

Research Paper Abstracts

AUR 2011 Research Paper Abstracts

Research papers are oral educational or scientific presentations that are 8 minutes in length, followed by a 2-minute discussion period.

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

Presentations by trainees (residents, medical students, or 1st-year fellows) are noted in green.

Thursday, April 14, 2011

2:00–3:30 PM

SS01: Scientific Session 1

Resident Education

Location: Grand Ballroom B

Moderators: Janet E. Bailey, MD

Theresa C. McLoud, MD

ED

(SS01-01) 2:00 PM

Addressing What Matters Most: Preparing the Next Generation of Radiologists—Resident Perception of Training to Manage Reactions to Iodinated Contrast Media

Pasquale D. Evangelista, BA, MD, *Monmouth Medical Center, Long Branch, NJ*; Richard Ruchman; Ernest Wiggins, MD (PasqualeEvangelista@gmail.com)

PURPOSE: 1. Assess resident perception of training quality and reaction experience. 2. Determine the types of training provided, exposure to the *ACR Manual on Contrast Media*, and whether programs certify resident ability to manage reactions. 3. Gauge resident knowledge of ACR management protocols.

METHOD AND MATERIALS: A 30-question survey was developed to assess radiology resident experience with iodinated contrast media; 297 residents participated. Data were gathered in four categories regarding iodinated contrast and management of reactions: (a) respondent demographics; (b) program verification process, if any, of resident ability to manage reactions; (c) training provided; and (d) reaction experience. Sample clinical scenarios were presented to assess familiarity with management protocols.

RESULTS: 77% of respondents indicated their program does not verify their ability to manage reactions to iodinated contrast media, and less than half received training that included the *ACR Manual on Contrast Media*. Only 54% believe they can manage all types of reactions; firsthand experience is lacking, as 65% indicated they have participated in the management of one to five reactions. 54% responded positively when asked if they were familiar with the ACR manual indications for epinephrine use; greater than 80% correctly identified the concentration for IV and subcutaneous/intramuscular epinephrine. Two clinical scenarios were presented involving a severe reaction to iodinated contrast media, with laryngeal edema, in an adult and a pediatric patient. For the adult patient, 97.6% of respondents would administer epinephrine; the correct dose was selected by 86% and 87% of those who opted for intravenous or subcutaneous administration, respectively. In the pediatric case, 93% of respondents would administer epinephrine. Only 48.6% selected the correct route, and 92% of this group selected the correct concentration. Of those using the correct concentration, 83% used a correct dose, and 17% overdosed the patient.

CONCLUSION: Resident ability to manage contrast reactions is lacking. Training is insufficient, and the *ACR Manual on Contrast Media* is woefully underused. Only half of respondents have a favorable impression of their training.

(SS01-02) 2:10 PM

Current Status of Residency Training with Regard to Adverse Reactions to Contrast Media

Jonelle M. Petscavage, MD, MPH, *Penn State Hershey Medical Center, Hershey, PA*; Angelisa M. Paladin, MD; Carolyn L. Wang, MD; Jennifer G. Schopp, MD, RN; Michael L. Richardson, MD; William H. Bush, Jr, MD (jpetscavage@hmc.psu.edu)

PURPOSE: Acute allergic-like adverse reactions to contrast media are rare but life-threatening events. Residents may complete a residency

without managing an adverse event. Surveys have shown practicing radiologists to incorrectly determine dose and administer medications for treatment. Thus, contrast education may be deficient or inconsistent. The purpose of this study is to assess the current status of contrast reaction education in U.S. radiology residency programs and the methods used to test resident knowledge.

METHOD AND MATERIALS: A 10-question anonymous survey on residency education methods and testing pertaining to contrast reactions was distributed through the APDR to program directors of U.S. diagnostic radiology residency programs. The past 4 years of the ABR in-service examination were reviewed to assess the number of contrast-reaction questions.

RESULTS: Fifty-one programs responded to the APDR survey; 49% of the programs train with one lecture per year, 29.4% train with two lectures, and 16% with three or more lectures. Only 44% include role-playing training during the lectures. 18% of programs are incorporating simulation training, with 9/10 programs holding one simulation session per year. Less than 50% of programs formally test resident knowledge. On the 2006–2009 ABR in-service examinations, there were zero questions testing allergic-like adverse events.

CONCLUSION: Resident education for contrast reaction management is primarily performed with annual lecture. Only 18% of programs are using simulation training, and less than 50% are testing resident knowledge or skills. Findings suggest that education may need revision to incorporate simulation or other means of psychomotor learning.

AUR Joseph E. and Nancy O. Whitley Award

(SS01-03) 2:20 PM

Radiology Resident Teaching Skills Improvement: Impact of a Resident Teacher Training Program

Andrea Donovan, MD, *Sunnybrook Health Sciences Centre, Toronto, ON* (andrea.donovan@sunnybrook.ca)

PURPOSE: Teaching is considered an essential competency for residents to achieve during their training. Instruction in teaching skills may assist radiology residents to become more-effective teachers and increase their overall satisfaction with teaching. The purpose of this study was to survey radiology resident teaching experiences during residency and to assess perceived benefits following participation in a teaching skills development course.

METHOD AND MATERIALS: Institutional review board approval was granted for this study. Study participants were radiology residents with membership in the A³CR² or SARRAD who participated in a 1.5-hour workshop on teaching skills development at the 2010 AUR meeting. Participants completed a self-administered precourse questionnaire that addressed teaching strategies, as well as the prevalence and structure of teaching skills training opportunities at their institution. A second post-course questionnaire enabled residents to evaluate the seminar and assessed new knowledge and skill acquisition.

RESULTS: Seventy-eight residents completed the pre- and postcourse questionnaires. The vast majority of respondents indicated that they teach medical students (72 of 78; 92%). Approximately 20% of residency programs (17 of 78) provided residents with a formal didactic program on teaching skills. Less than one-half (46%) of the resident respondents indicated that they received feedback on their teaching from attendings (36 of 78), and only 17% (13 of 78) routinely gave feedback to their own learners. All of the course participants agreed or strongly agreed that this workshop was helpful to them as a teacher.

CONCLUSION: Residents are frequent participants in teaching, yet few residency programs had instituted a resident teacher training curriculum. A resident teacher training workshop was perceived as beneficial by the residents, and they reported an improvement in their teaching skills.

* Faculty financial disclosures are located in the Faculty Index.

(SS01-04) 2:30 PM Impact of ABR Changes on Pediatric Radiology Residency Training

Kenny Rentas, *University of Missouri, Kansas City, MO*; Ramya Kollipara; Lisa H. Lowe, MD (rkqd9@umkc.edu)

PURPOSE: The purpose is to assess the impact of new American Board of Radiology (ABR) changes on pediatric radiology residency training, including the number, timing, availability, and funding of pediatric radiology rotations.

METHOD AND MATERIALS: Participants were selected by using ACGME list of accredited U.S. radiology residency programs, and data were collected via a survey. The program directors or a person designated by the program director was instructed to fill out the survey.

RESULTS: Of 186 programs, 84 (45%) responded to the survey. Three-month pediatric rotations were required in 61.0% of the programs, with most having their residents complete one pediatric rotation as PGY2, PGY3, and PGY4. In 46% of training programs, pediatric radiology rotations were completed at the home institution and billed to Medicare. 7% of the programs plan to decrease the number of required pediatric rotations, while 75% plan no change. 19% of programs plan to move pediatric rotations to earlier in training, and 52% are planning no change. 82% of programs responded that additional rotations in areas of interest are planned. However, only 53% could provide additional rotations in all 10 subspecialties, and 58% of programs indicated it was "very unlikely" or "impossible" that residents could acquire 12 or more months in one area. Pediatric radiology is among the top three most frequent subspecialty areas that cannot be accommodated, along with OB/women's and cardiac imaging. Funding limitations for pediatric rotations were not considered a barrier at 51% of programs.

