURPOSE:** Conventional imaging techniques are suboptimal in characterizing pleural thickening and effusion. Positron emission imaging with FDG is useful in differentiating benign pleural thickening from malignant causes, such as malignant mesothelioma or primary spindle cell tumor of the pleura.

**METHOD AND MATERIALS:** Imaging technique: All patients are scanned after overnight fasting; 7–11 mCi of F-18 deoxyglucose (FDG) is administered, followed by scanning after 45 min. All patients receive 1 mg lorazepam (Ativan) before the study to reduce paraspinous muscular contractions. Our typical protocol consists of five field-of-view emission images obtained over the chest and upper abdomen over 45 min. Three FOV axial transmission images are obtained for attenuation correction of 15 minutes duration each. Standardized uptake values are obtained over the most metabolically active region by drawing region of interest over the most metabolically active foci. SUV values are normalized using patient’s body weight. Imaging findings: Malignant mesothelioma demonstrates high FDG uptake in a (multi)focal or diffuse manner. This appearance is mimicked by metastatic breast and bronchogenic adenocarcinoma of the pleura. Primary spindle cell tumor generally presents with a focus of significant FDG uptake. Pleural implants from malignant thymoma and lymphoma demonstrate multifocal pleural masses showing moderate uptake, often associated with pleural effusion. Benign conditions of the pleura, even when diffuse in distribution, demonstrate relatively low SUV, usually below 2.8, with high specificity. A notable exception is inflammation from talc pleurodesis, which exhibits high FDG uptake, simulating malignant pleural conditions. CT scan appearance or patient history helps in such cases.

**RESULTS:** The viewer at the end of this exhibit will know (1) how to perform an FDG-PET examination of the pleura, (2) differentiating features of different benign and malignant conditions of the pleura, and (3) the classical PET and imaging pitfalls of different pleural conditions.

**CONCLUSION:** This exhibit highlights clinical issues, technical factors, and pitfalls in the imaging and diagnosis of pleural conditions.

**(P-11) Friday • 3:30 PM**  
**Utility of MR Imaging in Diagnosing Congenital Uterine Anomalies**



Sidhartha Chaudhry, MD, *University of Washington, Seattle, WA* (sidhartha.chaudhry@gmail.com)

**PURPOSE:** Congenital uterine anomalies (congenital mullerian duct anomalies) are present in 0.2% to 0.4% of women. However, up to one in five women with recurrent pregnancy loss has a uterine anomaly. Accurate characterization of the anomaly present helps identify patients who would benefit from surgical therapy, such as patients with septate uterus.

**METHOD AND MATERIALS:** Anatomic issues: Most cases of mullerian ductal anomalies can be explained by insufficient progressive caudal-to-cranial fusion. There may be associated ovarian and renal anomalies. Imaging technique: Oblique coronal (horizontal long-axis) and oblique axial (short-axis) fast spin-echo T2-weighted images are obtained using a phased-array pelvic multicoil. Typical parameters are TR/TE/ETL: 4000/102/16; 20–24-cm FOV; matrix 512 × 512; four signal averages; 4/1-mm slice thickness. Imaging findings: Horizontal long-axis images help assess fundal dip and intercornual distance, which help in distinguishing arcuate uterus from bicornuate uterus. These images also are useful in characterizing the septum in septate uterus. Short-axis images help in identifying caudal extent of a uterine septum to distinguish between bicornuate unicollis uterus and bicornuate bicollis uterus. Antenatal DES-exposed uterus has a characteristic T-shaped appearance on horizontal long-axis images. Other features to be looked for are structure of ovaries, as some of these cases may be accompanied with streak or rudimentary ovaries. Renal anomalies may be associated with uterine anomalies. Clinical significance: MR with T2 WI is the most accurate method of characterizing uterine anomalies, with diagnostic accuracy exceeding laparoscopy, ultrasound, and hysterosalpingogram.

**RESULTS:** From this exhibit, the viewer will be able to (1) identify different types of congenital uterine anomalies and their clinical features, (2) know how to protocol a pelvic MR directed towards identifying uterine anomalies, and (3) know the diagnostic pitfalls to avoid when diagnosing uterine anomalies.

**CONCLUSION:** This exhibit highlights the clinical issues, technical factors, key imaging findings, and pitfalls of different types of uterine anomalies presented in a systematic manner.

**(P-12) Thursday • 3:30 PM**  
**Radiofrequency Ablation at a Community Teaching Hospital: The 1st Year**



Nathan J. Linstrom, MD, *St Joseph's Hospital and Medical Center, Phoenix, AZ*; Eric vanSonnenberg, MD; William McMullen; Pejman Hedayati, MD; Gregory Stringfellow, MD; Hedi Saghari, MD; et al (eric.vansonnenberg@chw.edu)

**PURPOSE:** To describe our 1st-year experiences with an RFA service at an academic community hospital, with a discussion of the many facets of starting an ablation program. The discussion should serve as a guide for those hospitals starting similar programs.

**METHOD AND MATERIALS:** Fifty-five patients were evaluated, and 34 ablations were performed in 23 patients with RFA ± alcohol. Ablation sites included liver (23), bone (3), lung (7), and pancreas (1). Indications were palliative as well as curative; specifics included pain relief (5), debulking of mass effect (2) and tumor burden (18), relief of cough (1), and palliation of carcinoid syndrome symptoms (1). Cure was the goal in seven ablations. CT (30) and ultrasound (2) were used for guidance. Referrals came from nine different specialties. Referrals were from our institution, local physicians, and self-referrals. One to three lesions were treated per patient. Radiology residents participated in all cases.

**RESULTS:** Pain relief was achieved as a goal in five of five patients. Necrosis was achieved in 26 of the lesions. There were no major complications. One patient required a transfusion of 1 unit of blood post procedure. The longest hospital stay for those who came in for the procedure as outpatients was 2 days. Five patients had minor postablation syndrome. The ablation referrals prompted pre and post PET/CT, MRI, CT, and plain radiographs. Three patients also went on to have SIR-Sphere procedures within our department. All ablations were reimbursed. Academically, for the institution, outgrowths of RFA included at least eight submissions/publications, several CME courses, a SIR-Sphere program, a pain ablation program, and the establishment of an oncology center of excellence.

**CONCLUSION:** A few key components, including strong administrative support and a solid referral base, within an ablation program can directly boost a department's productivity through not only the ablations themselves, but also by stimulating additional imaging studies. Additionally, successful programs strengthen interdepartmental ties and can establish that hospital as a local, if not national, referral center for complex cases.

**(P-13) Thursday • 10:00 AM**  
**Nonsurgical Management of Posttraumatic Urinary Tract Injuries**



Parameshwari Baladandapani, MBBS, MD, *UMDNJ-Newark, Newark, NJ*; Sohail Contractor, MD; Sharon Gonzales, MD; Piotr Kizza, MD; David Klyde, MD (drbp\_007@yahoo.com)

**PURPOSE:** We performed a retrospective review of posttraumatic urinary tract injuries managed by interventional radiology at our institution (UMDNJ, Newark), a level 1 state trauma center. While most of the techniques employed in the percutaneous management of urinary tract trauma are well established, management of renal artery intimal injury following blunt trauma is controversial. Our review includes two cases where post-traumatic renal artery dissection was managed by placement of a self-expanding metallic stent.

**METHOD AND MATERIALS:** Review of our logs over a 5-year period was performed, and the most demonstrative cases were chosen for the purpose of this poster. Six cases of renal and ureteral injury which were managed percutaneously were selected. The injuries include renal laceration, renal avulsion, dissection of renal artery, caliceal injury, and ureteral leak.

**RESULTS:** Interventional radiology is emerging as an effective means of managing posttraumatic injuries, most often as a substitute for surgery, sometimes (as in our case with ureteral leak) as an intermediary step before definitive surgery. The management of posttraumatic renal artery dissection is controversial, and stenting has not yet been established. We have demonstrated two cases where stenting was performed for renal artery dissection, with reestablishment of good flow.

**CONCLUSION:** Interventional radiology is a continually expanding field that has minimized the need for open surgery, even in some severe cases of trauma.

**(P-14) Thursday • 3:30 PM**  
**Faculty Beliefs about Resignations and Mentoring**

Linda A. Deloney, EdD, *University of Arkansas, Little Rock, AR*; Ernest J. Ferris, MD (deloneylinda@uams.edu)

**PURPOSE:** The practice of academic radiology has changed significantly in the 21st century. Faculty are contending with chronic workforce shortages, ACGME duty-hours restrictions, the transition to outcome-based resident education, a national cap on funding for residency positions, and the conversion of most practices to filmless, paperless systems. Academic radiologists are expected to manage increased clinical workloads with more complex studies and demands for faster, continuous service, while learning and integrating new technology such as picture archiving and communication systems and voice-recognition dictation. In addition, they are expected to teach and advise medical students, train residents and fellows, conduct research, and perform institutional service. Chairmen of university-based radiology departments are challenged to recruit and retain faculty under these conditions.

**METHOD AND MATERIALS:** A 10-item survey was written by the authors. To encourage faculty participation, the survey was designed to be answered in 5 minutes or less. The survey was authored and administered via SurveyMonkey, a free Web-based program. A total of 53 faculty members were contacted via e-mail and invited to participate. A link to the survey was provided in the e-mail. Respondents were guaranteed confidentiality. Only aggregate outcomes are reported.

**RESULTS:** The faculty response rate was 74%. Descriptive statistics have been computed, and data are being further analyzed to determine if there are differences between genders, age groups, or academic ranks. Open-ended responses are being analyzed using qualitative methods.

**CONCLUSION:** The response to the survey indicated that the questions were of significant interest to the faculty. Outcomes will be used by the chairman to strengthen mentoring for junior faculty and increase job satisfaction among the faculty.

**(P-15) Friday • 10:00 AM**  
**Obesity and Success of Uterine Artery Embolization**

Martha-Gracia Knuttinen, MD, *University of Chicago Hospitals, Chicago, IL*; Thuong Van Ha, MD (mgk600@gmail.com)

**PURPOSE:** Uterine artery embolization (UAE) for the treatment of uterine fibroids has been studied in the literature, with success rates noted of up to 98% (Siskin et al, 2000). Several studies in the literature have addressed the correlation between symptomatic uterine fibroids as a comorbid disease state associated with obesity (Shikora et al, 1991). However, no studies to date have examined the success of UAE in obese individuals. We expand the current studies by examining the performance of UAE in obese patients.

**METHOD AND MATERIALS:** We analyzed the outcomes of all patients who underwent UAE over a 4-year period. The records were reviewed to identify 28 patients classified as obese. Obesity is defined as having a body mass index of 35 kg/m<sup>2</sup> with comorbidity or 40 kg/m<sup>2</sup> with no comorbidity factors. This population was standardized according to age, size, and ethnicity. The mean age of the women was 41 years. A questionnaire and review of medical records were performed and assessed prior to the UAE procedure. The questionnaire also addressed changes in symptoms and any procedure-related complications. The type, location, and size of fibroids were all documented in the surgical report and reviewed prior to UAE. Reporting standards were followed according to guidelines of the UAE Task Force Subcommittee (SCVIR 2001).

**RESULTS:** Obese patients were found to fare as well as reported in the literature for a standardized overall patient population. The majority of these patients reviewed demonstrated positive responses and did not undergo additional treatment in an average 23 months of follow-up (range, 8 to 36 months). Positive responses were defined as symptom improvement with no need for repeat embolization or other surgical procedure.

**CONCLUSION:** Much of the literature has addressed the value of UAE as being a less-invasive and safer treatment option than standard surgical techniques. However, to our knowledge, this is the first report addressing the interaction of a particular comorbid disease state, obesity, with success of UAE. We suggest that UAE is also a positive successful treatment for uterine fibroids even in obese individuals.

**(P-16) Friday • 3:30 PM**  
**CT-guided Percutaneous Cryoablation of Kidney Tumors: Medium-term Follow-up**

Mikala Brinkman, MD, *University of Illinois College of Medicine at Peoria, Peoria, IL*; Devin V. Waldrop, MD; Bradley A. Johnson, MD; Terry M. Brady, MD; Thomas Rashid, MD

**PURPOSE:** The effectiveness of percutaneous cryoablation (PC) in selected patients for treatment of kidney tumors has been well documented over the course of short-term follow-ups. Longer-term follow-up is necessary to determine treatment durability (Davol et al 2006). This study presents data on longer-term outcomes of patients undergoing PC.

**METHOD AND MATERIALS:** The potential subject sample was drawn from a retrospectively collected database of 42 people (21 males and 21 females, average age = 73.7 years) undergoing PC at two facilities in a Midwest city in the last 5 years. All patients were seen by a urologist and interventional radiologist prior to PC and felt to be poor surgical candidates ( $n = 40$ ) or refused surgery ( $n = 2$ ). All underwent PC for 44 tumors, ranging in size from 1 to 11 cm. Two tumors were angiomyolipomas; the others were suspicious for renal cell carcinoma. Four of the tumors were embolized with metallic coils prior to PC. The procedures were all performed under conscious sedation with CT guidance and use of 2.4-mm-diameter cryoprobes. In two cases, catheter-mounted balloons placed percutaneously into the abdominal cavity were used to displace and protect adjacent loops of bowel. CT and MRIs obtained prior to and after PC were reviewed and tumor measurements and enhancement patterns recorded. This report is a case series analysis of eight patients who were followed for 18 months or longer.

**RESULTS:** The eight patients (with nine tumors) underwent regular follow-up imaging an average of 7.2 times, with a mean follow-up period of 114.7 weeks, or just over 25 months (range, 79.1–181.6 weeks). Over 55% of the 36 follow-up imaging evaluations were done using MRI; the remainder used CT. In all patients studied, tumor size decreased (average reduction in tumor size was 59.4%; average tumor size at time of PC was 5.73 cm). Of interest, the tumors suspicious for renal cell carcinoma showed a quick size reduction of, on average, 38% within 3.5 months. The one subject who had an angiomyolipoma had a one-third reduction in tumor size by 12 months following PC. At the time of the first follow-up, none of the tumors showed significant enhancement. None of these patients experienced complications, and the PC procedure itself was completed in an average of 122.4 minutes (range, 60–201 minutes).

**CONCLUSION:** Renal cryoablation is a safe and effective alternative method of treatment of renal tumors in selected patients. Longer-term follow-up (18 months or longer) shows continued good outcomes.

**(P-17) Thursday • 10:00 AM**  
**The Role of Vasopressin in the Treatment of Nonvariceal Gastrointestinal Hemorrhage: A Retrospective Review**

Robert A. Yost, MD, *University of Minnesota, Minneapolis, MN*; David W. Hunter, MD; Charles A. Dietz, MD (yostx008@umn.edu)

**PURPOSE:** There have been few studies published in the last 10 years examining the efficacy of vasopressin in the management of lower gastrointestinal (GI) hemorrhage. The purpose of this effort was to review the cases of lower GI hemorrhage treated in the last 13 years with vasopressin at the University of Minnesota.

**METHOD AND MATERIALS:** We conducted a retrospective chart review of lower GI hemorrhage managed with vasopressin in cases where embolotherapy was not feasible. The presence or absence of contrast extravasation, site of extravasation, and the use of nuclear scintigraphy in diagnosis were recorded. Complications, including rehemorrhage, preprocedure hemoglobin, dose of vasopressin, and past medical history were noted. Major complications were defined as thrombosis of a visceral artery, thrombosis of the puncture site vessel, coronary or peripheral ischemia, and bowel ischemia/infarction. Minor complications were defined as catheter dislodgement, catheter occlusion, adynamic ileus, and access site hematoma. Results were compared with the most recently published retrospective studies.

**RESULTS:** There were 19 patients with lower GI hemorrhage treated with vasopressin during the last 13 years at our institution. In 18 cases, a branch of the superior mesenteric artery (SMA) was deemed responsible. In one case, a branch of the inferior mesenteric artery (IMA) was treated. Initial success rates were 50% (9/18) for cases in an SMA distribution and 100% (1/1) for cases in an IMA distribution. Of the patients successfully treated with vasopressin, one case (1/10) developed rebleeding. There were complications in five cases (5/19; 26%), four of which were minor. In one case, infarcted transverse colon was found at follow-up laparotomy. Screening with nuclear scintigraphy was utilized in 53% (10/19) of cases prior to angiography, all of which were positive.

**CONCLUSION:** Our initial success rates, complication rates, and rebleeding rates are comparable with other retrospective studies. The widespread use of embolotherapy in the percutaneous treatment of lower GI hemorrhage has resulted in a need for further studies on the efficacy and safety of vasopressin and its direct comparison with embolotherapy.

**(P-18) Thursday • 3:30 PM**  
**Does Increased Use of CT of the Chest Identify Occult Aortic Injuries in Blunt Trauma Patients at a Level 1 Trauma Center?**

Angela M. Fried, MD, *Louisiana State University Health Sciences Center-Shreveport, Shreveport, LA*

**PURPOSE:** This study evaluates if increased use of screening chest CT has identified occult aortic injuries in blunt trauma patients at LSUHSC-Shreveport during 2004 and 2005.

**METHOD AND MATERIALS:** Retrospective evaluation was performed of all "trauma stat" patients admitted to the LSUHSC-Shreveport ER from January 2004–December 2005 identified from the trauma registry. Blunt trauma patients older than 17 years who underwent screening chest x-ray (CXR) were included. Exclusion criteria included patients with no imaging and those with incomplete evaluation of abnormal chest findings on CXR (ie, patients taken to OR or patients too unstable for CT). Information from the trauma registry, including age, mechanism of injury, and injury severity score (ISS), was also recorded. All CXRs on PACS were evaluated for mediastinal width (measured in centimeters at the carina) and any chest injuries. CTs were then evaluated for evidence of chest trauma and aortic injury. Any angiographic data were included.

**RESULTS:** 344 blunt trauma patients were cared for in 2004 and 247 in 2005. 145 (42%) of patients in 2004 versus 153 (62%) in 2005 had a chest CT as part of their initial work-up. Eight aortic injuries were identified by CCT in 2004 but only three in 2005. 100% of these patients had widened mediastina on CXR, with other chest injuries identified in 85%. The average ISS for patients with CT in 2004 was 23 versus 20 in 2005. In patients with aortic injury, the average ISS was 28. 49% of all patients seen in 2004 and 2005 had widened mediastina despite a 1.9% incidence of aortic injury.

**CONCLUSION:** Despite increased use of CT, no increased incidence of aortic injury was identified. In fact, all patients with aortic injury were found to have widened mediastina on CXR. We can therefore conclude that CT to evaluate for aortic injury should only be performed in patients with a widened mediastinum on CXR. However, 48% of patients had widened mediastinal shadows on CXR, but only 1.9% had aortic injuries. Therefore, CXR is a highly sensitive but poorly specific exam. By increasing the specificity of CXR by including additional views, such as upright exam, unnecessary CTs could possibly be eliminated.

**(P-19) Friday • 10:00 AM**  
**Prospective Sample Size Methods for Equivalence Testing of High-Field-Strength Functional MR Imaging**

Kelly H. Zou, PhD, *Harvard Medical School, Boston, MA*; Jui G. Bhagwat, MBBS, MPH; Inez Y. Wu, MS; William M. Wells III, PhD; Lucila Ohno-Machado, MD, PhD; Ion-Florin Talos, MD (kelly.zou@childrens.harvard.edu)

**PURPOSE:** To design a prospective neuroinformatics study to compare the effects of field strength on the sensitivity of functional magnetic resonance imaging (fMRI).

**METHOD AND MATERIALS:** In a pilot prospective multi-institutional fMRI study sponsored by the BIRN Research Network, five healthy right-handed males aged between 20 and 29 years were scanned at each site in two visits. A sensory-motor task was performed for four of 10 runs per visit. A block design was used, with 15-second epochs of alternating baseline (fixation) and task for 85 (plus two discarded) acquisitions per run. Subjects performed bilateral finger tapping on a dummy and on an actual button box with a 3-Hz audio cue and a reversing checkerboard. We designed a hypothetical equivalence study to compare mean sensitivities for the field strengths at 3 T and 4 T using paired *t*-test on the same set of subjects. The significance level (type 1 error) was specified at 5%, and the statistical power (1 - type 2 error) was 90%.

**RESULTS:** Field strength was found to be a significant factor impacting sensitivity of brain activation detection ( $17\% \pm 9\%$  at 1.5 T,  $66\% \pm 14\%$  at 3 T, and  $57\% \pm 7\%$  at 4 T;  $P = .02$ ). The difference in sensitivity between 3-T and 4-T MR imaging in the null hypothesis was  $-9.34\% \pm 17.45\%$ . In a hypothetical prospective study,  $N = 23$  subjects would be required to demonstrate the equivalence in activation detection sensitivity undergoing both 3-T and 4-T MR imaging. When the difference in sensitivity in the null hypothesis ranged from 11% to 2%, sample sizes increased from  $N = 11$  to 473.

**CONCLUSION:** We recommend calculating the sample sizes with caution when designing such studies so that the study populations may well reflect and be comparable to those included in the pilot evaluation.

**(P-20) Friday • 3:30 PM**  
**Clinical Significance of Expansive Arterial Remodeling in Carotid Artery Disease: A Multidetector CT Angiography Study**

Andrew D. Hardie, MD, *University of Virginia Health System, Charlottesville, VA*

**PURPOSE:** Arterial remodeling secondary to atherosclerosis has been described in the coronary vasculature, and the degree of expansive remodeling may correlate with clinical symptoms. This association has not been studied extensively for carotid atherosclerosis. The purpose of our study was to examine the association between the degree of expansive carotid arterial remodeling and clinical presentation in patients with significant stenosis using multidetector computed tomography (MDCT).

**METHOD AND MATERIALS:** One hundred eight (108) patients with  $\geq 50\%$  stenosis of a carotid artery (NASCET criteria) as measured by MDCT angiography between January 2004 and June 2006 were identified. The study group included 37 symptomatic ( $65.9 \pm 13.0$  yrs; 12 female; stenosis,  $82.0\% \pm 11.8\%$ ; 17 stroke, 15 TIA, 5 amaurosis fugax) and 71 asymptomatic patients ( $70.5 \pm 10.5$  yrs; 28 female; stenosis,  $79.3\% \pm 10.7\%$ ). Remodeling ratio (RR) was calculated by dividing the outer vessel circumference at the site of greatest stenosis by a normal reference segment vessel circumference. Maximum vessel thickness (MxVT) and eccentricity index (EI) of the plaque, defined as maximal thickness/minimal thickness at site of greatest luminal narrowing, were also determined. Data were analyzed with the independent *t* test.

**RESULTS:** The RR was significantly higher in symptomatic patients ( $1.64 \pm 0.44$ ) than asymptomatic patients ( $1.41 \pm 0.5$ ) ( $P = .02$ ). There was no significant difference in MxVT in symptomatic ( $5.9 \pm 2.1$  mm) and asymptomatic patients ( $5.6 \pm 2.4$  mm) ( $P = .45$ ) and no significant difference in EI (symptomatic,  $4.7 \pm 2.7$ ; asymptomatic,  $4.3 \pm 2.2$ ;  $P = .38$ ).

**CONCLUSION:** In the setting of significant carotid artery stenosis, expansive carotid remodeling was demonstrated to be significantly greater in patients with cerebral ischemic symptoms than in asymptomatic patients. The extent of expansive remodeling could suggest underlying atherosclerotic plaque vulnerability. Based on these results, MDCT may have a role in the evaluation of carotid artery disease beyond simply the evaluation of degree of luminal stenosis.

**(P-21) Thursday • 10:00 AM**  
**Primary Muscular Atrophy**

Sachin B. Sheth, *Medical University of South Carolina, Charleston, SC* (sheths@musc.edu)

**PURPOSE:** The purpose is to extend the differential diagnosis of focal MRI lesion of the spinal cord to include primary muscular atrophy. We describe a patient with primary muscular atrophy, a rare lower motor neuron variant, who exhibited abnormal MRI findings in the cervical spine. Possible differential diagnosis of focal spinal cord lesion in the cervical spine is discussed.

**METHOD AND MATERIALS:** A 58-year-old white male presented with a 10-year history of painless limb weakness that began in his hands. He progressively experienced muscle twitching and painful spasms in his arms and legs. Three years after the onset of symptoms, the patient developed footdrop and required a leg brace. One year after onset of symptoms, weakness accompanied the muscle twitching and painful spasms in his legs. After 9 years, he started to feel numbness in his toes, which progressed over time to the knee level. The numbness was constant. He denied diplopia, difficulty swallowing, and difficulty with elimination or bowel movements. An MRI of the cervical spine was performed.

**RESULTS:** MRI of the cervical spine demonstrated multilevel disk degeneration, most prominent at the level of C6 and C7. At the same level, there was a nonenhancing focal increase on T2 signal and STIR within the posterior aspect of the cervical spinal cord. There was also evidence of broad-based disk bulge with bilateral unconvertible joint hypertrophy at the level of C6-C7.

**CONCLUSION:** We conclude by stressing the importance of considering primary muscular atrophy along with other diagnoses when T2 signal abnormalities without enhancement are observed within the cervical spinal cord.

**(P-22) Thursday • 3:30 PM**  
**Third Nerve Metastatic Lesion**

Sachin B. Sheth, *Medical University of South Carolina, Charleston, SC* (sheths@musc.edu)

**PURPOSE:** The purpose is to report a case of a metastatic lesion of the third nerve identified by MRI.

**METHOD AND MATERIALS:** A 54-year-old white male presented with a 2-week history of diplopia with left ptosis and a right-bearing gaze. His left pupil was 6 mm and not reactive to light. The right pupil was reactive from 3–5 mm. He had medial gaze paresis of his left eye. There was no known primary tumor or trauma noted in the patient's history. An MRI and MRA were performed. Based upon his clinical data, there was suspicion of an aneurysm of the left carotid artery.

**RESULTS:** MRA excluded an aneurysm. MRI demonstrated a 7-mm homogeneous enhancing lesion along the third nerve on the left side that was isointense to gray matter on T1 and FLAIR and was slightly hypointense on T2. A possible MRI diagnosis of schwannoma of the third nerve was made. The lesion was surgically removed, and histology was verified to be metastatic adenocarcinoma. Three months later, a bone scan demonstrated diffuse osseous metastasis from a primary lung adenocarcinoma.

**CONCLUSION:** Metastases to the oculomotor nerve are very rare and should be considered in a differential diagnosis along with other lesions such as schwannoma, meningioma, and perineural spread of a tumor or any granuloma versus other infection or inflammation.

**(P-23) Friday • 10:00 AM**  
**A Case Study of Bilateral Parotid Gland Enlargement: CT and MR Imaging Findings**

Sonia J. Bobra, MD, MPH, *Harlem Hospital Center, New York, NY*;  
 Jeffrey Tsai; Leszek Piszinski, MD

We present a case of a 53-year-old female, with long-standing history of diabetes type II, hypertension, and obesity, complaining of a gradual painless bilateral parotid gland enlargement for 1 month. The initial evaluation with contrast-enhanced (CE) neck MRI demonstrated bilateral diffuse enlargement of parotid glands, which appeared homogeneous T1 hyperintense and hypointense on fat-suppressed (STIR) images. No discrete nodules, masses, or abnormal enhancement were noted within the parotid glands. No pathologically enlarged or necrotic neck lymph nodes were present. The 2-month follow-up CE neck CT showed again diffusely enlarged, grossly stable-in-size, low (fatty)-density parotid glands without evidence of parotid duct obstruction/stenosis, intraparotid mass, or lymphadenopathy. The CT and MR appearance suggested sialadenitis or parotid gland lipomatosis. Given the history of type II diabetes, chronic use of antihypertensives, and relative stability of findings, the diagnosis of sialadenitis was made. Sialadenitis of the parotid gland is a condition with bilateral, often recurrent, and painless swelling of the parotid gland. The pathophysiology is related to a primary secretory disruption with acinar cell hypertrophy without signs of inflammation. It may be seen in a variety of systemic conditions, including endocrine disorders (diabetes mellitus; pituitary gland, thyroid gland, and gonadal dysfunction), dystrophic-metabolic disorders (alcoholism, malnutrition, avitaminosis, chronic liver diseases), and as a neurogenic sialadenitis (dysfunction of the vegetative nervous system; drug-related damage seen with antihypertensive agents). Recognizing sialadenitis is important because it may point to the unsuspected presence of underlying systemic disease.