CONCLUSION: Residency programs (7%) plan to cut back the overall number of pediatric radiology core rotations and move them to earlier in training (19%). Although 82% of programs say they plan to provide more time in areas of interest, 58% say it is unlikely or impossible that residents could accumulate 12 months in their area of interest. Funding may limit access to additional pediatric rotations in up to 44% of programs.

(SS01-05) 2:40 PM Radiology Residents Describe Their Radiology Business Training as "Poor"

Rajni Natesan, MD, MBA, *Northwestern University Hospital, Chicago, IL*; Richard E. Sharpe, Jr, MD, MBA

PURPOSE: Current health care reform requires/demands an in-depth understanding of the business of radiology. There is minimal research describing this aspect of resident training. This study seeks to describe radiology trainees' perceptions of their education in the business of radiology.

METHOD AND MATERIALS: An online survey sent to diagnostic radiology trainees asked them to rate the quality and frequency of radiology business education during residency, as well as their current competence in 16 different business areas, by using a 6-point scale. Weighted response averages were calculated. Respondents also described their year of training and their institution.

RESULTS: Surveys were received from 266 trainees. Trainees rated the quality of their business of radiology training as follows: not provided (46; 17.3%), poor (92; 34.6%), fair (77; 28.9%), good (37; 13.9%), and excellent (14; 5.3%). Training is provided as follows: never (51; 19.2%), 1/yr (60; 22.6%), 2–5x/yr (84; 31.6%), 6–12x/yr (27; 10.2%), >12x/yr (9; 3.4%), and "don't know" (35; 13.2%). Weighted average responses for each business area are presented by increasing average competence (no knowledge = 0, trace knowledge = 1, below competent = 2, competent = 3, more than competent = 4, and highly competent = 5): contract negotiation, 1.6; practice management, 1.6; marketing, 1.6; imaging equipment costs, 1.8; job search, 1.9; imaging study costs, 1.9; radiology lawsuits, 1.9; radiology compensation, 2.1; personal insurance, 2.2; quality assurance, 2.2; health care policy, 2.2; information technology, 2.3; choosing between academic and private radiology, 2.4; personal finance, 2.4; practice management, 2.5; and patient safety, 2.8.

CONCLUSION: Trainees self-report their average understanding of seven business of radiology topics as less than "below competent" and nine topics as less than "competent." Fewer than 20% of radiology trainees

describe their business of radiology training as "good" or "excellent." This study demonstrates that more attention should be focused on this critical aspect of residency training. Self-reporting bias may limit these findings. Further research is necessary to identify those topics of most interest to trainees and to determine ideal education format.

(SS01-06) 2:50 PM Administrative Organization in Diagnostic Radiology Residency Program Leadership

Grant R. Webber, MD, *Emory University School of Medicine, Atlanta, GA*; Mark E. Mullins, MD, PhD; Zhengjia Chen, PhD, MS; Carolyn C. Meltzer, MD (grwebbe@emory.edu)

PURPOSE: The purpose is to document the current state of administrative structure in U.S. diagnostic radiology (DR) residency program leadership. A secondary objective was to assess for correlation(s) with DR residency programs that equipped positions such as assistant, associate, and/or emeritus program director (PD) with respect to residency size and region of the country.

METHOD AND MATERIALS: We used FREIDA (Fellowship and Residency Electronic Interactive Database, www.freida.ama-assn.org/freida), as well as direct communication and programmatic Web site search, to gather data regarding current U.S. DR residency program leadership. Data collected included the presence of additional leadership titles, including assistant PD, associate PD, and PD emeritus, and how many faculty members currently held each position. Programs were excluded if results could not be identified. A *t* test and analysis of variance were used to estimate correlation of the size of residency with programs having additional director positions and the type of positions, respectively. The χ^2 test was employed to assess for any regional differences.

RESULTS: FREIDA defines 186 U.S. DR residency programs. A total of 173 programs (93%) were included in analysis; 124 of 173 (72%) programs had additional leadership positions. Of the 173 programs, 30 (17%) had more than one such position. There were no significant differences in the size of the programs that employed these additional positions (mean, 25; SD, 12; range, 6–72) versus programs that did not (24; 12; 7–51). There were no significant size differences between residency programs that employed assistant PD (25; 11; 8–72) or associate PD (25; 12; 10–55) and those that did not, but programs with PD emeritus positions (46; 22; 21–72) did have significantly larger residencies. There were no significant differences between programs that had additional positions with respect to region of country.

CONCLUSION: The majority of U.S. DR residency programs utilized some form of additional leadership position. In the majority of cases, this was in the form of an assistant or associate PD. Almost one-fifth of programs studied had more than one such position utilized. We speculate that this is a positive model for depth of education leadership in U.S. residency programs.

(SS01-07) 3:00 PM Report on the Status of Grand Rounds in Radiology Residency Programs in the United States

Corrie M. Yablon, MD, *Beth Israel Deaconess Medical Center, Boston, MA*; James S. Wu, MD; Priscilla J. Slanetz, MD, MPH; Ronald L. Eisenberg, MD, JD (cyablon@bidmc.harvard.edu)

PURPOSE: The purpose is to assess the current status of grand rounds educational programs associated with radiology residencies throughout the United States.

METHOD AND MATERIALS: Institutional review board exemption was granted for this study. An electronic survey was sent to the program directors of all 163 radiology residencies in the United States to ascertain the size and type of the residency program, the frequency and other characteristics of grand rounds (GR), the source of speakers, honorarium (if any), and whether guest speakers participated in other educational activities in the section or department. Respondents were also asked to rate their perceived value of GR.

RESULTS: Of the 58 respondents (35.6% response rate), 66.7% reported having a stand-alone GR program. 81.6% of university and 60% of university-affiliated residencies had formal GR programs, while only 14.3% of community and no military residencies held GR. GR were held monthly in 42.1% of residencies, weekly in 18.4%, and only every 2 months in 15.8%. All GR programs reported a broad spectrum of presentations,

* Faculty financial disclosures are located in the Faculty Index.

invited outside speakers, and involved them in a variety of additional interactions within the department. With the recent economic downturn, some programs reported decreasing the number of outside speakers, and one canceled its GR program outright. Regarding attitudes toward medical education, 78.5% of respondents agreed that GR are an essential component of an academic radiology department, and 96.5% agreed that general radiologic education of subspecialists is valuable. 65% agreed that attendance at GR should be required of all attending radiologists, while 17.5% disagreed, citing pressures to maintain the flow of clinical schedules while covering resident absence, the difficulty of staffing multiple remote clinical sites, and the lack of universal interest of GR topics in an era of increasing subspecialization.

CONCLUSION: Most university and university-affiliated programs sponsor GR and integrate them with resident education. Most respondents believe that GR are an essential component of an academic radiology department and that general education of subspecialists is valuable.

(SS01-08) 3:10 PM
How to Turn Your Case Conference Presentation into an Online Practice Module for the ABR Exams of the Future

Spencer B. Gay, MD*, *University of Virginia Health System, Charlottesville, VA*

PURPOSE: The structure of the American Board of Radiology exams is changing to a computer-based format. In order to help prepare our residents for these exams, we should consider new formats for teaching. Adobe Captivate® can help to convert an oral case conference presentation into an online practice module for the ABR exam of the future.

METHOD AND MATERIALS: Adobe Captivate® is a commercially available product that can be used to convert a PowerPoint presentation into an online learning module. The software has built-in tools to help import ppt files and image stacks and to create many types of questions that can simulate the experience of the ABR core and certifying exams. A small amount of training and experience will allow the radiologist-educator to take already-existing case conferences used to prepare residents for the current oral exam and add questions in a moderate amount of time. Clinically oriented physics questions can also be added to simulate the core exam.

RESULTS: The resulting files can be posted on the residency program Web site and be available on the Internet or, if more-limited access is desired, on an intranet. A score can be provided to the resident and also archived to document participation in this exercise. The material would then be available anywhere within the institution or the world anytime for resident study, even after they complete the residency program, when they will take the certifying exam.

CONCLUSION: Adobe Captivate® provides an opportunity for the radiologist-educator to use already available material to create new learning modules, to better prepare learners for the new format of the ABR exams.

(SS01-09) 3:20 PM
Interventional Radiology Simulation Lab: Initial Experience with US-guided Right Internal Jugular Central Venous Catheter Placement

Anton Mahne, MD; Vikram S. Dravid, MD, *Bryn Mawr Hospital, Bryn Mawr, PA*; Stephanie Landmesser, RN, MS (*mahnea@mlhs.org*)

PURPOSE: The purpose is to evaluate diagnostic radiology residents performing ultrasound-guided right internal jugular central venous catheter (RIJCVC) placement in a simulation lab setting, before and after formal training.

METHOD AND MATERIALS: Thirteen radiology residents (four PGY-2, four PGY-3, and five PGY-4) were evaluated placing a RIJCVC under ultrasound guidance in an IR simulation lab setting. Sessions were recorded on video. Prior to the simulation, residents were given an outline describing placement of a RIJCVC. A vascular access mannequin (Blue Phantom ultrasound training model) was used. Residents were evaluated according to a checklist created by the simulation lab coordinator and an interventional radiologist with 18 years of experience. Each section on the checklist can be scored as "Yes," "Yes with reminder," or "No," pertaining to whether or not the resident successfully completed the checklist items. Residents rated their comfort level with performing placement of a RIJCVC in a simulated and true clinical setting, before and after the simulation. A scale from 1 to 5 was utilized, with 1 representing a low comfort

level and 5 representing a high comfort level. A formal training session on ultrasound-guided RIJCVC placement is to be performed in the future. Residents will undergo repeat evaluation in a simulation lab setting, as outlined above.

RESULTS: Residents with limited experience reported increased comfort levels in RIJCVC placement following the simulation session, while residents with experience did not. However, the checklist evaluation pointed out deficient areas. The simulation exercise allowed us to evaluate and demonstrate progress of the residents in all six core competencies.

CONCLUSION: Ultrasound-guided RIJCVC placement in a simulation lab setting is an excellent baseline measure of resident proficiency for this procedure. Residents with limited experience report an overall increase in comfort level following the simulation, while residents with experience do not. The objective checklist serves to identify areas of suboptimal performance and allows for focused learning. The vascular access mannequin is a safe alternative for residents to practice ultrasound-guided RIJCVC placement prior to attempting it on real patients.

Thursday, April 14, 2011
2:00–3:30 PM

SS02: Scientific Session 2
Medical Student Education; General Education
Location: Grand Ballroom CD

Moderators: Petra J. Lewis, MD*
 Christopher M. Straus, MD

ED

(SS02-01) 2:00 PM
The Radiology Elective: Creating an Educational Framework in the Digital Era

M. Reza Rajebi, MD, *SUNY Upstate Medical University, Syracuse, NY*;
 J. Nicole Taylor; Michele Lisi, MD; Hal E. Cohen, MD (*rajebim@upstate.edu*)

PURPOSE: The purpose is to create a 3rd- and 4th-year medical student radiology rotation curriculum pertinent to those pursuing a radiology residency, as well those pursuing other specialties.

METHOD AND MATERIALS: Using the AMSER National Medical Student Curriculum in Radiology as a guideline, we created a curriculum for the medical student radiology rotation. Our goal was to create a medical student-centered learning environment. Our curriculum includes the following: (a) an orientation to the department on the 1st day of the rotation, with a description of goals and objectives; (b) a system-based lecture series addressing key radiologic terminology, identification of anatomy and common pathology, clinical management, and the ACR Appropriateness Criteria®; an electronic copy of each lecture is provided for later review; (c) a list of teaching points by organ system for the attending radiologists, residents, and medical students; (d) a recommended radiology textbook for further study; (e) an interesting case presentation assigned to each medical student; (f) a multiple-choice paper-based exam at the end of the rotation; and (g) an interesting case folder on a picture archiving and communication system (PACS) to collect relevant cases.

RESULTS: Based on the results of an anonymous survey, 63% of students rated the overall radiology rotation experience as great, 25% as good, 12% as average, and no one ranked the overall experience as below average. The main complaint was the poor image quality on the electronic copy of lectures and final exam. We are utilizing the Blackboard Learning System to create a course shell for electronic copies and the AMSER Radiology ExamWeb (*radiology.examweb.com*) Web site developed by Dr Petra J. Lewis to administer a computer-based exam in our computer lab.

CONCLUSION: Based on the guidelines developed by Lewis and Shaffer, we created a medical student radiology elective curriculum that includes an orientation, lecture schedule, list of teaching points, recommended textbook, case presentation, and a final exam. We focused on creating a curriculum appropriate for students regardless of their specialty choice. Most students were satisfied with their overall experience.

* Faculty financial disclosures are located in the Faculty Index.

AMSER Henry Goldberg Medical Student Award

(SS02-02) 2:10 PM Understanding the U.S. Medical School Requirements and Medical Students' Attitudes about Radiology and Pathology Electives

Jeffrey D. Poot, BA, *Lake Erie College of Osteopathic Medicine, Pittsburgh, PA*; Matthew S. Hartman, MD (jeffrey.poot@lecom.edu)

PURPOSE: The purpose of this research is to assess what percentage of medical schools in the United States, both allopathic and osteopathic, require medical students to complete rotations in radiology and pathology during the clinical years. A secondary end point is to evaluate medical students' opinions about radiology and pathology requirements.

METHOD AND MATERIALS: Curriculum data were obtained from the Association of American Medical Colleges and the American Association of Colleges of Osteopathic Medicine. Medical schools participating in the study sent a voluntary electronic survey to 3rd- and 4th-year medical students to gather opinions on the importance of radiology and pathology in clinical medical education. We investigated factors leading students to select radiology and pathology electives, as well as the importance of these courses for becoming a competent physician.

RESULTS: Out of 159 U.S. medical schools (132 allopathic, 27 osteopathic) during the 2009–2010 academic year, 39 required radiology (25%) and 10 required pathology (6%) during the clinical years as stand-alone courses. Of 861 medical students (406 third-years, 455 fourth-years) who responded to the electronic survey, 490 students (57%) indicated that radiology should be required and 215 students (25%) indicated that radiology should not be required during the clinical years. Additionally, 153 students (18%) indicated that pathology should be required and 503 students (58%) indicated that pathology should not be required during the clinical years.

CONCLUSION: Currently, 25% of medical schools in the United States require radiology and 6% require pathology during the clinical years as stand-alone courses. Medical students believe that learning radiology plays an important role in their becoming a competent physician. In the ever evolving world of medicine and medical school education, medical schools should consider ways of incorporating radiology into their clinical curriculum. This can be accomplished through the standard 4-week elective, through integrated courses such as a radiology-pathology course, and by having radiology rounds taught by radiology faculty during core clerkships.

(SS02-03) 2:20 PM Medical Student Case Presentations: Quality Improvement Project

Mark E. Mullins, MD, PhD, *Emory University Hospital, Atlanta, GA*; Amanda S. Corey, MD (memulli@emory.edu)

PURPOSE: In our core required 2-week course/clerkship in radiology, medical students (predominantly M3s) give a 5-minute case presentation. In this project, our aim was to perform a quality improvement process analyzing these presentations to determine trends and/or opportunities for improvement.

METHOD AND MATERIALS: Student case presentations over a 2-year period were retrospectively reviewed. Numerical values were tabulated, including numbers of slides, radiology images, and nonradiology images. Modalities were noted, as were enhancements such as normal comparisons. Cases were divided into classical radiology divisions (eg, neuroradiology). Data analysis included standard statistical parametric formulation and further characterizations of the data.