**(P-24) Friday • 3:30 PM**  
**Using Baseline CT Perfusion to Assess Patients at High Risk of Vasospasm**

Zuzan Cayci, MD, *New York Presbyterian Hospital, New York, NY*;  
 Pina C. Sanelli, MD\* (zycayci@hotmail.com)

**PURPOSE:** To improve clinical outcomes of patients following A-SAH by implementing CTP as a means to provide earlier and more accurate diagnosis of vasospasm and guide effective treatment strategies.

**METHOD AND MATERIALS:** A retrospective cohort study of 50 patients with aneurysmal subarachnoid hemorrhage (A-SAH) was performed. A-SAH was determined by initial noncontrast CT, cerebrospinal fluid analysis, CT angiography, and/or digital subtraction angiography (DSA). All patients had undergone treatment of the ruptured aneurysm by surgical clipping or endovascular coiling, per usual standard of care. Patients were followed according to the day of hemorrhagic event, with day 0 defined as the day of the acute subarachnoid hemorrhage. Transcranial Doppler ultrasound (TCD) examinations were performed daily at bedside. CT perfusion (CTP) studies were performed during days 0–3 as a baseline study, prior to the typical time period of vasospasm onset. DSA was only performed in patients with suspicion of vasospasm. Medical triple-H therapy and/or intraarterial treatment were performed in patients with symptomatic or angiographic vasospasm. Clinical outcome was determined by neurologic deficit, follow-up CT or MRI for evidence of delayed infarction, and death.

**RESULTS:** Global mean quantitative values of cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT) were obtained for each patient. Preliminary data analysis revealed statistical significance between the vasospasm and no-vasospasm groups for only the baseline CBF parameter ( $P = .003$ ). There was no statistical significance for the baseline CBV and MTT parameters between the two groups. Further data analysis using receiver operator characteristic (ROC) curve may define threshold values for determining patients at high risk of developing vasospasm from baseline CTP data.

**CONCLUSION:** Baseline CT perfusion data obtained in the first 3 days following A-SAH have the potential to play an important role in predicting patients at high risk of developing vasospasm.

**(P-67) Friday • 3:30 PM**  
**Incorporating the ACGME Competencies: A Neuro-radiology Evaluation System in Progress**

Annette C. Douglas-Akinwande, MD\*, *Indiana University Hospital, Indianapolis, IN*; Jennifer Steele, MS

**PURPOSE:** The Accreditation Council for Graduate Medical Education (ACGME) has mandated a change in the graduate medical educational system. Programs are now required to develop educational curricula that are based on the concept of “competency to practice.” Programs are also required to develop a system to evaluate trainees’ attainment of these competency-based objectives. The outcome data generated by new curricula and evaluation systems should facilitate continuous improvement of both individual trainees and the educational program.

**METHOD AND MATERIALS:** The strengths of the old neuroradiology fellowship program and evaluation system were identified. We utilized several components from the ACGME “toolbox” to teach specific objectives. In addition, we identified weaknesses in our old curriculum and assessment system and created methods to improve them. A neuroradiology curriculum which incorporated the six ACGME competencies and an electronic rubric evaluation system of the fellows, faculty, and the program were developed. The system was taught to faculty and trainees. The curriculum and evaluation system were tested in the neuroradiology fellowship program for 2 years.

**RESULTS:** The rate of overall compliance and use of the system has been approximately 75% and has reached as high as 100%. Aggregate data have provided continuous opportunities for learning improvement for trainees, faculty, and the program. Trainees at risk can be easily identified. Deficiencies as well as strengths in the program can become more evident from aggregate data.

**CONCLUSION:** We have developed and used a new evaluation system that incorporates the six ACGME competencies. This new system effectively provides outcome data which can identify successes and challenges in training fellows and complying with the ACGME competencies. The aggregate data are available for continuous learning and improvement. We propose that this evaluation system be customized for other subspecialty sections in diagnostic radiology programs.

**(P-68) Friday • 3:30 PM**  
**Ahead of the ACGME Competencies: A Neuroradiology Procedure Evaluation in Progress**

Jennifer Steele, MS, *Indiana University, Indianapolis, IN*; Annette C. Douglas-Akinwande, MD\*

**PURPOSE:** The development and inclusion of a procedure evaluation are necessary to provide a complete assessment of neuroradiology fellowship performance. This new evaluation gives faculty an objective tool by which to measure fellows’ mastery of technical skills and additionally provides insight into the strengths and weaknesses of the procedural rotation.

**METHOD AND MATERIALS:** We developed an assessment tool to measure fellows’ procedural skills in a three-part online evaluation. Fellows are evaluated on an 8-point scale. Descriptive statements about fellows’ procedure skills are also included to provide a more detailed look at the fellow’s performance. Additional free-form comments by faculty are provided for and encouraged. All faculty neuroradiologists who work with fellows on procedures are required to complete the technical skills evaluation as part of the fellows’ monthly rotation assessment.

**RESULTS:** Compliance by faculty has been over 80%. Aggregate data have provided the fellowship director with a more accurate view of fellows’ technical performance. The evaluation has supplied faculty with insights into the quality of procedure training and provides fellows with clearer assessments of their patient care and medical skills during their reviews.

**CONCLUSION:** The procedure evaluation effectively incorporates a new tool which provides a more complete assessment of fellows’ ability to perform procedures. Additionally, the assessment provides information about the quality of the procedural rotation, highlighting its strengths and challenges.

## AUR 2007 Education Exhibit Poster Abstracts

Education exhibit posters are located in Centennial D. Each poster will be presented by its author during one of four AMA PRA Category 1 Credit™ poster sessions scheduled for Thursday and Friday. The day and time follow the presentation number.

Presenting author is identified by institution, city, state, and country, if not United States or Canada.

Presentations by trainees (residents, medical students, first-year fellows) are noted in purple.

### (E-25) Thursday • 10:00 AM Multimodality Imaging of Musculoskeletal Soft-Tissue Infections: A Pictorial Review

Alana Y. Stubbs, MD, *University of Arizona Health Sciences Center, Tucson, AZ*; Mihra S. Taljanovic, MD; John T. Ruth, MD; Ana R. Graham, MD; Tim B. Hunter, MD (aystubbs@yahoo.com)

**PURPOSE:** To illustrate the imaging features of various types of musculoskeletal soft-tissue infections with multiple radiologic modalities.

**METHOD AND MATERIALS:** Representative images of pathologically proven cases of infectious cellulitis, fasciitis, including necrotizing fasciitis, soft-tissue abscess, and pyomyositis are presented with multiple modalities, including radiography, ultrasound, computed tomography (CT), magnetic resonance (MR) imaging, and nuclear medicine imaging. Typical intraoperative and histopathologic findings are also presented.

**RESULTS:** The signs and symptoms of musculoskeletal soft-tissue infections can be nonspecific, making it difficult to distinguish between disease processes and the extent of disease. Radiographic findings are usually nonspecific. While ultrasound displays inflammatory changes of the affected soft tissues, it can underestimate the extent of disease. CT imaging can be of great value and is superior to MR imaging in detection of soft-tissue air. MR imaging is the study of choice in detection and evaluation of extent of musculoskeletal infections of any type. Nuclear medicine can be used to exclude the presence of osteomyelitis in the setting of cellulitis, particularly in patients for whom MR imaging is contraindicated or in situations where the value of CT or MR imaging is limited secondary to the presence of surgical hardware.

**CONCLUSION:** Imaging work-up of musculoskeletal soft-tissue infection typically starts with radiography and is usually followed by MR imaging. CT, ultrasound, and nuclear medicine studies are occasionally utilized. Prompt and appropriate imaging work-up of musculoskeletal soft-tissue infection aids in early diagnosis and treatment and decreases the risk of complications resulting from misdiagnosis or delayed diagnosis.

### (E-26) Thursday • 3:30 PM PET/CT Imaging Artifacts: Recognition and Prevention

Christine P. Chao, MD, *Mayo Clinic, Jacksonville, FL*; Patrick J. Pelzer, MD; Dimitrios Karantanis; Rathan M. Subramaniam, MBBS, MD (chao.christine@mayo.edu)

**LEARNING OBJECTIVES:** (1) To illustrate the spectrum of artifacts associated with PET/CT imaging. (2) To provide strategies for detection and prevention of PET/CT imaging artifacts.

**BACKGROUND:** Artifacts are unwanted spurious abnormalities created by the imaging process which often result in a difficult diagnostic challenge. Whereas imaging artifacts have been previously described for PET, there are artifacts unique to PET/CT which also warrant discussion. PET/CT imaging artifacts may be due to motion, technical issues, and high-attenuation materials. These artifacts can degrade image quality, obscure normal and abnormal findings, and, most seriously, simulate pathology. In this exhibit, we analyze the imaging characteristics and etiologies of various PET/CT imaging artifacts. The differentiation of a PET/CT imaging anomaly from abnormality is more than an academic interest. The interpreter's ability to discriminate fact from artifact is a mark of skill and experience. Misdiagnosis of an artifact as evidence of pathology may lead to unnecessary and potentially harmful intervention and therapy.

**IMAGING FINDINGS:** Motion artifacts have varied imaging appearances depending on the type of motion, such as voluntary patient movement or

involuntary physiologic motion. Artifacts resulting from technical aspects of PET/CT imaging can demonstrate typical characteristics suggesting an operator-dependent etiology or software or other technical limitation. Artifacts related to high-attenuation materials can often be identified upon correlation with CT. Strategies for minimizing PET/CT artifacts are targeted at the root cause of each artifact.

**CONCLUSION:** This educational exhibit illustrates the spectrum of PET/CT imaging artifacts, provides helpful clues for their detection, and offers strategies for prevention or correction.

### (E-27) Friday • 10:00 AM Spectrum of Pulmonary Infections in Hematopoietic Stem Cell Transplantation on High-Resolution CT



Douglas P. Ivancsits, BS, *University of South Florida College of Medicine, Tampa, FL*; Angela E. Sroufe, MD, PhD; John Greene, MD; Lynn Coppage, MD; Todd R. Hazelton (hazeltr@moffitt.usf.edu)

Pulmonary infections are a common cause of morbidity and mortality in up to 60% of hematopoietic stem cell transplantation (HSCT) recipients despite prophylactic and empiric therapy. High-resolution CT is excellent for the detection of pulmonary abnormalities, but the findings are often nonspecific. The infectious pulmonary complications typically reflect the immunologic state of the patient, which changes considerably in relation to the time following HSCT. During the 2–3-week period following HSCT, there are severe neutropenia and compromise of mucosal membranes. During this phase, patients are predisposed to fungal pneumonia, primarily angioinvasive aspergillosis, which is often characterized by large nodules surrounded by a halo of ground-glass attenuation and focal regions of consolidation. There is also predisposition to gram-negative bacterial pneumonia during this phase, characterized by focal regions of airspace consolidation. Diffuse alveolar hemorrhage and pulmonary edema can also occur at this time. After engraftment and up to 100 days following HSCT, both humoral immunity and cell-mediated immunity remain compromised. During this phase, patients are predisposed mainly to cytomegalovirus infection (characterized by multiple small centrilobular nodules with areas of consolidation and ground-glass attenuation) and Pneumocystis jiroveci pneumonia (characterized by diffuse, perihilar, or a mosaic pattern of ground-glass attenuation). During the late phase 100 days after HSCT, immune function has largely been restored, but pulmonary complications may still occur. These include noninfectious cryptogenic organizing pneumonia (COP), which is characterized by subpleural or peribronchial patchy consolidation and ground-glass attenuation. In addition, chronic graft-versus-host disease may persist in as many as 50% of these patients. The resultant bacterial, fungal, and viral infections that occur can have overlapping characteristics on high-resolution CT. The purpose of this study is to review the high-resolution CT findings in patients with infectious pulmonary manifestations following HSCT and to show distinguishing characteristics among the various types of infection.

**(E-28) Friday • 3:30 PM**  
**Preparing 1st-Year Residents for Call: An Outcome-based Approach**

Jennifer L. Nicholas, MD, MHA, *Northwestern Memorial Hospital, Chicago, IL*; Paul Nikolaidis, MD (j-nicholas@northwestern.edu)

**PURPOSE:** Call preparation for radiology residents has traditionally involved taking cases at teaching conferences and studying independently from textbooks. Both approaches typically utilize preselected images with abnormal findings. Key components of the call process include being able to organize images, search for abnormal findings efficiently and effectively, correlate the findings with limited clinical information, and communicate findings. Most call-preparation strategies fail to address these critical skills. The purpose of this study is to evaluate the effectiveness of a novel course designed to enhance call preparation by incorporating outcome-based skill building into fundamental content review.

**METHOD AND MATERIALS:** Eight 1st-year radiology residents participated in a 10-week call-preparation course. Each week, they were given a brief introduction to a specific call-related topic. They then independently worked through 10–15 studies, some of which were normal. Brief clinical histories were provided. The group reconvened to review the findings and to discuss how to effectively communicate the findings. Residents evaluated themselves in two areas: (1) ability to identify significant findings, and (2) level of comfort in communicating findings. At the end of the course, a comprehensive posttest was administered. After their first night float and solo call, residents will again be surveyed. These self-assessments will be analyzed to determine the effectiveness of our approach to call preparation.

**RESULTS:** Preliminary feedback and data support the hypothesis that preparing residents in an environment that more closely simulates the real call experience helps them develop skills that will make them more efficient and confident when they take call independently. Data analysis will be complete by February 2007, prior to presentation, following the comprehensive post-test and first solo calls.

**CONCLUSION:** Efficiency and effective communication are crucial skills for the on-call radiology resident. A novel outcome-based method preparing 1st-year residents for call emphasizing these skills has been implemented and seems promising.

**(E-29) Thursday • 10:00 AM**  
**Doppler US: Evaluation of Waveform, Direction, and Velocity of Blood Flow in the Diagnosis of Vascular Abnormalities in Different Body Parts**

Tariq A. Hameed, MBBS, *Indiana University, Indianapolis, IN*; Marc D. Kohli, MD (thameed@iupui.edu)

Flowing blood in the human body follows general physical principles and is affected by multiple factors, including vessel size and pressure changes. Different pathologic processes affecting the blood vessels may cause an alteration in flow patterns, velocity, and direction. The normal vascular waveform and flow velocities vary in different parts of the body and in different organ systems and between arteries and veins. However, the underlying principles for the Doppler flow changes are similar in different organ systems, and understanding basic concepts of Doppler ultrasound is helpful in the diagnosis of vascular abnormalities, which can be applied throughout different body systems. This exhibit presents basic principles of Doppler ultrasound useful in the diagnosis of vascular abnormalities. Normal and abnormal Doppler ultrasound findings in different body parts are presented.

**(E-30) Thursday • 3:30 PM**  
**Should Patients Be Imaged in Small Rural Hospitals prior to Trauma Center Transfer?**

Maureen G. Heldmann, MD, *Louisiana State University Health Sciences Center, Shreveport, LA*; Abbie Martin, MD, PhD; William E. Behm, MD

**PURPOSE:** We sought to quantify the adequacy of acute trauma patient imaging prior to transfer for specialized care and to identify resource limitations that may negatively impact radiologic exam quality.

**METHOD AND MATERIALS:** From February 1 through May 1, 2006, data were collected regarding patients accepted in transfer from outside acute care facilities to our tertiary care and level 1 trauma center with outside imaging presented for radiologic interpretation. Type of media (hard-copy film/compact disc), estimated number of plain films and computed tomographic studies, contrast utilization, exam quality, and availability of initial report were recorded. Note was made whether exams were repeated due to quality limitations. Perceived image quality was ranked by radiologist on call as poor = 1, fair = 2, or good = 3. Referring institutions were contacted by phone to determine resource availability, including radiology services after hours, age of computed tomography equipment, and availability of surgical subspecialty physicians.

**FINDINGS:** Data from 112 patients were available for review. Of these, 83 (74%) were trauma transfers from outside facilities. 91% of total exams did not have an interpretation included with the study, and 69% of media were limited to hard-copy film. Average number of radiographs per patient transfer was 5.92, and average plain film quality was estimated as 1.99. The median number of CT studies per patient was 2.55, and most of these were not performed with radiographic contrast (59%). 56% of plain films and 47% of CT exams were repeated. Many of the transferring institutions did not have radiology services after hours nor subspecialized surgical care available.

**CONCLUSION:** Rural settings may be unable to provide rapid imaging of a quality adequate to avoid repeat studies at the accepting facility. Delay to definitive care for radiologic services may not be justified if the transferring facility is underserved clinically. Further study is justified to determine the optimal allocation of regional resources.

**(E-31) Friday • 10:00 AM**  
**It's Just 4 cm Long: What Can Go Wrong? Female Urethral Pathology with Radiologic Correlation**

Maureen G. Heldmann, MD; William E. Behm, MD, *Louisiana State University Health Sciences Center, Shreveport, LA*

Despite its small size, the female urethra is commonly subject to a wide variety of pathology. We show radiology's contribution to the diagnosis and evaluation of female urethral disease. Because of its inherent soft-tissue contrast and lack of ionizing radiation, MRI is the primary imaging modality for evaluating the urethra. Normal urethral anatomy and urethral pathology are demonstrated on conventional radiography, CT, and MRI. Congenital and acquired processes, including diverticula and calculi, are shown, with pathologic and urethroscopic correlation. Benign and malignant neoplasms are demonstrated, and examples shown include primary urethral squamous cell carcinoma, adenocarcinoma, and melanoma. Post-therapeutic imaging includes evaluation of artificial urethral sphincters and after injection of urethral bulking agents.

**(E-32) Friday • 3:30 PM**  
**Building a Vertical Advisory System: Win-Win-Win! (How to Succeed as an Educator and Mentor without Going Insane; How to Make Academic Radiology More Attractive; How to Grow our Future Educators and Mentors)**

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

Effective, interested radiology medical student and resident educators may find their professional lives consumed by the legitimate but endless demands placed on them by advisees, mentees, and the medical school. Teaching traditionally also has been harder to promote and, even with the rapid emergence of teaching portfolios, document. Academic radiology is also facing recruitment and retention issues. We need to find a way to encourage, develop, and protect passionate involved educators and mentors, who may be the earliest encountered role models for academic careers. Formalizing a vertical advisory has allowed this author to "take on all comers" and see to it they get the attention and time they deserve, without creating the 29-hour day. Preclinical students asking about possible careers are referred to interested 3rd- and 4th-year students to discuss how best to

explore radiology and what factors should be considered. We also evolved a second preclinical radiology interest group run by a (then) 1st-year resident, allowing that resident to start a teaching portfolio and to grow into a more effective teacher, while giving 1st-year students the attention they initially requested of faculty. In launching our long-overdue integration of radiology into the 1st-year anatomy curriculum, we have three people (one staff, fellow, and 4th-year student) to lecture. The student is organizing classmates to visit various dissections to explain clinical correlates and significance. We are hoping to turn this into an accredited elective month but already realize the rewards in letting clinical students experience how much more they now know and to search for the most effective ways to pass on this learning. Our PGY2 residents teach from September on, being assigned an elective student for clinical half-days. They, too, get perspective on their own progress and grow as educators and mentors. They become match advisors and interview coaches for interested students, running our “radiology finishing school” for match applicants. Many of the six competencies can be formally integrated and documented at many levels. And why reinvent the wheel annually?

### **(E-33) Thursday • 10:00 AM** **Using US to Resolve Clinical Pitfalls in the Diagnosis of Hernias**

Gregory R. Beyers, MD, MS, *University of Michigan, Ann Arbor, MI*;  
Gandikota Girish, MBBS; David Jamadar; Jon A. Jacobson, MD\*  
(grbeyers@umich.edu)

**OBJECTIVE:** To describe pitfalls in the clinical diagnosis of abdominal wall hernias which may be resolved with sonography. We describe sonographic techniques in the evaluation for anterior abdominal wall hernias and the expected location of these hernias and demonstrate a spectrum of pathology that may simulate a hernia on clinical examination. Examples of hernia mimics include the following: subcutaneous endometrioma, abdominal wall mesh, hematoma, saphenous varix, lymph nodes, prominent xiphoid process, scars, focal muscle bulge, splenomegaly, and divarication of the rectus abdominus.

**CONCLUSION:** Awareness of the expected locations of anterior abdominal wall hernias and the potential clinical pitfalls allows an accurate diagnosis of a hernia and differentiates a hernia from other abnormalities.

### **(E-34) Thursday • 3:30 PM** **Liver MR Imaging: How Confident Are You with Lesion Detection and Characterization?**

Matthew DeVries, MD, *University of Nebraska Medical Center, Omaha, NE*; Shahid Hussain, MD, PhD (mdevries@unmc.edu)

With the rapid increase in body CT utilization, radiologists are often confronted with multiple “indeterminate” lesions throughout the abdomen. Recent CT literature has demonstrated that this problem will only increase with the introduction of multi-row detector CT, mainly because thinner slices show more smaller liver lesions that will require characterization. In most cases, liver MRI—a highly specific, sensitive, and robust modality—offers conclusive diagnosis, which obviates the need for other studies or percutaneous biopsy. Furthermore, without ionizing radiation and iodinated contrast agents, MRI provides a safe user profile compared with CT. Despite its advantages, however, many residents and radiologists alike are unfamiliar or lack confidence in the diagnostic certainty that is afforded with MRI. The purpose of this exhibit is (1) to describe the state-of-the-art MR imaging procedure for liver MRI; (2) to illustrate and describe examples of the most common benign and malignant liver lesions at MRI; and (3) to demonstrate how the findings on the individual MRI sequences, such as those on the chemical shift imaging, short and long T2-weighted sequences, and multiphasic dynamic gadolinium-enhanced images, can be combined to provide certain diagnoses. Interested participants and readers will be able to interactively test their diagnostic accuracy and level of confidence in characterizing liver lesions. By becoming confident with state-of-the-art abdominal MRI, radiologists are able to provide more specific diagnoses for referring physicians, thereby improving health care and radiology practice.

### **(E-35) Friday • 10:00 AM** **Review of Interventional Management Modalities of Malignant Pleural Effusions**



Vladimir Sheynzon, MD, *New Jersey Medical School, Newark, NJ*;  
Piotr Kiszka, MD (vladimir.sheynzon@gmail.com, kiszaps@umdnj.edu)

**INTRODUCTION:** Malignant pleural effusion is a common cause of dyspnea in patients with advanced cancer, responsible for significant morbidity. Median survival following diagnosis of MPE ranges from 3 to 12 months, dependent on stage and type of underlying malignancy. Optimal palliative management of respiratory symptoms associated with MPE is important to improve quality of life in patients with terminal malignancies.

**PURPOSE:** The aim of this review is to systematically describe available minimally invasive modalities for management of MPE, focusing on modern strategies, technical aspects of the procedures commonly performed to control MPE, and choice of medical devices used.

**FINDINGS:** Chemical sclerotherapy with tube thoracostomy to achieve pleurodesis remains mainstay treatment of MPE. Technical aspects of the procedure, choice of sclerosing agents, typical outcomes, and possible adverse effects are described. Although chemical sclerotherapy is an effective method to induce pleurodesis, it requires several days’ stay in a hospital and is associated with frequent incidence of failure. An alternative method to manage MPE involves placement of tunneled long-term drainage catheter. The catheter may be used in the outpatient setting. It is associated with low morbidity, and repeated MPE drainage using the catheter is associated with 42%–58% incidence of pleurodesis. Another treatment modality available is use of implantable drainage port system. The port system also may be used in the home setting for regular drainage of pleural effusions. The advantages of the port include decreased incidence of infections as compared to tunneled drainage catheter. Technical aspects, typical outcomes, and risks associated with the use of each system will be compared.

**CONCLUSION:** Safe, effective, and minimally invasive techniques beyond traditional thoracentesis are available for palliation in MPE. We review these techniques in detail in order to inform the clinician and the patient about options available for managing MPE. Comparison of efficacy, risks, and cost-effectiveness of various minimally invasive techniques for managing MPE is also addressed.

### **(E-36) Friday • 3:30 PM** **The Impact of Apology and Apology Laws on Radiology Practice**

Stephen R. Baker, MD; Akosua Sintim-Damoa, *UMDNJ-New Jersey Medical School, Newark, NJ*

Recent efforts to improve quality in the delivery of medical care have generated initiatives seeking greater accountability and dialogue between providers and patients. Mandatory reporting of errors and other disclosure protocols are now becoming commonplace. In addition, the role of apology has been promoted both as a means of fostering greater trust and as a maneuver to reduce the likelihood of a malpractice suit after a medical error has occurred. In the past 5 years, 29 states have enacted apology laws to encourage prompt and sincere admission of regret by physicians. The purpose of this discussion is to examine the elements of apology and differentiate it from apologia, or a mere accounting with no admission of wrongdoing, to examine similarities and differences of the various statutes with respect to apology, and to present the risks specific to a radiologist with respect to conflicts an apologia may engender with a referring physician when both may be a party to medical error.

**(E-37) Thursday • 10:00 AM**  
**US Approach to Differentiation and Characterization of Intratesticular Lesions: Benign, Malignant, and “Tumor-Like”**

Inira Kaplan, MD, *Columbia University Medical Center, New York, NY*; Joan C. Prowda, MD, JD

Palpable painless scrotal masses are accurately evaluated by US. When lesions are shown to be intratesticular, 95% prove to be malignant and require an orchiectomy, often followed by radiation therapy and chemotherapy, depending on the histologic subtype. However, it is also important to recognize benign and “tumor-like” intratesticular lesions for which orchiectomy is not required. The purpose of this pictorial essay and educational exhibit is to familiarize radiologists with the US appearance of the benign and “tumor-like” intratesticular lesions and to distinguish them from the more ominous germ cell tumors, such as embryonal cell and yolk sac tumors, as well as non-germ cell tumors, such as Leydig cell, which have a better outcome.