RESULTS: A total of 232 presentations were reviewed. The average presentation length was 11.7 slides (SD, 5.6), with a maximum of 60 and a minimum of 5. The average number of radiology images used was 6.8 (SD, 5.4), with a maximum of 48 and a minimum of 1. The average number of nonradiology images used was 1.3 (SD, 2), with a maximum of 12 and a minimum of 0. The most common modality used was radiography (x-ray; 42%). The average number of modalities used was 1.8 (SD, 0.8), with a maximum of 4 and a minimum of 1. The most common diagnosis chosen was brain tumor ($n = 8$). The most common subspecialty represented was neuroradiology (22%), and the least common was breast imaging (<1%). The vast majority of diagnoses chosen did not correspond to "must-see" diagnoses from the AMSER curriculum. The most common enhancement used was a "cartoon diagram" (22%).

CONCLUSION: Our results may provide reference data for medical students and medical student educators preparing for individual medical student case presentations. Observations that may provide opportunities for improvement include possible trends in diagnosis and modality selection toward complexity, unequal representation by subspecialties in radiology, and possible underutilization of teaching enhancements.

(SS02-04) 2:30 PM Medical School Radiology Curriculum: The Relationship between Radiology Exposure and Medical Student Career Choice

Neena Kapoor, MD, *Brigham and Women's Hospital, Harvard Medical School, Boston, MA*; Stacy E. Smith, MD

PURPOSE: There is conflicting evidence regarding the effect of exposure to radiology on the ultimate specialty choice of a medical student. The purpose of this study is twofold: First, the study will obtain more information about the types of radiology curricula at U.S. medical schools. Second, the study will determine if radiology curriculum influences the number of medical students applying and matching in radiology. Instead of depending on student opinions, this research will look at objective data regarding application and match rates in order to provide a more definitive answer regarding the potential relationship between radiology curriculum and future career choice.

METHOD AND MATERIALS: An online survey was distributed to radiology clerkship/program directors at 129 accredited MD-granting U.S. medical schools. Questions included year of medical school in which the radiology curriculum is offered, length of course, mandatory versus elective enrollment, didactic versus observational teaching, methods of student evaluation, and the number of students applying per school, as well as those matching in radiology per year from 2006 to 2010. The number of medical students graduating per year from each institution, as well as the percentage who matched in radiology, was obtained from the ERAS database for correlation.

RESULTS: Greater exposure to radiology in both the preclinical and clinical years showed a positive relationship with regard to application rates of students applying to radiology residencies. Our methods allowed us to identify the independent and joint effect of preclinical and clinical exposure on rates of radiology applications. Well-organized dedicated mandatory rotations provided students with earlier information regarding radiology as a career.

CONCLUSION: There is a relationship between the types of current medical school radiology curricula and radiology residency application rates, with earlier exposure influencing medical student interest in radiology. This initial study explores the spectrum of radiology education across the United States. Our findings help in understanding what educational factors are important in radiology career choice, in order to ensure that the field continues to attract the best medical students.

(SS02-05) 2:40 PM Faculty Perceptions of Assessing and Accounting for Teaching Activities in an Academic Radiology Department: How Do We Best Incorporate a Teaching Component into the Academic Relative Value Unit?

Meghan E. Single, MD, *University of Maryland, Baltimore, MD*; Theresa C. Kouo, MD; Jade J. Wong You Cheong, MD; Charles S. Resnik, MD

PURPOSE: The purpose is to assess the current contribution of a teaching component to the academic relative value unit (aRVU) and faculty perceptions of its value, as well as the best methods of incorporating teaching into the aRVU.

METHOD AND MATERIALS: A 25-question survey was distributed to members of the Association of University Radiologists. Questions focused on the contribution of teaching to the aRVU, in addition to the current methods of accounting for such teaching activities in academic radiology departments. Opinions were also gathered regarding which specific teaching components should be incorporated into the aRVU.

RESULTS: A total of 176 responses are analyzed. 89% state that resident evaluations contribute to their performance evaluations; however, only 42% state that teaching is a component of the aRVU at their institution. 79% and 70% feel that teaching activities should be part of the aRVU and should be given equal weight to research, respectively. When composing

* Faculty financial disclosures are located in the Faculty Index.

a teaching component to the aRVU, respondents favor the following components: lecture quantity (94%), educational leadership positions (94%), workstation teaching (84%), and lecture quality (61%). Although teaching activities are considered in the performance evaluation of 89%, the specific criteria considered to be important in the creation of an aRVU are included in respondents' performance evaluations at a much lower rate. Lecture quality is considered in 60%, lecture quantity in 52%, and workstation teaching in only 28% of performance evaluations. Overall, lectures appear to be evaluated and incorporated as an objective measure in performance evaluations and the aRVU at a much higher rate (75%) than workstation teaching (28%). Dedicated resident evaluations and feedback focusing on workstation teaching are the most favored method of assessing the quality and quantity of workstation teaching.

CONCLUSION: Although teaching activities are considered in a high percentage of academic radiology faculty performance evaluations, teaching activities are incorporated into the current aRVU at a much lower rate. Among the activities considered important criteria of the aRVU, workstation teaching appears to be one of the most valued yet is the most under-assessed component.

(SS02-06) 2:50 PM
Maintaining an Active and Vibrant Grand Rounds and Visiting Professor Program: How We Do It

Srini Tridandapani, MD, PhD, *Emory University, Atlanta, GA*; Mark E. Mullins, MD, PhD (*stridan@emory.edu*)

PURPOSE: The purpose of this presentation is to provide a "how-to guide" or useful framework on how to initiate and maintain an active and vibrant grand rounds (GR) and visiting professor (VP) program.

METHOD AND MATERIALS: In developing this "how-to" recipe, we have used our collective 5 years of experience in maintaining an extensive GR and VP program at a large U.S. academic radiology department that includes large residency and fellowship programs. Our experience to date includes coordinating over 150 GRs and 75 VPs.

RESULTS: Our experience has led to a structured framework for running an extensive GR and VP program.

CONCLUSION: Running an extensive GR and VP program can be expensive in terms of time, cost, and effort, which can be initially daunting. However, the rewards more than make up for the investment. The benefits include (a) CME benefits and (b) a networking venue for interaction with clinical colleagues within the department and referring clinical services and with prominent radiologists and scientists from around the world.

AUR Trainee Prize: 3rd Place

(SS02-07) 3:00 PM
Fluoroscopic Sentinel Event: What Is It, Why Should I Care about It, and How Can I Avoid It?

Brent Weinberg, MD, PhD, *University of Texas Southwestern Medical Center, Dallas, TX*; Awais Vance, MD, BS; Gary M. Arbiq, PhD, MS; Jeffrey B. Guild, PhD, MS; Jon Anderson, PhD; David P. Chason, MD (*david.chason@utsouthwestern.edu*)

PURPOSE: Prolonged use of fluoroscopy, particularly during interventional procedures, can place patients at risk for radiation injury. The Joint Commission recently addressed this concern by defining the "fluoroscopic sentinel event." Understanding these events allows the physician to manage and minimize radiation dose and risk.

METHOD AND MATERIALS: In 2005, the Joint Commission defined the *fluoroscopic sentinel event* as prolonged fluoroscopy resulting in a cumulative skin dose of 1500 rad or more to a single field. This dose may be accumulated either with a single procedure or multiple procedures over 6 months to a year and necessitates a root cause analysis. Sentinel event investigations should be triggered by stricter criteria (eg, >600 rad or >150 minutes of fluoroscopic time per procedure). Patient dose can then be calculated by a medical physicist using technique factors, study geometry, reported air kerma, recorded images and runs, and interviews with staff. Common features of these cases were scrutinized to generate recommendations for policies and procedures that could be implemented to minimize radiation dose and risk.

RESULTS: Sixty-four cases meeting criteria for a potential sentinel event were evaluated. Policies and recommendations included specific criteria for selecting potential events, a well-defined path for reporting potential

events, and preserving original image data on the console. Key methods for minimizing radiation dose included using lower frame rates, minimizing run times, and carefully selecting study geometry. Tracking multiple interventional procedures potentially performed across departments and institutions and ill-defined time frames can be major hurdles to collecting data for an exposure calculation.

CONCLUSION: Physicians performing interventional procedures should be aware of how the fluoroscopic sentinel event is defined and what factors contribute to patient skin dose. Clear departmental policies should be developed to identify sentinel events and to avoid excessive radiation exposure to the patient.

(SS02-08) 3:10 PM
Show Me the Money: Current Status of Radiology Business Practice and Health Care Policy Curricula at U.S. Radiology Residency Programs

Jonathan R. Medverd, MD, *University of Washington, Seattle, WA*; Demetrius L. Dicks, MD; Joseph Tang; Christina M. Cinelli; Peter G. Stratil, MD, MBA; Jennifer R. Kohr, MD (*jmed@uw.edu*)

PURPOSE: The purpose is to assess the prevalence, content, and perceptions of curricula focused on radiology business practice and health care policy at U.S. radiology residencies.

METHOD AND MATERIALS: Three surveys were distributed. An online survey was sent to the membership of the Association of Program Directors in Radiology (APDR) by e-mail in June 2010. A similar paper survey was distributed to American College of Radiology (ACR) Resident and Fellow Section (RFS) representatives attending the ACR annual meeting (AM) in May 2010. An abbreviated online survey was sent to the ACR RFS membership by e-mail in December 2009, with a second request in April 2010.

RESULTS: Survey response rates were 20%, 37%, and 12% for APDR (64/315), ACR AM (56/150), and ACR RFS (439/3580), respectively. Geographic distribution of responses mirrored the locations of U.S. residency programs. APDR and ACR RFS membership agreed that a noninterpretive curriculum is important to the future careers of residents. APDR responses suggest that 91% of residency curricula include these topics. However, only one-quarter of respondents devote more than 12 hours of formal instruction to these topics per year, and one-half of programs provide less than 8 hours. University programs were more likely to provide more teaching time to these topics than were community programs. ACR RFS members' perception on time invested in these curricula mirrored APDR membership. However, only 64% from ACR AM and 75% from ACR RFS surveys were aware that curricula were established at their programs. Educational modalities used most often included didactic lectures (96%), journal clubs (42%), small-group activities (21%), discussion panels (10%), and online materials (<10%). APDR and RFS groups most often rated the effectiveness of these curricula as "moderately" effective (45%, 58%, respectively), followed by "marginally" effective (31%, 25%); both groups infrequently rated their curricula as "very" effective (12%, 6%).

CONCLUSION: Program directors and residents value radiology business practice and health care policy education, but our data suggest that current curricula are suboptimal or absent. Commitment to and innovation within these curricula are needed.

(SS02-09) 3:20 PM
Perceptions and Understanding of Authorship and Publication Ethics

Elaine S. Gould, MD; Kenny Lien, MD, *Stony Brook University Medical Center, Stony Brook, NY*; Andrew Maleson, MD, BA (*egould@notes.cc.sunysb.edu*)

PURPOSE: The aim of this study is to survey medical students, residents, and faculty at an academic teaching center regarding the understanding of ICMJE authorship criteria and the role of imaging consultation in assigning authorship. This project was part of an authorship ethics curriculum needs assessment. Hypothesis: Confusion exists concerning authorship criteria.

METHOD AND MATERIALS: A confidential e-mail survey was sent to medical students ($n = 523$), residents/fellows ($n = 649$), and faculty ($n = 700$) at our institution. Respondents were categorized by demographics and publication experience. Participants were asked questions on the ICMJE authorship criteria and given scenarios describing authorship assignment that did not fulfill the criteria. They were asked to agree/disagree

* Faculty financial disclosures are located in the Faculty Index.

with appropriateness of author assignment using a Likert scale. A scenario that describes authorship assignment to a radiologist who only provided images, with no additional input to the manuscript, was given. Participants were also asked whether they would benefit from an educational session on publication ethics.

RESULTS: The survey was sent to 1872 individuals. Responses were collected from 8/01/2010–9/01/2010 and categorized by medical students (MS), residents, and faculty. 63 MS, 57 residents, and 178 faculty members responded to the survey with a response rate of 19.4%, 30.2% of MS, 40.4% of residents, and 48.9% of faculty identified the ICMJE criteria correctly. 15.9% of MS, 12.3% of residents, and 32.5% of faculty strongly agreed that receiving authorship solely by providing images was acceptable. 64.2% responded favorably or neutrally to an educational session. More specifically, 41.6% responded favorably and 22.6% responded neutrally to an educational session.

CONCLUSION: Our survey has shown that the knowledge and perspectives on authorship are varied at our institution. While more faculty members correctly identified the ICMJE criteria, they were more likely as a group to “strongly agree” that strict criteria need not be met to assign authorship. The authors believe that there is a need for a curriculum on ethical authorship, and participants responded favorably to an educational curriculum.

Thursday, April 14, 2011
2:00–3:30 PM

SS03: Scientific Session 3
Cardiopulmonary Radiology; Women’s Imaging
Location: Grand Ballroom E

Moderators: Sanjeev Bhalla, MD*

TBD



(SS03-01) 2:00 PM
Genomic Profiling of Non–Small Cell Lung Cancer for Personalized Targeted Therapy with CT-Guided Transthoracic Needle Biopsy: Technological Assessment

Ritu R. Gill, MBBS*, *Brigham and Women’s Hospital, Boston, MA*; Andetta R. Hunsaker, MD; Pasi A. Janne, MD, PhD; Scott J. Swanson, MD; David M. Jackman, MD; Mohit Butaney, et al

PURPOSE: The purpose is to assess the utility, efficacy, and safety of CT-guided transthoracic core needle biopsy of non–small cell lung cancer (NSCLC) for genomic profiling for targeted therapy.

METHOD AND MATERIALS: Patients with NSCLC underwent CT-guided transthoracic needle biopsy (TTNB) for genetic profiling of their tumors prior to starting chemotherapy, using 18-gauge core biopsy needles (Tempo) after the administration of local anesthetic (2% lidocaine) and intravenous conscious sedation. Adequacy of tissue for genetic profiling was assessed qualitatively by a pathologist, and testing for EGFR and KRAS was performed when tissue was adequate. Frequency and severity of procedural complications, such as pneumothorax, intraparenchymal hemorrhage, and hemoptysis, were recorded, along with hospital admissions and lengths of stay.

RESULTS: Forty-five patients (14 men, 31 women) were biopsied, with an average age of 53.2 years (range, 29–78 years) and an average tumor diameter of 3.9 cm (range, 2.7–5.5 cm). Thirty-nine patients (86.7%) had sufficient tissue for genetic profiling: Fourteen tumors (31.1%) were found to harbor EGFR mutations (exon 19-21 deletions), 10 tumors (22.2%) had KRAS mutation, 13 tumors (28.9%) had neither EGFR nor KRAS mutation, and eight specimens (17.8%) had insufficient tissue for mutational analysis. Twenty-one patients (46.7%) had small pneumothoraces (<10%). Three patients (6.7%) required chest tube placement and admission, two of whom were discharged the following day, while one patient was admitted for 3 days. Three patients (6.7%) had grade I hemoptysis. Forty-two (93.3%) patients were discharged home with follow-up instructions.

CONCLUSION: CT-guided TTNB is a feasible, safe, and efficacious technique for genomic profiling for targeted therapy and enables personalized therapy based on mutational analysis.

(SS03-02) 2:10 PM
Presurgical Planning for Resection of Non–Small Cell Lung Carcinoma: Comparison of Combined Use of CT and PET/CT to CT Imaging Alone

Charlie Mullan, *Altnagelvin Area Hospital, Derry, Northern Ireland*; Francine Jacobson; Andetta R. Hunsaker, MD (*cpmullan@hotmail.com*)

PURPOSE: The purpose is to determine if the combined use of CT and PET/CT improves the accuracy of presurgical assessment of non–small cell lung cancer (NSCLC), in comparison to CT imaging alone.

METHOD AND MATERIALS: The medical records of all patients undergoing surgical resection of NSCLC at our institution during a 2-year period were reviewed retrospectively. The study population consisted of 101 patients who had both CT and PET/CT imaging performed within 60 days prior to surgery. The surgical and pathologic findings were correlated with the final approved report of CT and PET/CT examinations performed prior to surgery. The accuracy of both imaging modalities was compared with surgical-pathologic findings. In cases of discrepancy between the imaging report and surgical-pathologic findings, the PET/CT and CT scan were reviewed by an experienced staff radiologist.