**(E-38) Thursday • 3:30 PM**  
**Invasive Placentation: US and MR Imaging in Prenatal Diagnosis**

Beatriu Reig, MD, MPH, *Columbia University–New York-Presbyterian Hospital, New York, NY*; Michael Rasiej, MD; Sherelle Laifer-Narin, MD

Invasive placentation occurs when migrating trophoblasts invade beyond the inner third of the myometrium, causing pathologic attachment of the placenta to the uterus. This entity occurs in varying degrees of severity, described as placenta accreta, placenta increta, and placenta percreta. Invasive placentation is associated with placenta previa and prior cesarean section. It occurs in 1/2500 deliveries, with increase in incidence related to increased frequency of cesarean sections. Mortality may be as high as 7%. Prenatal diagnosis is paramount to decrease morbidity and mortality, as it allows for presurgical planning and preparation for potential hemorrhage. Ultrasound has been the most commonly used modality for prenatal diagnosis. Fetal MRI is especially useful in cases of posterior placental attachment, for evaluation of bladder involvement, for evaluation of the degree of uterine involvement, and for presurgical planning. Sonographic criteria of invasive placentation include absence or thinning of the normal hypoechoic myometrial zone, thinning or disruption of the hyperechoic interface between the uterine serosa and the bladder wall, and extension of placental tissue beyond the uterine serosa. MRI criteria of invasive placentation include thinning and loss of the myometrial border and placental tissue interrupting the uterine wall. Interruption or indistinctness of the bladder wall is indicative of bladder involvement. Several cases are presented which illustrate the use of ultrasound and MRI in the prenatal diagnosis of abnormal placentation.

**(E-39) Friday • 10:00 AM**  
**Improving Quality Assurance in Bone Densitometry**

Joseph Morrell, Jr, MD, MPH, *Harlem Hospital Center, New York, NY*; Chaitali Bagchi, MD; Sanya N. Henry, MD

The analysis of bone mineral density (BMD) with central dual-energy x-ray absorptiometry (DXA) is considered the “gold standard” for diagnosing osteopenia and osteoporosis. Mistakes in patient information, improper region of interest, improper positioning, and artifacts can lead to incorrect scan analysis and misinterpretation of BMD. This educational poster reviews the fundamentals of positioning, region of interest, and scan analysis as they relate to interpretation for central DXA and highlights some of the common pitfalls.

**(E-40) Thursday • 10:00 AM**  
**Tibial Plateau Fractures: A Multimodality Review of Imaging Characteristics**

David R. Sopko, MD, *Rochester General Hospital, Rochester, NY*; Michael Pawlik, MD; Adam Zinkin, MD

Tibial plateau fractures are frequent injuries of the proximal tibia. These result from axial loading, varus/valgus stress, or a combination of these. While the lateral plateau is the most commonly injured anatomic location, there are numerous variations and configurations of injury, with several classification systems. Plain film images are often the initial imaging modality in the setting of acute trauma. However, CT or MRI is often required for diagnosis or complete characterization. In addition, cross-sectional imaging findings can have a profound impact on both treatment and long-term outcome. We present a radiographic review of the spectrum of findings of tibial plateau fractures, including plain film and cross-sectional modalities. We review classification of these injuries and the associated clinically relevant characteristics.

**(E-41) Thursday • 3:30 PM**  
**Overview of Cross-sectional Imaging Findings in Partial Anomalous Pulmonary Venous Return**

Michael J. Pawlik, MD, *Rochester General Hospital, Rochester, NY*; David R. Sopko, MD; James J. Montesinos, MD

Anomalous pulmonary venous connection is a rare entity. It most commonly involves the right lung and has an upper lobe predominance. It is frequently asymptomatic and discovered incidentally, except in cases with significant right-to-left shunt. While a chest radiograph is usually the initial diagnostic study, it is frequently inadequate for complete characterization. Cross-sectional imaging is an accurate and noninvasive method to demonstrate the anomalous connection. In the past 6 months, we have encountered four cases of partial anomalous pulmonary venous return. These include one case of right-sided congenital venolobar syndrome and three cases of left upper lobe pulmonary venous connection to the left brachiocephalic vein. We present select images from these cases, which illustrate the pertinent findings. Additionally, we review the most common types of partial anomalous pulmonary venous connection, with attention paid to their cross-sectional imaging characteristics.

**(E-42) Friday • 10:00 AM**  
**Spectrum of Meningeal Enhancement: Pictorial Review of Imaging Characteristics and Differential Considerations**

Joyce Y. Li, MD, MS, *Rochester General Hospital, Rochester, NY*; Michael J. Rivero, MD; Sarah Ifthikharuddin, MD (joyce.li@viahealth.org)

The learning objectives of this pictorial review are to demonstrate the various MR patterns of cranial and spinal cord meningeal enhancement and to discuss the spectrum of disease entities comprising the differential considerations. The meninges are comprised of the leptomeninges, consisting of the pia and arachnoid maters, and the pachymeninx or dura mater. In MR imaging, the meninges normally enhance slightly post gadolinium contrast administration. However, enhancement pattern changes with meningeal irritation due to inflammatory, neoplastic, infectious, or postsurgical processes. This pictorial review discusses the normal anatomy and MR enhancement characteristics of the meninges. It then focuses on the various patterns of meningeal enhancement: leptomeningeal versus pachymeningeal, diffuse versus focal, and nodular versus smooth. Differential considerations and their imaging characteristics are discussed in relation to their enhancement patterns. Disease entities to be illustrated with leptomeningeal enhancement include infectious meningitis, with diffuse smooth enhancement; meningeal carcinomatosis, primary leptomeningeal melanoma, and diffuse leptomeningeal gliomatosis, with focal or diffuse nodular enhancement; vasculitides such as moyamoya and Sturge-Weber, with diffuse curvilinear enhancement; inflammatory neurosarcoidosis, with focal or diffuse nodular enhancement; and siderosis from recurrent subarachnoid hemorrhage, with diffuse enhancement. Disease entities with pachymeningeal enhancement

include pachymeningitis secondary to infections such as TB and syphilis; spontaneous or secondary intracranial hypotension, with reversible diffuse smooth meningeal enhancement and secondary Arnold-Chiari I malformation; chronic subdural hematoma/hydruma, with diffuse smooth enhancement; calvarial metastasis, with adjacent focal nodular enhancement; autoimmune pachymeningitis secondary to rheumatoid arthritis, Wegener's granulomatosis, or sarcoidosis, with diffuse nodular enhancement; and idiopathic hypertrophic pachymeningitis, with focal even or nodular enhancement.

#### **(E-43) Friday • 3:30 PM Cerebral Venous Thrombosis: Early Recognition and Imaging Characteristics**

Joyce Y. Li, MD, MS, *Rochester General Hospital, Rochester, NY*;  
Sarah Ifthikharuddin, MD ([joyce.li@viahealth.org](mailto:joyce.li@viahealth.org))

Cerebral venous thrombosis is a relatively rare condition with potentially high morbidity and is often first suggested by a radiologist. Due to its non-specific presentations and numerous predisposing causes, this diagnosis can be easily overlooked if specific imaging characteristics are not sought. This pictorial review illustrates the anatomy of the cerebral venous system and gives a brief overview of the clinical presentations and predisposing factors of cerebral venous thrombosis. Since nonenhanced CT is most commonly the first examination ordered through the emergency department, early detection requires prompt recognition of signs that are suggestive of cerebral venous thrombosis. These findings are displayed and include the "delta sign," hyperdense thrombosed cortical vein or "cord sign," unilateral or bilateral subcortical infarction, compression of lateral ventricles, and hemorrhagic infarct not conforming to vascular distribution. Enhanced CT of the brain may demonstrate the "empty delta sign" and intense gyral or tentorial enhancement secondary to collaterals. MR findings of cerebral venous thrombosis, such as lack of flow void, are also depicted. Final diagnosis requires noninvasive CT or MR venography or invasive angiography. CT/MR venographic and invasive angiographic images of cerebral venous sinus thrombosis are displayed in the order of frequency: superior sagittal, transverse, sigmoid, and straight sinuses. Finally, pitfalls as well as causes for false-positives and false-negatives of CT and MR venography are discussed.

#### **(E-44) Friday • 3:30 PM Multidetector CT of the Spleen: Common and Uncommon Diseases**

A. R. Klekers, *University of Rochester Medical Center, West Henrietta, NY*;  
Shweta Bhatt, MBBS; Vikram S. Dogra, MD

Imaging of the spleen with computed tomography (CT) is frequently performed and serves as one of the primary modalities for evaluating the spleen. The spleen is frequently involved in both systemic and focal disease processes. It is important to be familiar with normal anatomy and enhancement patterns of spleen in normal and abnormal states. This exhibit highlights various pathological lesions of spleen, which can be seen as diffuse or focal lesions. Various important imaging features of diffuse pathological involvement of spleen include lymphoma, tuberculosis, sarcoidosis, Gaucher's disease, Gamna-Gandy (siderotic nodules), bacillary angiomatosis, amyloidosis, histoplasmosis, disseminated *Pneumocystis carinii* infection, and *Candida* infection. Focal splenic lesions include abscess, infarcts in sickle cell disease, and metastases (melanoma). Nonsystemic diseases involving the spleen, such as littoral cell angioma, hemangioma, and various types of splenic cysts, are also discussed.

**TEACHING POINTS:** 1. Multimodality imaging demonstrating systemic and focal disease processes involving spleen. 2. To learn the key differential points that allow for the specific diagnosis for most splenic lesions. 3. To describe differentiating features of focal enhancing lesions within the spleen, such as littoral cell angioma.

#### **(E-45) Friday • 10:00 AM Multidetector CT of the Abdomen and Pelvis in the Pregnant Patient: Evolving Indications and Spectrum of Imaging Findings**

Kristina Siddall, MD, *University of Rochester Medical Center, Rochester, NY*;  
Antonio Russo; Margaret Ormanoski, DO ([Kristina\\_Siddall@urmc.rochester.edu](mailto:Kristina_Siddall@urmc.rochester.edu))

Multidetector abdominal CT evaluation of pregnant trauma patients and pregnant patients with severe abdominal pain is becoming more frequent in our institution and other tertiary care facilities in the United States. The variable risks of radiation to the fetus are often outweighed by the severity of maternal symptoms in these cases. This exhibit reviews common indications for CT in pregnant patients and shows representative cases from our institution, including appendicitis in the third trimester, obstructing ureteral stone, bowel obstruction with unclear transition point, and severe maternal trauma. In addition to multiplanar reconstructions of both the abdominal pathology and the gravid uterus, examples of focused volume rendering of the gravid uterus are also provided. The subsequent management, outcome, and patient-specific radiation doses are also discussed.

#### **(E-46) Thursday • 3:30 PM MR Imaging Differentiation of Benign versus Malignant Breast Lesions: Test Your Skills with the BI-RADS MR Imaging Lexicon**

Dana R. Rausch, MD, *The Mount Sinai Medical Center, New York, NY*  
([danaraus@hotmaill.com](mailto:danaraus@hotmaill.com))

The purpose of this exhibit is to demonstrate the patterns of benign and malignant lesion enhancement on breast MRI and to apply the morphologic criteria of the ACR BI-RADS MRI lexicon to histologically verified case examples. Key descriptive and differential diagnostic points are highlighted in the discussion of each case. The ACR BI-RADS MRI lexicon provides an organized, systematic approach to the interpretation and reporting of contrast-enhanced breast MRI. As breast MRI has become a widely used imaging study, it is important for radiologists to become familiar with its terminology.

#### **(E-47) Thursday • 10:00 AM Postoperative Imaging of Liver Transplantation: A Primer for Residents**

Dana R. Rausch, MD, *The Mount Sinai Medical Center, New York, NY*;  
William L. Simpson, MD ([danaraus@hotmaill.com](mailto:danaraus@hotmaill.com))

Liver transplantation is a common surgical treatment of patients with end-stage liver disease. As imaging plays a key role in the postoperative evaluation of these patients, it is essential that radiologists be familiar with the potential complications. The early recognition of organ-related complications is critical for patient and graft survival. A brief description of the surgical technique is illustrated, as well as the normal sonographic appearance of the transplant in the immediate postsurgical period. The role of gray-scale and Doppler ultrasonography in the initial evaluation of potential acute and chronic complications, such as vascular compromise, biliary sequelae, peritransplant collections, parenchymal abnormalities, posttransplant lymphoproliferative disease, and tumor recurrence, is described, with case examples. Indeterminate abnormalities detected are then typically evaluated with MR angiography, MR cholangiography, and/or MDCT and are demonstrated. Various complications can be treated with interventional radiologic techniques and are presented.

#### **(E-48) Friday • 10:00 AM Back to the Future: The Novel Anatomic Radiology Clerkship at Mount Sinai School of Medicine**

William L. Simpson, MD, *Mount Sinai Medical Center, New York, NY*;  
Jeffrey Laitman, PhD

As technology advances, new visualizations of our anatomy become increasingly integral to proper patient care. Our students' need to understand both the fundamentals of modern imaging and the anatomy visualized by

it will be concomitantly increased. To accomplish this goal, the Mount Sinai School of Medicine (MSSM) began a new required 2-week clerkship, "Anatomic Radiology" (AR), in 2003. AR is given in year 4, after students are exposed to both basic anatomy and their initial clinical experiences. As such, AR is designed to place their knowledge of imaging modalities into a coherent framework—and introduce them to any not encountered—and to review seminal anatomy via these modalities. The advantages/disadvantages and appropriate usages of each modality (eg, plain film, CT, MR, US, PET), both from the perspectives of anatomic visualization and patient safety/tolerance, are emphasized. Teaching methods include (1) didactic radiology lectures, (2) discussion-oriented case conferences focusing on students' film interpretation, and (3) correlative anatomy lectures/prosecution workshops to "rekindle and refresh" knowledge of gross structure. On the last day, students are examined on imaging techniques, diagnoses, and recognizing structures via various modalities. Each student makes a presentation on a patient, emphasizing the imaging required in diagnosis/treatment. AR is well received by the students, who feel it improves their ability to interpret images and prepares them for their careers. For 2005–2006, 81% rated the overall clerkship as very good to superior. Students agreed/strongly agreed that AR improved their ability to interpret/understand chest x-rays (94%), CT (94%), US (86%), and MRI (81%). The establishment of a senior clerkship melding key anatomic visualizations within the seminal radiological milieu is a new model in medical education and one that we hope will maximize our students' learning of a rapidly expanding field.