RESULTS: Seven patients had pneumonectomy, one patient had bilobectomy, 48 patients had lobectomy, and 45 patients had segmentectomy or wedge resection performed. Combined interpretation of the reports of CT and PET/CT accurately predicted the surgical-pathologic stage in 83 cases (82.2%), in comparison to 79 cases (78.2%) when the report of CT was used alone. Three patients had lesions identified on CT or PET/CT report that were not sampled during mediastinoscopy or surgical resection. Combined CT and PET/CT predicted more-extensive disease than found on pathologic analysis in 11 patients, in comparison to 15 patients for CT imaging alone. Combined CT and PET/CT predicted less-extensive disease than found on pathologic analysis in three patients, with the same number of subjects being understaged by CT imaging alone.

CONCLUSION: Noninvasive imaging remains an important factor in presurgical planning. The combined use of CT and PET/CT imaging did not significantly increase the accuracy of presurgical planning, in comparison to CT alone.

(SS03-03) 2:20 PM
Relapsing Polycondritis of the Proximal and Distal Airways: CT Findings in 29 Patients

Janneth Romero, MD, BS, *Beth Israel Deaconess Medical Center, Boston, MA*; Alexander Bankier, BS, MD; Phillip M. Boiselle, MD (*pboisell@bidmc.harvard.edu*)

PURPOSE: The purpose is to determine the frequency of inspiratory and expiratory CT findings in the proximal and distal airways in symptomatic patients with relapsing polycondritis (RP).

METHOD AND MATERIALS: A series of 29 consecutive symptomatic RP patients were referred for paired inspiratory-expiratory CT from January 2000 to December 2007. The study cohort included 21 women and eight men, with mean age of 52 (range, 24–75 years). In all patients, CT was performed by using a standard protocol, with end-inspiratory and dynamic expiratory imaging from the glottic region to the lower lobe bronchi. Expiratory CT was technically suboptimal in one case, resulting in 29 inspiratory sequences and 28 expiratory sequences available for review. Two thoracic radiologists retrospectively reviewed CT scans by consensus agreement for the following abnormalities: stenosis (>25% luminal diameter narrowing compared to an uninvolved segment); wall thickening (>2 mm) and calcification; airway malacia (>50% expiratory reduction in cross-sectional area); and airtrapping (>25% of lung parenchyma failing to increase in density or to decrease in volume during expiration).

RESULTS: Inspiratory CT was abnormal in 24 (83%) of 29 patients. Airway wall thickening was present in 22 (76%) of 29 patients, involving the following regions: subglottic, 12 (54%); intrathoracic trachea, 19 (86%); main bronchi, 16 (73%); lobar bronchi, 8 (36%); segmental bronchi, 7 (32%); and subsegmental bronchi, 1 (5%). Wall thickening spared the posterior membranous wall of the intrathoracic trachea in 16 (84%) of 19 cases but was circumferential in all 12 cases of subglottic stenosis. Both regions showed the same frequency (58%) of airway wall calcification. Stenoses were present in 21 (72%) of 29 patients, involving the following regions: subglottic, 12 (57%); intrathoracic trachea, 13 (70%); and bronchi, 15 (71%). Expiratory CT was abnormal in 27 (96%) of 28 patients and demonstrated malacia in 19 (68%) and airtrapping in 27 (96%).

* Faculty financial disclosures are located in the Faculty Index.

CONCLUSION: Anatomical and functional airway abnormalities are common in symptomatic RP patients and frequently coexist. Thus, CT imaging of these patients should routinely include both inspiratory and expiratory sequences.

(SS03-04) 2:30 PM
CT-based Triage for Disseminated Histoplasmosis

Muhammad O. Afzal, MD, MBBS, *University of Tennessee/Methodist Healthcare, Memphis, TN*

PURPOSE: Histoplasmosis is the most prevalent endemic mycosis in the United States, usually causing mild and self-limited infection. In immunodeficient individuals, histoplasmosis is associated with a severe disseminated and life-threatening condition. Amphotericin B lipid complex (Abelcet), an effective treatment, is expensive and associated with many adverse reactions, including death. Due to these factors, early diagnosis is critical. Diagnosis requires clinical suspicion along with multiple laboratory tests, none of which is specific. Final diagnosis rests on isolation of the fungus in cultures of body fluid or organ biopsy, which usually require 2–4 weeks. We evaluate the efficacy of computed tomography (CT) for early diagnosis of disseminated histoplasmosis using a CT scoring system.

METHOD AND MATERIALS: In this retrospective study, we enrolled 40 patients with confirmed disseminated histoplasmosis based on positive blood cultures and 50 patients who were suspected of having the disease but whose blood cultures were eventually negative. Both groups were matched for age (20–50 years) and underlying disease (HIV, AIDS) and received amphotericin B lipid complex (Abelcet). Charts, labs, and CT images of all of these patients were reviewed. On CT, lymphadenopathy, hepatomegaly, splenomegaly, splenic hypodensities, adrenal nodularity, and lymph node calcification were used as markers of disease. Scores of 0 and 1 were assigned to normal and abnormal findings, respectively. For lymph nodes, scores of 0–3 were used, with 0 being normal and 3 being large necrotic nodes. Net score was calculated using all of the positive findings.

RESULTS: In the 40 patients with disseminated histoplasmosis, the average CT score was 4.3, while in the control group, the average score was 1.6. Using 4 as a cutoff criterion, CT-based triage had a 74% sensitivity, 89% specificity, 80% PPV, and 85% NPV. The most striking finding was adrenal nodularity, with 88% specificity and 62% sensitivity.

CONCLUSION: CT is an effective diagnostic tool in the setting of disseminated histoplasmosis, with good sensitivity and high specificity. Adrenal nodularity is highly specific for the disease, and lymphadenopathy was the most sensitive finding in our study.

(SS03-05) 2:40 PM
Prospective Gated 64-Slice CT in Assessment of Coronary Artery Disease: A Single Center's Experience and the Relation of Body Mass Index to Outcomes

Amit A. Habbu, MD, MPH, *Rochester General Hospital, Rochester, NY*; Irina Cech, PhD, MS; Wendell C. Taylor, MPH, PhD, MS; Pamela Polashenksi, MD, MPH (amit.habbu@rochestergeneral.org)

PURPOSE: Coronary angiography (CA) is the gold standard test to investigate coronary artery disease. Since prospective gated 64-slice CT (CT) is a relatively new noninvasive diagnostic test, patients may still end up needing a CA if either the CT study quality is poor or the scan shows significant disease. Since both studies (CA and CT) involve contrast and radiation, it would be best to avoid both in the same patient. The prevalence of adult obesity in 2004 was 33%. Therefore, it would be of interest to know the effect of BMI on prospective 64-slice CT, in terms of the need for repeat CA and the quality of CT. The aim of the current study was to examine the effect of BMI on the need for CA after CT and the quality of the CT.

METHOD AND MATERIALS: The inclusion criteria were all patients who underwent CT from January 1, 2008 to December 31, 2008. Excluded were (a) patients who underwent CT for reasons other than evaluation of CAD, (b) patients not from the cardiology outpatient office, and (c) CT scans done to test the system. Although no sample size was calculated, the power of the study was estimated, and the recommended sample size for future studies, based on the current results, was measured.

RESULTS: Sixty-two patients were included in the final analysis. The mean age was 56.2 years, and mean BMI was 31.3 kg/m². Eight patients underwent a CA within 1 month of CT. Eight patients had a poor-quality CT. There was significant association of higher BMI as a factor for occurrence of CA after CT ($P < .05$). There was a trend but no statistical signifi-

cance was observed for the association of being obese and occurrence of CA ($P = .06$). BMI and obesity were not found to be significantly associated with poor quality of CT ($P = .19$ and $P = .76$, respectively).