**(E-49) Thursday • 10:00 AM**  
**Osteomyelitis: Review of MR Imaging Findings for the Radiologist on Call**

Richard Hong, *New York-Presbyterian Hospital, New York, NY*; Keith D. Hentel; Kevin W. Mennitt, MD (keh9003@med.cornell.edu)

The detection and characterization of osteomyelitis are an increasingly common diagnostic challenge for the on-call radiologist. Rapid and accurate diagnosis is necessary, as, if untreated, osteomyelitis can result in severe morbidity and even mortality. However, the detection of osteomyelitis is not always straightforward. Findings on plain radiography are often absent or subtle during the early stages of infection. Bone scan, although highly sensitive, is not specific. Increasingly, magnetic resonance imaging (MRI) is utilized for the detection of osteomyelitis. While MRI has been proven to be useful for the diagnosis of osteomyelitis and its associated soft-tissue findings, not all on-call radiologists are comfortable with interpretation of such. The purpose of this poster is to illustrate the MRI findings of osteomyelitis and associated soft-tissue findings, such as abscess, tenosynovitis, cellulitis, and gangrene. Also reviewed are common mimics and pitfalls in the diagnosis of osteomyelitis. Emphasis is placed on what the clinician needs to know in order to properly treat these patients.

**(E-50) Thursday • 3:30 PM**  
**CT Venography in Suspected Venous Thromboembolism: Findings, Pitfalls, and Controversies**

Douglas S. Katz, MD; Andrew Y. Choi, MD; Peter A. Loud, MD; Man Hon, MD; Zachary D. Grossman, MD; John P. Fantauzzi, MD, *Winthrop-University Hospital, Mineola, NY* (dsk2928@pol.net)

CT venography has utility, for a variety of reasons, for the diagnosis or exclusion of DVT, as well as for the determination of the extent of clot burden and its location and chronicity, in the lower extremities and in the abdomen and pelvis. Radiologists performing CT venography in conjunction with CT pulmonary angiography should be familiar with routine and uncommon and unusual findings, as well as pitfalls and controversies regarding the technique. The purpose of this exhibit is therefore to review our experience with CT venography (CTV) over the past decade, which we routinely perform in patients undergoing CT pulmonary angiography for suspected thromboembolic disease. Findings on CTV will be demonstrated from case material from our institutions over the past decade, including pitfalls, variants, and uncommon and unusual findings, as well as alternative diagnoses. The latest literature on CTV is discussed, as are controversies, including the appropriate/optimal technique and strategies to minimize radiation dose.

**(E-51) Friday • 10:00 AM**  
**Colonic Volvulus: Review of Clinical Findings, Imaging Findings, and Treatment**

Vladimir Merunka, BS; David I. Winger, MD; John Hines, MD; James Brock, MD; Shiohhan R. Weston, MD; Douglas S. Katz, MD, *Winthrop-University Hospital, Mineola, NY*; et al (dsk2928@pol.net)

Colonic volvulus is a gastrointestinal tract emergency which can involve the sigmoid colon, the cecum, or, rarely, the transverse colon. The diagnosis and treatment of colonic volvulus include emergency consultations among radiologists, gastroenterologists, and surgeons. Imaging modalities for colonic volvulus include plain radiography, barium enema, and CT, which are often used in conjunction with each other to exclude or establish the diagnosis. The purpose of this exhibit is to demonstrate, using case material from three institutions, the spectrum of plain film, CT, and barium enema findings of colonic volvulus and to review its presentation, imaging, and treatment. Imaging algorithms, findings, variants (cecal bascule), and pitfalls—especially that of pseudo-obstruction—will be reviewed and demonstrated. The imaging and clinical literature on colonic volvulus is also reviewed.

**(E-52) Friday • 3:30 PM**  
**Subcutaneous and Cutaneous Imaging on FDG PET: Benign and Malignant Findings**

Steven L. Blumer, MD; Bobbi Wax, MD, *Winthrop-University Hospital, Mineola, NY*; Ravi Johnson, RTN, CNMT; Betty Motroni, MD; Douglas S. Katz, MD; Elizabeth Yung, MD (dsk2928@pol.net)

With the increased indications for and utilization of FDG PET, more cutaneous lesions are being detected, which are frequently incidental but which may or may not be related to the reason for imaging. It is important to decipher whether these sites of hypermetabolism on FDG PET are of clinical importance or not. This exhibit highlights the PET findings of cutaneous and subcutaneous lesions, including nonmalignant conditions such as burns, recent surgical scars, colostomy sites, and rhinophyma. Malignant conditions such as melanoma and lymphoma are also exhibited. We also correlate these PET findings with CT scans and photographic images of these conditions, when possible. By demonstrating these cutaneous and subcutaneous findings on PET, we aim to increase their recognition and instruct radiology residents and attendings as to the differential diagnosis for these findings.

**(E-53) Thursday • 10:00 AM**  
**Imaging Patients with Fever of Unknown Origin**



Yogi Trivedi, MD, *Winthrop-University Hospital, Mineola, NY*; Douglas S. Katz, MD; Elizabeth Yung, MD; Anca Kranz, MD; Betty Motroni, MD (dsk2928@pol.net)

The diagnostic work-up of patients with fever of unknown origin (FUO) remains a challenge. The spectrum of diseases that may cause FUO includes infection, malignancy, inflammatory processes, and idiopathic disorders. Traditionally, in addition to chest radiography and in some cases sonography and CT, nuclear medicine imaging studies have played a pivotal role in the diagnosis of patients with FUO. The literature regarding the utility of some of the newer techniques for imaging patients with FUO, including MR, PET, and PET/CT, is limited. The diagnosis of FUO should begin with a thorough history and physical examination. A sequence of noninvasive laboratory studies should then be performed based on potential diagnostic clinical clues. A labeled-white blood cell scan, with CT if needed, is then preferred as the next step in the work-up with suspected occult infection, whereas a gallium scan is still useful in "classical" FUO. The purpose of this exhibit is therefore to discuss the utility of nuclear medicine studies, sonography, CT, and MR in the diagnostic work-up of patients with FUO. This exhibit reviews the imaging work-up of such patients in the context of the previous and current imaging and clinical literature. A variety of cases from our institution where imaging was used to establish a diagnosis in patients with up until that point FUO are demonstrated. The potential

role of PET/CT in the assessment of patients with FUO is also discussed, as are the recent problems with antigranulocyte antibody imaging.

**(E-54) Thursday • 3:30 PM**  
**Importance of Intravenous Contrast in the Evaluation of Any Deep-seated Invasive Intramuscular Mass**

Rachelle Goldfisher, MD, *Harlem Hospital Center, New York, NY*; Rama Sharma

Malignant fibrous histiocytoma (MFH) is a soft-tissue sarcoma seen late in adult life and is commonly found in the deep soft tissues of the extremities. Although most radiologists are aware that other sarcomas (ie, fibrosarcoma, synovial cell sarcoma, poorly differentiated liposarcoma) are in the differential diagnostic considerations, the appearance can mimic a hematoma and create a diagnostic dilemma in certain nebulous clinical situations or absent clinical history. Contrast-enhanced CT and MR are vital in evaluating soft-tissue masses to characterize the mass and to determine the depth of tumor involvement and the relationship of the mass to neurovascular structures for surgical planning and predicting prognosis. On CT, a large, lobulated, well-defined soft-tissue mass which contains areas of central low attenuation, possibly corresponding to regions of myxomatous tissue, hemorrhage, or necrosis, is often seen. On intravenous contrast-enhanced CT and MRI, the presence of enhancing solid components within the mass may help to suggest neoplastic process underlying the hematoma. We present a case in which a 52-year-old male with a history of progressive right thigh swelling for 2 months with associated weight loss was found to have a thigh mass. This complex mass on noncontrast CT was interpreted as a chronic hematoma but subsequently revealed at biopsy to be MFH (storiform-pleomorphic subtype). Although the imaging appearance of MFH can be nonspecific, MFH should be considered in any deep-seated invasive intramuscular mass and hematoma in a patient over 50 years of age, regardless of the history.

**(E-55) Friday • 10:00 AM**  
**Neuroradiologic Imaging of the Phakomatoses**

Michael J. Rivero, MD, *Hilton, NY*; Joyce Y. Li, MD, MS; Sarah Ifthikharuddin, MD (m7j7r@yahoo.com)

The phakomatoses, also referred to as neurocutaneous syndromes, encompass a large group of disorders, the most common of which are neurofibromatosis, tuberous sclerosis, Sturge-Weber syndrome, and von Hippel-Lindau disease. The most common forms of neurofibromatosis are type 1 (NF-1), associated with a defect on the long arm of chromosome 17, and type 2 (NF-2), where the long arm of chromosome 22 is abnormal. The classic central nervous system manifestation of NF-1 is the optic glioma, which is present in 15%–30% of patients. Additional CNS features of the disease include hamartomas, cerebral gliomas, neurofibromas, and plexiform neurofibromas. The hallmark of NF-2 is bilateral vestibular schwannomas, which typically present in the 2nd decade of life. Unlike type 1, these patients do not develop neurofibromas but rather develop meningiomas and, less frequently, ependymomas. Tuberous sclerosis affects as many as one in 10,000 live births and in 30% of cases presents with the Vogt triad of adenoma sebaceum (facial nevus), seizures, and mental retardation. CNS manifestations of tuberous sclerosis are common and include cortical and subcortical tubers, subependymal nodules, white matter hamartomas, and subependymal giant cell astrocytomas. These patients also show a higher incidence of both heterotopic gray matter and ventriculomegaly. Encephalotrigeminal angiomas, also known as Sturge-Weber syndrome, is another member of the group of phakomatoses. Cases are sporadic and clinically present with the classic “port-wine stain,” most commonly seen in a V-1 distribution. Patients often have leptomeningeal venous angiomas associated with tram-track cortical calcifications and underlying hemihypertrophy caused by anoxic brain injury. von Hippel-Lindau disease is characterized by hemangioblastomas, which most often arise in the cerebellum, though they can present throughout the CNS. Over 80% of cases will eventually develop cerebellar hemangioblastomas. We attempt to provide an in-depth discussion of both these most common entities, as well as the classic manifestations of the less-common disorders characterized as phakomatoses.

**(E-56) Friday • 3:30 PM**  
**Normal Variants in PET Imaging: Head to Toe**

Rajeev Anugu, MD, *Bryn Mawr Hospital, Bryn Mawr, PA*; Marchello Barbarisi, MD

**LEARNING OBJECTIVE:** To illustrate with examples the areas of normal physiological uptake in FDG PET from head to toe. FDG (F-18 fluorodeoxyglucose) is the most clinically used radiotracer in PET imaging. Accurate interpretation of FDG PET images requires knowledge of the normal distribution in various structures. Increased radiotracer uptake is not only seen in tumors, infection, and inflammation, but also in areas of high physiological activity. It is important to recognize the normal variants to avoid misinterpretation with more serious pathologies. In this exhibit, we show an extensive review of the normal variants, like the cortex of the brain, salivary glands, vocal cords, heart, bowel, liver, spleen, bone marrow, skeletal muscles, brown fat, various ostomy sites, uterus, breast, etc.

**(E-57) Thursday • 10:00 AM**  
**Imaging Features of Granular Cell Tumor in Breast**

Abid Irshad, MD, *Medical University of South Carolina, Charleston, SC*; Susan Ackerman, MD; Thomas L. Pope, MD

**PURPOSE:** To review clinical, mammographic, and ultrasonographic features of granular cell tumor (GCT) of breast and compare its frequency to that of breast carcinoma.

**METHOD AND MATERIALS:** Retrospective review of 4727 breast biopsies from last 10 years was performed, and eight cases of GCT were found. Clinical data and imaging features were evaluated. The mammograms were analyzed for size, density, location, margin characteristics, and calcifications. Sonographic images were reviewed for size, echogenicity, margins, height/width ratio, and transmission of sound through the lesion. The frequency of GCT was compared to that of breast carcinoma during the same study period.

**RESULTS:** Eight cases of GCT were identified from our database of 4727 biopsies (0.17%). Seven were females, and one was male. Five of eight (62%) were palpable masses, and 3/8 (38%) were identified on screening mammograms. The mean patient age was 50 y (range, 32–60 y), and the mean lesion size was 1.3 cm (range, 0.8–1.9 cm). Seven of eight (88%) tumors were visualized at mammography. Five of these seven (71.4%) were spiculated, and 2/7 (28.6%) were well circumscribed. Calcifications were not visualized in any of the tumors (0%). Ultrasound was performed in six of eight patients, and five of these six (83.3%) tumors were visualized on ultrasound. All five (100%) visualized tumors were hypoechoic masses. There was posterior enhancement in 2/5 (40%) cases and poor sound transmission (posterior shadowing) in 2/5 (40%) cases. One did not show any posterior enhancement or shadow. Two of five (40%) masses were taller than wide. During the same time period, 1083 cases of breast carcinoma were diagnosed, making the frequency of GCT of breast about 7.4 per thousand breast carcinomas.

**CONCLUSION:** GCT of breast is a rare neoplasm, with a frequency relative to breast carcinoma of about 7 per thousand in this series, which is higher than reported in literature. It may show benign or malignant features on imaging. Spiculation is a common mammographic feature and mimics carcinoma when present. No calcifications were noted associated with this tumor in our series.

**(E-58) Thursday • 3:30 PM**  
**The Development of an Effective Radiology Interest Group to Promote Radiology as a Career Choice and to Increase Awareness regarding the Various Subspecialties within the Field**

Timothy A. MacFall, BS, *Medical University of South Carolina, Charleston, SC*; Leonie Gordon, MBChB\*; Scott Steenburg, MD (macfalta@musc.edu)

**PURPOSE:** Interest groups around medical campuses are increasing the awareness and exposure of medical students to specialties at an earlier point in their medical training. Radiology is a specialty that students are not generally exposed to during the didactic years of medical school. Therefore, the development of an effective radiology interest group was sought to promote radiology as a career choice and to increase awareness regarding the various subspecialties within the field.

**METHOD AND MATERIALS:** Since the inception of the group 4 years ago, monthly meetings have been scheduled during the school year to focus on all of the dimensions of radiology as a specialty. Students are introduced to CT, MRI, ultrasound, interventional practices, and other modalities by way of lectures provided by faculty and residents. The roles of both faculty and private practice radiologists are compared and discussed. A resident-shadowing program has also been implemented to provide students the opportunity to interact with residents and observe their daily training process. Additionally, students in the 1st and 2nd years are provided opportunities to get involved in research with faculty members.

**RESULTS:** The number of dues-paying members has steadily increased over the last 4 years, from seven in the inaugural year to 22 at present. Additionally, in the 3 years prior to the inception of the radiology interest group, a total of eight students had matched into radiology residency programs. The year the group was established, 10 students matched into radiology residencies, followed by seven, seven, and two students in the subsequent years, respectively. There are currently eight students in the senior medical school class who have applied for radiology residencies. Of note, two of these students are not dues-paying members of the radiology interest group.

**CONCLUSION:** An environment where students can interact with faculty and residents regularly is an important aspect of making this interest group effective at improving knowledge about radiology as a career and boosting interest in the specialty.

**(E-59) Friday • 10:00 AM**  
**Beginning a New 3rd-Year Student Radiology Rotation: Lessons Learned**

James G. Ravenel, MD, *Medical University of South Carolina, Charleston, SC*; Leonie Gordon, MBChB\* (ravenejg@musc.edu)

**BACKGROUND:** Our institution recently instituted a system of 3-week “selectives” for 3rd-year students, providing an opportunity for students to gain an organized exposure to radiology prior to their senior year. Up to four students could sign up for each 3-week period; periods ran continuously from August through May. The rotation was set up with four distinct facets: didactic lectures by faculty, case conferences by residents, time in each reading room, and shadowing of technologists. Overall, hands-on learning was preferred over didactic lectures. We found early on that it was critical to split up the didactic lectures and ensure that interactive experiences made up at least ½ of every day. Residents were an integral part of the process and received the greatest amount of praise from the students. The objectives of this exhibit are to review our initial experiences in setting up the rotation, review the lessons learned and adjustments made over time, and review the feedback received from students.

**(E-60) Friday • 3:30 PM**  
**Oral Fixation**

Kristen M. Brewer, MD, *Medical University of South Carolina, Charleston, SC*; Susan Ackerman, MD; Dirk Koester, MD

Oral boards are a stressful time for all senior radiology residents. Although innumerable independent study hours are put in by each resident, the amount of “allotted time” for oral board preparation varies with each program. Radiology programs take multiple approaches when dealing with oral board preparation, ranging from dedicated board reviews with some time off from clinical duties to no time off from clinical duties and very little dedicated board review. A survey was conducted to identify and evaluate the differences between radiology programs, including their policies toward seniors preparing for oral boards and their subsequent pass rates. Preliminary results comparing both academic and private programs seem to indicate that dedicated oral board reviews play a more crucial role in senior pass rate than dedicated study time and release from clinical duties.

**(E-61) Thursday • 10:00 AM**  
**Basic Lumbar and C1-C2 Puncture and the Myelographic Examination: A Primer for Residents**

John M. McMenamy, MD, *University of Texas Southwestern Medical Center, Dallas, TX*; Julie H. Harreld; Seth Toomay, MD; David P. Chason, MD (david.chason@utsouthwestern.edu)

The use of myelography and postmyelography CT for the evaluation of patients with spinal pathology and neck/back pain has largely been supplanted by the noninvasive modality, MRI. Despite this trend, myelography and postmyelography CT continue to play an important role in the work-up of many of these patients. Lumbar and cervical puncture and the performance of myelography remain, therefore, important and essential skills to be acquired and mastered by radiology residents and fellows in training. The purpose of this exhibit is to describe and illustrate the basic techniques of lumbar and cervical puncture, as well as of myelography. The learning objectives include (1) patient screening (medications), preparation, and table setup; (2) standard and alternative positioning for lumbar and cervical puncture; (3) needle and contrast selection and rationale; (4) lumbar puncture—interlaminar approach; (5) C1-C2 puncture—lateral approach; (6) routine exam strategies and views for the performance of cervical, thoracic, and lumbar myelography; (7) commonly encountered problems (eg, kyphosis/scoliosis, hardware, subdural injection, extradural block) and their solutions; (8) postmyelogram CT protocols; and (9) postmyelography care.

**(E-62) Thursday • 3:30 PM**  
**Assessment of Vascular Extremity Injury in Major Blunt and Penetrating Trauma Using a 3D Volume-rendered Interactive Viewer Technique: How Do We Do It!**

Hanickam Kumaravel, MD, FRCR, *University of Texas at Houston, Houston, TX*; O. Clark West, MD

**PURPOSE:** The presence of vascular injury in major trauma patients with both blunt and penetrating wounds of extremities significantly affects patient management. In many emergency centers, the initial evaluation is performed by CT angiography using both axial images and 2D maximum intensity projection (MIP) images. 3D volume-rendered images have traditionally been dismissed by radiologists as “pretty” images with no additional diagnostic value. In this pictorial essay, we highlight the feasibility and utility of 3D interactive volume viewer in providing accurate diagnosis of vascular injury by the radiologist and a global perspective of the injury to the clinician.

**METHOD AND MATERIALS:** Vascular injury is illustrated with 3D interactive volume viewer images, 2D MIP images, and axial images. The various appearances of arteriovenous fistula, active extravasations, vascular dissection, and pseudoaneurysms are the focus of the poster. Patients were imaged on a Siemens Sensation 40 multislice CT scanner, and postprocessing was performed on a Syngo InSpace 4D “wizard” station (Siemens, Erlangen, Germany).

**EDUCATIONAL POINTS:** 1. Technique for image acquisition using 0.6-mm and 1.2-mm secondary raw data with image smoothing. 2. Technique for creating and interpreting diagnostic-quality 3D volume-rendered images in under 5 minutes. 3. Differentiation among the most common arterial injuries: arteriovenous fistula, active extravasation, and pseudoaneurysm. 4. Recognition of imaging limitations due to metal streak artifacts created by bullet fragments and pseudo-injuries due to vessel compression.

**CONCLUSION:** This poster illustrates the benefit of 3D interactive volume viewer images in rapidly and accurately identifying vascular injury resulting from blunt and penetrating injuries of the extremity. Artifacts from bullet fragments, adjacent fracture fragments, and dressing can limit the diagnostic value of this technique in some cases.

### **(E-63) Friday • 10:00 AM MR Pulmonary Angiography: Role in the Diagnostic Work-up of Pulmonary Embolus**

Andrew D. Hardie, MD, *University of Virginia Health System, Charlottesville, VA*

Pulmonary embolus (PE) is a common but potentially treatable cause of medical mortality, particularly in the inpatient setting. The advent of multidetector CT (MDCT) has allowed the diagnosis of PE to be excluded to a high degree of certainty in a large percentage of patients. However, contrast-enhanced CT is relatively contraindicated in some patients, in particular in the setting of poor renal function. In this exhibit, we discuss the potential clinical role for MR pulmonary angiography (MRPA) imaging. Important technical requirements for performing MRPA are presented. Also, the essential elements of interpretation are discussed and demonstrated. Based on our experience, MRPA is an acceptable alternative to MDCT for patients with relative contraindications to contrast-enhanced CT.

### **(E-64) Friday • 3:30 PM Electronic Teaching Files in the Age of PACS: Where We Are Going and How We Can Get There**

Christopher P. Ho, MD, *University of Virginia Health System, Charlottesville, VA*; Spencer B. Gay, MD\*; Matthew J. Bassignani, MD

**PURPOSE:** To determine the barriers to resident use of a PACS/integrated electronic teaching file and how to optimize its use.

**METHOD AND MATERIALS:** An electronic survey was sent to radiology residents/fellows to poll their opinions on electronic teaching files, specifically their utility, functionality, ease of use, and accessibility.

**RESULTS:** Based on the survey results, a majority responding felt that having access to a teaching file is an integral part of radiology education for residents. However, the actual number of residents who used the teaching file on a regular basis (daily or weekly) was largely a minority of those surveyed. Respondents indicated that infrequent use of the teaching file is closely related to a relatively non-user-friendly interface. On a scale of 1–5, with 1 being “very difficult” and 5 being “very easy,” the average rating for ease of use, accessibility, and case submission was 2.4, 2.6, and 2.9, respectively. Functionality and key features that residents felt would be important were access outside the hospital, search functions, links to related articles, and simple case submission procedures. These features, on a scale of 1–5, with 1 being “not important” and 5 being “very important,” averaged 3.6, 4.8, 4.2, and 4.9, respectively. Finally, residents were asked to freely submit any feature or improvements they desired in an electronic file. A wide range of responses were elicited, including “ease of navigation,” “better search functions,” “ability to quiz,” and “relevant links to related articles or websites.”

**CONCLUSION:** Nearly all those polled desired to make better and more frequent use of the teaching file; however, they are hindered by the non-user-friendly interface. Our current teaching file is a PACS-based teaching file system. It could be a major teaching and review tool for radiology residents if developed properly. A system that is more easily accessible and user-friendly could prove to be a powerful tool in resident education.

### **(E-65) Thursday • 10:00 AM Teaching Reference Guides for Entry-Level Radiology Residents in Nuclear Medicine**

Kenneth A. Veselicky, MD, DDS, *West Virginia University/Robert Byrd Health Sciences Center, Morgantown, WV*; Sean Tyszko, MD; Heather E. Boo; Nathan A. Maertz, MD; Gary D. Marano, MD (kenvrad@adelphia.net)

For the beginning radiology resident, the first rotation in nuclear medicine can be a confusing and challenging experience. In comparison to the rest of the radiology department, nuclear medicine studies are unique in how they are performed, interpreted, and dictated. Additionally, there is a bewildering array of unfamiliar radiotracers used nowhere else in the department. To help transition the beginning radiology resident into the world of nuclear medicine, a handy reference and teaching guide for each of the common nuclear medicine studies was developed. These guides describe the study and radiotracer and provide sample dictations (both normal and abnormal), along with short differential lists for common findings. Also included are helpful hints and reminders specific to that study. For convenience and readability, the entire format is confined to a single page, suitable for placement in a binder in each reading room. Finally, although this project was designed for the entry-level resident, it is hoped that residents of all levels will find it useful.

### **(E-66) Thursday • 3:30 PM A Novel Way to Develop a Differential Diagnosis for Skull Base Lesions That Is Based upon the Anatomic Location of the Cranial Nerves**

Andrew M. Zbojnowicz, MD, *West Virginia University, Morgantown, WV*; Jeffery Hogg, MD (zbojniew@yahoo.com)

A typical approach to developing a differential diagnosis for skull base lesions is based on anatomical regions (ie, petrous apex, middle cranial fossa, cerebellopontine angle cistern). This exhibit presents an alternative way to think about existing pathological entities, with a new twist based on the anatomical location and course of the cranial nerves. The exhibit aims to help aid residents not only in identifying the course and appearance of the cranial nerves using different modalities (CT and MRI), but also in reviewing important differential considerations in each area, with emphasis on helpful discriminators to assist in narrowing the differential diagnosis.

## AUR 2007 Electronic Education Exhibit Abstracts

Electronic education exhibits will be displayed on Friday, April 27, 2:00–4:00 PM, and will be located in Centennial A. AMA PRA Category 1 Credit™ will be awarded for attending this session.

Presenting author is identified by institution, city, state, and country, if not United States or Canada. Presentations by trainees (residents, medical students, first-year fellows) are noted in purple.

### (E-101)

#### Cardiac MR Imaging Basics

Patrick T. Norton, MD, *University of Virginia, Charlottesville, VA*;  
Spencer B. Gay, MD\*; Nicholas C. Nacey; Dominique Caovan; Bryan S. Jeun

**PURPOSE:** The purpose of this Web-based exhibit is to (1) teach the basic physics of MRI as they apply to cardiac MRI, (2) teach the current indications for cardiac MRI, and (3) teach anatomy and pathological findings on MRI of the heart.

**CONTENT ORGANIZATION:** A. MR technique. B. Indications. C. MR anatomy. D. Pathology—coronary artery disease; cardiomyopathy; pericardial disease; cardiac masses; valvular disease; congenital heart disease; aorta and great vessels. E. Posttest. F. Bibliography.

**CONCLUSION/SUMMARY:** Major teaching points: 1. Current indications for cardiac MRI. 2. Techniques for cardiac MRI exams. 3. Basic cardiac MR anatomy. 4. Appearance of pathologic cardiac conditions on MRI. URL: <http://www.med-ed.virginia.edu/courses/rad/cardiacmr/>

### (E-102)

#### A Multipurpose Application Utilizing Faculty Multimedia as an Alternative to Internet Resources

Bryan S. Jeun, *University of Virginia School of Medicine, Charlottesville, VA*; Ramin Javan; Juan M. Olazagasti, MD

Microsoft Visual Basic was used to create a software application that provides residents and medical students with an additional educational resource aside from the Internet. The radiology faculty at the University of Virginia was asked to submit an array of electronic resources such as conference presentations, lectures, publications, and other multimedia. These resources were indexed and stored on a network drive. The software features a fast and efficient search algorithm that returns a list of these resources relevant to the user query, along with a quick preview of any selected item. This application employs an end-user-friendly graphics display interface (GDI) for easy viewing and navigation. It also showcases an innovative module titled "Snapshot," which presents a brief and concise summary of a disease, namely, its pathophysiology, differential diagnosis, work-up, treatment, prognosis, and specific radiologic findings, that can be printed out on a single page. Another component of the application can be used to simultaneously search multiple Internet sites, such as Google, eMedicine, and PubMed. Future expansion of the software will include the development of a central database that provides access to resources from other departments within the university, as well as from other universities. The ability to perform remote-access presentations over the Internet will also be developed. This software offers a simple and rapid means of accessing scientific information and is a sound alternative to Internet resources.