CONCLUSION: Higher BMI was significantly associated with occurrence of CA within 1 month of CT. A trend but no statistical significance was observed for being obese and occurrence of CA. Thus, in patients with a higher BMI, diagnostic investigation with both tests could be avoided; instead, only CA could be performed. However, the relationship of BMI to the quality of CT needs to be further investigated, since the sample size of the current study was small.

(SS03-06) 2:50 PM
Evaluation of the Microinsert Procedure by Hysterosalpingogram

Ashley D. Abramson, MD, BS, *Beaumont Hospital, Royal Oak, MI*; Syed Z. Jafri, MD; Katie Reed; Hanh V. Nghiem (ashley.abramson@beaumont.edu)

PURPOSE: The microinsert (Essure) procedure is a relatively new, minimally invasive procedure for permanent sterilization of women. In this procedure, coils are placed into each fallopian tube through a transcervical approach by using hysteroscopy. The device itself, as well as the body's fibrotic reaction to the device, leads to occlusion of the fallopian tube. This occlusion is evaluated by hysterosalpingogram, usually performed approximately 3 months after the procedure. This research evaluates the outcome of the microinsert procedure as evaluated by HSG. Additional findings related to the uterus or other pelvic organs are also analyzed.

METHOD AND MATERIALS: Images and reports from 150 patients who underwent hysterosalpingogram for follow-up of prior microinsert procedure for permanent sterilization were evaluated.

RESULTS: Twenty of the 150 patients had evidence of microinsert procedure failure (patent fallopian tube[s]) on follow-up hysterosalpingogram. Of the 20 patients, 11 underwent repeat HSG, four went directly to tubal ligation, and the treatment of the remaining five is unknown. Eight of the 11 who underwent repeat HSG showed tubal occlusion on the repeat studies. The remaining three of the 11 showed persistent tubal patency, and of these, one patient is known to have subsequently undergone tubal ligation.

CONCLUSION: The microinsert procedure, as evaluated by hysterosalpingogram, is a successful, minimally invasive method of permanent female sterilization.

(SS03-07) 3:00 PM
Assessment of Qualitative and Quantitative Measures of Breast Arterial Calcifications Seen on Digital Mammograms and Association with Cardiovascular Disease Risk

Elodia Cole, MS*; Kenneth L. Crosby, MD, *University of North Carolina, Chapel Hill, NC*; Dinggang Shen; Donglin Zeng, PhD; Cherie Kuzmiak; Etta D. Pisano, MD*

PURPOSE: The purpose is to assess qualitative and quantitative measures of breast arterial calcifications (BACs) from digital screening mammograms and to determine if BACs seen on mammograms correspond to cardiovascular disease risk.

METHOD AND MATERIALS: We collected 40 digital screening mammograms of women seen at UNC mammography clinic between May 2007 and May 2008 who were at least 40 years of age. The screening mammograms of 20 women with known history of cardiovascular disease (cases) were randomly selected from screening mammograms acquired during this period. Similarly, the screening mammograms of 20 women without a history of cardiovascular disease (controls) were randomly selected from screening mammograms acquired during this same period. The cases and controls were matched by year of mammogram and patient age (± 1 year). The case cohort was comprised of women who underwent screening mammography with a documented history of cardiovascular disease. The control cohort was comprised of women who underwent screening mammography during the time frame without a history of cardiovascular disease. Five radiologists were included in the reader study, where they each reviewed all 40 digital mammograms selected for inclusion. Readers were asked to specify the presence of breast arterial calcifications and to provide an assessment of the severity of BACs by quantifying the number of calcified arteries seen and, with the use of a software program, to calculate percent area of calcifications within breast arteries.

* Faculty financial disclosures are located in the Faculty Index.

RESULTS: There was no significant association found between CVD and the presence of BACs ($P = .207$), even after controlling for possible confounding variables such as age, race, and diabetes status. There was no significant association between CVD and the number of calcified breast arteries ($P = .559$) identified by radiologists. There was no significant association between CVD and the percentage of calcifications in breast arteries ($P = .971$). There was very little variation in BAC assessment for four out of five radiologists.

CONCLUSION: The presence of breast arterial calcifications on digital mammograms does not appear to be correlated with risk of cardiovascular disease.

(SS03-08) 3:10 PM

Dynamic Contrast-enhanced MR Imaging for Prediction of Pathologic Response to Neoadjuvant Chemotherapy in Breast Cancer Patients

Amar P. Patel, MD, *Tu and Yuen Center for Functional Onco-Imaging, University of California, Irvine, Irvine, CA*; Daniel Chang; Jeon-Hor Chen; Muqing Lin; Rita S. Mehta; Min-Ying Su, et al (amarppatel@gmail.com)

PURPOSE: The purpose was to determine if changes in dynamic contrast-enhanced (DCE) MRI pharmacokinetic parameters can be used to predict which patients achieve pathologic complete response (pCR).

METHOD AND MATERIALS: Fifty-seven patients (mean age, 49 ± 10 years) received neoadjuvant chemotherapy (NAC) and underwent DCE-MRI; 26 patients were *HER2* positive, and 31 patients were *HER2* negative. All patients received doxorubicin and cyclophosphamide (AC) followed by a taxane regimen. *HER2*-positive patients received trastuzumab with taxane. DCE-MRIs were obtained before NAC and at first follow-up, which was after two cycles of AC. For each MRI study, the whole-tumor region of interest (ROI) was drawn manually, slice by slice. A computer algorithm selected and labeled the hot spot that showed the greatest percentage enhancement within each ROI. Enhancement kinetics from the whole tumor and hot spot were fitted with the Tofts model to obtain the transfer constant (K_{trans}) and rate constant (k_{ep}). Pathology samples were categorized as pCR or non-pCR. The ability of pharmacokinetic parameters to predict pCR was analyzed by using paired two-tailed *t* tests. An artificial neural network was also used to select a classifier based on K_{trans} and k_{ep} parameters that could predict pCR. Receiver operating characteristic (ROC) analysis was performed, and the area under the ROC curve (AUROC) was examined.

RESULTS: Thirty patients (30/57; 53%) achieved pCR, including 19 *HER2*-positive (19/26; 73%) and 11 *HER2*-negative (11/31; 35%) patients. In the pCR group, the hot spot K_{trans} value at the first follow-up was lower compared to the pretreatment value ($P < .05$). There was no significant difference in K_{trans} or k_{ep} between the pCR and non-pCR group. The AUROC to differentiate between pCR and non-pCR was 0.76.

CONCLUSION: With a 53% pCR rate, the NAC regimen used was effective, especially in *HER2*-positive patients (73%) who received trastuzumab with taxane. While DCE-MRI pharmacokinetic parameters may not strongly predict pCR after patients received only two cycles of AC, further analysis after the administration of trastuzumab with the taxane regimen may demonstrate a higher accuracy in prediction because pCR is most likely achieved by using targeted therapy with trastuzumab.

(SS03-09) 3:20 PM

Accuracy of Sonoelastographic Scoring for Differentiation of Malignant and Benign Breast Abnormalities: A Systematic Review

Gelareh Sadigh, *University of Michigan, Ann Arbor, MI*; Ben A. Dwamena, MD (bdwamena@med.umich.edu)

PURPOSE: Ultrasound elastography (USE) is a noninvasive imaging method for differentiating between benign and malignant solid breast masses. By measuring the breast tissue strain, USE can improve the accuracy of conventional B-mode ultrasound (USB). We systematically reviewed literature on diagnostic accuracy of USE for characterizing breast masses according to Cochrane Diagnostic Test Accuracy Working Group guidelines.

METHOD AND MATERIALS: We conducted an extensive literature search of PubMed and other medical databases through to September 2010 and cross-citation with reference lists of identified studies. Published studies in the English or German language evaluating the diagnostic performance of USE for characterization of focal breast lesions, using cytology

(fine-needle aspiration) or histology (core biopsy) as reference standard(s), were included. Methodological quality of the eligible studies was assessed in duplicate by using 11 items of the extensively validated Quality Assessment of Diagnostic Accuracy Studies (QUADAS) checklist.