### (E-103)

#### Expanded Use of 3D Modeling from CT Data Sets for Teaching Difficult Anatomical Concepts

Sonia Pujol, PhD, *Surgical Planning Laboratory, Brigham and Women's Hospital, Harvard Medical School, Boston, MA*; Michael Baldwin, MD; Joshua D. Nassiri, BA; Jorge Castellanos, BA; Kitt Shaffer, MD, PhD (spujol@bwh.harvard.edu)

In a previous study, we developed teaching modules for anatomy education of 1st-year medical students in the complex area of the mediastinum. Our goal was to enhance learning of anatomical structures through 3D visualization of anatomical models reconstructed from actual patient cases and to demonstrate the variability of structures from patient to patient. This

paper presents new models and methodology developed to improve the learning of the students. Models now include structures of the pelvis and abdomen. We collected 18 anonymized CT patient data sets, including the mediastinum (five data sets), the liver (eight data sets), and the pelvis (three female data sets and two male data sets). IRB approval was obtained for use of clinical images. We generated 225 anatomical models from patient cases using the 3DSlicer platform. In each patient case, all the anatomical structures were classified into four different categories: organs, arteries, veins, and bones. Twenty-two students took the class on a voluntary basis and completed an online pretest on the anatomical area before working with models. Students attended a training tutorial on the concepts of 3D modeling and were able to use the software in less than 10 minutes. A series of tasks was assigned that encouraged students to work with the models toward a specific goal. Most students gave positive feedback on the value of 3D visualization. Initial pretest results suggest that students do not have a good 3D concept of complex structures such as pelvic muscles prior to completion of the training. Future work will include a comparative analysis of the scores of students who completed the training with those who did not, to measure the educational value of the teaching method.

### (E-104)

#### CT and MR Imaging in Patients with Truncus Arteriosus

Mamata Myneni, MD, *St Joseph's Hospital and Medical Center, Phoenix, AZ*; Randy Richardson, MD; Jon A. Machayya, MD; Mike Switzer

We present the CT and MR imaging of truncus arteriosus in an interactive computer exhibit to better understand the different types of truncus arteriosus, to comprehend the physiology in these cases, and to show the surgical repairs necessary for patients with truncus arteriosus. 3D reconstructions of CTA or MRAs of the chest were performed in nine different patients with truncus arteriosus using a commercially available workstation. The 3D models were then labeled and inserted into the presentation as unknowns. Functional imaging was used to demonstrate the physiology of truncus arteriosus, to show the mixing of oxygenated and deoxygenated blood required for the patient to survive. The repair of truncus arteriosus was then shown from CT and MRI of patients after surgery.

### (E-105)

#### Tumors and Tumor-Like Lesions of the Scalp and Skull Vault

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**LEARNING OBJECTIVES:** 1. To classify the different tumors and pseudotumors of the scalp and skull vault. 2. To identify the nonneoplastic lesions which mimic a tumor. 3. To illustrate the imaging features of scalp and skull vault tumors.

Swellings and masses of the scalp are common in clinical practice. Not many undergo imaging for diagnosis. In this exhibit, we present a spectrum of tumors arising from the scalp and skull vault, with their imaging appearances. These have been broadly divided into (a) scalp and soft tissues and (b) skull vault (inner and outer table). In each group, we describe the tumors, as well as the different congenital and inflammatory lesions that mimic a tumor. Plain radiographs and CT scan are the first-line modalities for evaluation of these lesions. MR imaging is helpful for further characterization of soft-tissue lesions and in marrow abnormalities of the skull vault.

**(E-106)****Interactive Web-based Training Module for Entry-Level Emergency Radiologists**

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The purpose of this Web-based module is to provide an interactive method of familiarizing beginning radiology residents, emergency department and primary care physicians, residents, and medical students with imaging findings of commonly encountered urgent conditions. The module utilized a Web-based computer program which includes radiographs, computed tomographic images, and ultrasound examinations and allows the participant to view the unlabeled images and select the abnormalities independently. Each case includes a brief clinical scenario and several basic questions regarding the radiologic findings, the differential diagnosis, and the disease process. The module simulates the practice environment and tests perceptual as well as clinical knowledge. Ultimately, each individual will receive a numerical score, and when multiple scores are tallied, an expected score for each individual's experience level can be projected. The program has been validated with preliminary testing of residents in different stages of training and faculty as well. The module serves as an additional resource to aid in preparing beginning radiology residents for taking call in the emergency department. Also, CME credit is offered for physicians desiring to improve or review their diagnostic radiology skills.

**(E-107)****CT Angiography of Nontraumatic Aortic Emergencies**

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CT is the imaging test of choice for suspected nontraumatic aortic emergencies, and radiology residents and attendings should be familiar with the common as well as the unusual presentations of aortic aneurysm and dissection, as well as the appropriate protocols and techniques for emergent CT imaging when such disorders are suspected. The purpose of this exhibit is therefore to review the CT findings of abdominal and/or thoracic nontraumatic aortic rupture and impending rupture, as well as of acute aortic dissection, intramural hematoma of the aorta (its forms and variants), and uncommon and unusual aortic disorders which may present emergently for CT imaging. Protocols for CT angiography of the aorta are reviewed, as is the literature on the subject, using case material from a single tertiary-care teaching hospital, emphasizing multidetector CT. Complications of aortic dissection are discussed, as are pitfalls of CT interpretation, such as motion artifacts of the ascending aorta and inflammatory aortic aneurysm. Uncommon and unusual aortic disorders which may present acutely or subacutely, including mycotic aneurysm, graft infection, and aortoenteric fistula, are shown and the imaging findings and CT and clinical literature on these topics reviewed.

**(E-108)****Uncommon, Atypical, and Rare Presentations of Appendicitis on CT**

Douglas S. Katz, MD; Vladimir Merunka, BS; John P. Fantauzzi, MD, *Winthrop-University Hospital, Mineola, NY*; John Hines, MD; Joseph P. Mazzie, DO; Michael Sadler, MD; et al (dsk2928@pol.net)

Radiologists need to be familiar with the broad spectrum of uncommon, unusual, and rare variants and presentations of appendicitis that may be identified on CT and the implications for appropriate patient management. The purpose of this exhibit is to demonstrate this spectrum, in conjunction with review of the imaging and clinical literature. The following presentations of appendicitis on CT will be shown, and the corresponding imaging, surgical, and pathologic literature will be reviewed: tip, resolving, stump, perforated, foreign body, Amyand's hernia, femoral and umbilical hernia, nonrotation/left-sided, related to tumor, and secondary appendicitis.

**(E-109)****US for Dummies: Tips and Tricks for Radiology Residents in Performing Emergent On-Call US Examinations**

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**ABSTRACT:** The purpose of the exhibit is to provide a quick reference resource for radiology residents who are asked to perform emergent ultrasound examinations as part of their on-call duties. Residents in most radiology programs are routinely asked to perform the following studies on call: right upper quadrant abdominal, right lower quadrant abdominal to rule out appendicitis in pregnant patients, DVT of upper and lower extremity, testicular, kidney, pyloric stenosis, and tenosynovitis/joint effusion. Many residents, particularly junior residents, have limited experience in performing these exams. We will discuss proper patient positioning, transducers (type, positioning), and use of scan parameters to optimize imaging. Also included are "tips and tricks" for obtaining optimal images in various scenarios and the pitfalls to avoid. Key anatomic landmarks and measurements that must be documented are stressed. This presentation is in a computer-interactive format that facilitates quick user navigation for real-time reference or use as a teaching module.

**(E-110)****Designing Database Applications for Resident Education**

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**OBJECT:** Several areas of radiology resident education deal with large volumes of data that lend themselves to organization within an electronic database. At our institution, two different areas of resident education were identified that would benefit from organization within a database: (1) unknown cases prepared by residents for weekly case conference and (2) differential diagnoses.

**METHOD AND MATERIALS:** A database was designed in Microsoft Access to organize the numerous cases residents prepare in Microsoft PowerPoint for the weekly resident-run departmental Proven Case Conference. Each week, residents prepare 10–15 unique cases in PowerPoint for Proven Case Conference. Previously, these cases were not stored or organized in any useful fashion. The database serves three functions: (1) storing information about the case and a hyperlink to the case's PowerPoint file; (2) presenting the cases to residents as unknowns, with numerous filters for various categories; and (3) storing a predefined set of cases for various ad hoc resident case conferences. The database and the PowerPoint files are stored on a secure departmental server accessible from any computer in the hospital and from home using a VPN connection. Currently, over 1500 unique cases are stored in this database. Another Microsoft Access database was also created as a flash-card application. This database contains differential diagnoses for various findings, populated by residents using various resources (faculty, AFIP, notes, etc). The database presents each of these topics to residents in flash-card format. Residents can quiz themselves on questions or differentials and track whether they answer them correctly. Residents can then preferentially review items that they initially missed.

**CONCLUSION:** Database applications can be used to store data important for resident education and to present them in a useful fashion. Residents at our institution have used both of these applications in preparing for written and oral boards.

**(E-111)**  
**Utilizing the MIRC Database System to Catalogue and Store Interesting Cases for Teaching Purposes**

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William Weadock, MD\*

Radiology education is dependent upon presentation of interesting/relevant cases encountered throughout the workday. Traditional methods of keeping track of such cases can often be cumbersome and disorganized. Utilizing the MIRC teaching file system and the software applications RadPix and RadPix MIRC Authoring Tool, we demonstrate a simple, organized method of obtaining images and exporting them into a searchable database as interesting cases are encountered. These entries can then be accessed at a later time, when they can be edited/annotated. Relevant cases can then be searched for and exported into PowerPoint presentation format when needed.

**(E-112)**  
**Determining When 1st-Year Residents Are Ready for Call: An Image-based Examination**

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The first 6 months of residency are focused on preparing residents to take solo call. Each December, programs must determine if their residents have sufficient diagnostic skills in many key areas. Our purpose was to develop an objective criterion in the form of an examination, to help judge call-readiness. We also defined a list of images and modalities with which our residents must be familiar, to help focus their studies. A list of appropriate diagnoses was developed and heavily weighted to typical on-call cases. The list was distributed to all members of the Department of Radiology at Dartmouth-Hitchcock Medical Center, who were then asked to submit examples of these cases. From over 140 diagnoses, 50 cases were selected for the exam. Our aim was to simulate call as much as possible while allowing completion within a reasonable length of time. PowerPoint™ was used for ease of application and transferability. Plain film sets were shown in their entirety. Cross-sectional DICOM image sets were exported and converted into individual PowerPoint™ files using RadPix™ to allow seamless “PACS-like” scrolling. Cross-sectional image sets were shortened to 15–45 images per set, made anonymous, and hyperlinked to the main PowerPoint™ exam file to reduce the file size and memory requirements. Minimal history was supplied, and answers were elicited in the form of a preliminary interpretation. All eight 1st- and 2nd-year residents were administered the exam to ascertain what level of competency should be expected of 1st years. The exam was scheduled for early December to allow time for remediation in case of inadequate performance, in which case the onset of call would be delayed by 1 month, with such missed call to be paid back at a later date. Administering such an exam provides an objective criterion to assess call-readiness. It specifically provides a breakdown of the residents’ strengths and weaknesses in individual sections so that they can improve any weaknesses prior to call. Data will be collected from each subsequent annual exam to derive an appropriate 1st-year passing score, and the exam will be varied using our now extensive case database.

**(E-113)**  
**On-Call Assessment Examination for Junior Radiology Residents’ Call at Albany Medical Center**

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The junior resident, under supervision of the senior resident, is responsible for reading all plain film studies, as well as neuroradiology CT studies, including CT of the head, spine, neck, and CT angiography. Residents have found the call experience to be integral in their resident education. To ensure residents’ ability to successfully begin the call experience, we have developed an assessment examination which includes selected ER cases. The exam consists of 100 study questions based on recent images taken from the PACS system. Cases test the residents’ ability to interpret and guide appropriate patient care: neuro CT, chest, abdomen, and skeletal cases. The examination has been used both as an assessment tool for junior residents and a refresher and teaching tool for more senior residents.

**(E-114)**  
**Creation of a Radiology Residency Management Web Site**

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The World Wide Web is the standard for which information and ideas are rapidly conveyed and shared amongst individuals and groups. A presence on the Web is a practical way for any practice or department to easily disseminate information to patients, referring physicians, and colleagues; but rather than just merely displaying static content, today’s interactive Web sites afford much more functionality to users. Connectivity to the Internet is ubiquitous in today’s society, making availability of such resources nearly effortless. These qualities make the need for a well-developed Web site essential to any practice or, in our case, radiology residency program. Using widely available and freely distributed programming tools, the authors developed *wbhrad.com*, a Web site that was initially developed as a manner in which to easily share our “Case of the Week” teaching files but has now grown into a fully featured radiology residency management Web site. *wbhrad.com* was developed using a MySQL database, with PHP, HTML, and JavaScript as the primary programming languages. For “Case of the Week,” an intuitive interface allows users to upload their images and case information to the database from anywhere with Internet access. Answers to cases may be scored, and cumulative results for participants are automatically updated. Participation in “Case of the Week” at our institution has tripled since the inception of Internet-based presentations. Additional features to *wbhrad.com* include secure user log-in with variable-level access, a searchable interesting case database, a personal case database with the ability to mark cases for follow-up, online teaching files creation, message board forums, procedures log, on-call and conference calendars, a powerful and versatile text paging system, and the ability for users to submit hyperlinks to online educational material with an additional peer review rating system. There are many more features currently in production. For a demonstration of the most current version of the Web site, please visit *www.wbhrad.com*, and log in with username: guest; password: guest.