RESULTS: Eighteen studies provided relevant information on 4293 breast masses, 1492 of which were malignant. Over 70% of the studies may have suffered from incorporation bias. None of the studies indicated whether or not interpreters of reference standard(s) were blinded to index test result. Summary test operating measures for USE were a sensitivity of 0.82 (95% confidence interval [CI], 0.78–0.85) and specificity of 0.88 (95% CI, 0.82–0.92). The positive and negative likelihood ratios were 6.6 (95% CI, 4.5–9.6) and 0.21 (95% CI, 0.17–0.25), respectively. The area under the summary ROC curve was 0.89 (95% CI, 0.87–0.94), compatible with a good test accuracy. There was significant heterogeneity across studies (inconsistency index [*I*²] = 99.95%; $P < .001$), 44% of which may be due to threshold variability. Funnel plot and linear regression showed no evidence of publication bias.

CONCLUSION: USE has good diagnostic performance for distinguishing benign from malignant breast masses. However, it is not certain if this performance is incrementally superior to that of USB, translates into improved patient outcomes, or will engender cost-effective clinical practice and societal investment.

Thursday, April 14, 2011

2:00–3:30 PM

SS04: Scientific Session 4

Musculoskeletal Radiology

Location: Commonwealth Ballroom AB

Moderator: Barbara N. Weissman, MD*



(SS04-01) 2:00 PM

Shoulder MR Imaging after Trauma: What Synovial Injuries Are Relevant?

Majid Chalian, MD, *Johns Hopkins Hospital, Baltimore, MD*; Theodoros Soldatos, MD; Neda Faridian-Aragh, MD; John A. Carrino, MD, MPH*; Avneesh Chhabra, MD* (mchalia1@jhmi.edu)

PURPOSE: The purpose is to determine the magnetic resonance (MR) findings relevant to synovial injury in patients with and without acute shoulder trauma.

METHOD AND MATERIALS: We evaluated consecutive shoulder MR imaging exams performed over a 9-month period. The MR studies were performed on a 1.5-T scanner. All examinations were interpreted in consensus by two musculoskeletal radiologists, blinded to the clinical information. Various findings relevant to synovial injury were studied, such as the presence of capsular rupture/diverticulum; bursal (subacromial-subdeltoid [SASD], subcoracoid [SC], and subscapularis [SS]) rupture/diverticulum; biceps tendon sheath (BTS) rupture/diverticulum; ganglion cyst; sequelae of previous shoulder dislocation, including Hill-Sachs deformity; and geysier phenomenon. The patient population was divided into a study group, which included subjects with positive MR findings, and a control group, which included subjects without any of the aforementioned MR findings. The patients' medical records were reviewed to assess for a history of acute trauma. A value of $P < .05$ was accepted as significant.

RESULTS: A total of 309 MR studies (185 M/124 F; 49 ± 15 years old) were evaluated. Of these individuals, 56 were included in the study group and 253 in the control group. There was no statistical difference in age and gender between the two groups. Compared to the control individuals, the subjects of the study group exhibited a higher incidence of trauma. In the study group, the incidences of capsular rupture and SASD bursal rupture were higher among patients with trauma, whereas the incidences of BTS diverticulum and ganglion cysts were higher in subjects without trauma. There was no difference in the frequency of capsular diverticulum, SC/SS bursal rupture, bursal diverticulum, biceps tendon sheath rupture, geysier phenomenon, and Hill-Sachs deformity between subjects with and without trauma.

CONCLUSION: Although not previously reported, findings of the presence of capsular rupture and SASD bursal rupture in MR examinations of the shoulder are strongly suggestive of a recent history of shoulder trauma.

* Faculty financial disclosures are located in the Faculty Index.

The above findings should alert the MR reader to assess for other trauma-related shoulder internal derangement findings, if such a history has not been provided.

(SS04-02) 2:10 PM
High-Resolution 3-T MR Neurography in Sciatic Neuropathy

Avneesh Chhabra, MD*, *Johns Hopkins Medical Center, Baltimore, MD*; Theodoros Soldatos, MD; Majid Chalian, MD; Neda Faridian-Aragh, MD; John A. Carrino, MD, MPH* (*achhabr6@jhmi.edu*)

PURPOSE: The purpose of this study was to illustrate the qualitative and quantitative 3-T MR neurography criteria in patients with clinically diagnosed sciatic neuropathy.

METHOD AND MATERIALS: The imaging database of our institution was searched for MR neurography examinations of the pelvis and thighs performed over a period of 3 years (from September 2007 to August 2010). This search yielded 36 examinations, of which four were excluded due to inadequate imaging quality related to motion artifacts. Subsequently, the clinical and electrodiagnostic laboratory records of the respective subjects were reviewed for the diagnosis of sciatic neuropathy. From the 32 patients (11 males, 21 females; mean age, 51 ± 14 years) of the total study population, 15 had a surgical or electrodiagnostic confirmation of sciatic neuropathy, whereas the remaining 17 had no clinical diagnostic evidence of sciatic neuropathy and served as controls. All studies were performed with 3-T MRI using high-resolution protocol. In all studies, sciatic nerve signal characteristics, size, signal intensity (SI) ratio of nerve versus adjacent vein, fascicular abnormality, and regional muscle changes, such as edema-like signal, fatty replacement, and atrophy, were evaluated.

RESULTS: There were statistically significant differences between study and control groups with respect to nerve-vessel SI ratio (1.31 ± 0.27 vs 0.67 ± 0.27 ; $P < .05$), when abnormal and normal sides were compared. These differences persisted (1.31 ± 0.27 vs 0.65 ± 0.21 ; $P < .05$), even when all normal sides (of controls and neuropathy subjects) were compared to the abnormal side of study subjects. Significant differences were also found in nerve signal, size, fascicle abnormality, and muscle denervation changes.

CONCLUSION: 3-T MR neurography is a valuable diagnostic tool in clinically suspected cases of sciatic neuropathy, as it can directly demonstrate the nerve abnormality, as well as secondary muscle denervation changes. Apart from qualitative parameters of fascicular abnormality and nerve enlargement, an increasing nerve-vessel signal intensity ratio is a useful quantitative parameter for the confirmation of sciatic neuropathy.

(SS04-03) 2:20 PM
High-Resolution 3-T MR Neurography in Suprascapular Neuropathy

Avneesh Chhabra, MD*, *Johns Hopkins Medical Center, Baltimore, MD*; Majid Chalian, MD; Theodoros Soldatos, MD; John A. Carrino, MD, MPH* (*achhabr6@jhmi.edu*)

PURPOSE: The purpose of this prospective study was to illustrate the imaging findings of high-resolution 3-T MR neurography in patients with clinically suspected suprascapular neuropathy.

METHOD AND MATERIALS: High-resolution 3-T MR neurography was performed in seven patients with clinically suspected suprascapular neuropathy. The diagnosis was confirmed by electrodiagnostic studies, clinical, and/or surgical follow-up examinations.

RESULTS: In all cases, MR neurography depicted asymmetric enlargement and abnormal T2 hyperintensity of C5/C6 brachial plexus nerve roots, upper cervical trunk, and suprascapular nerve. MR findings of denervation changes in supraspinatus and infraspinatus muscles were detected ipsilaterally in all patients. Contrast-enhanced imaging confirmed the abnormal muscular findings relevant to suprascapular neuropathy but did not provide additional information regarding nerve abnormality.

CONCLUSION: 3-T MR neurography is a valuable diagnostic tool in clinically suspected cases of suprascapular neuropathy, as it can directly demonstrate the nerve abnormality, as well as secondary muscle denervation changes.

(SS04-04) 2:30 PM
Additional Imaging in Axial Oblique Plane to Increase Detection Rate and Diagnostic Confidence Level of Acetabular Labral Tears in MR Arthrography of the Hip

Murthy R. Chamrathy, MD, MS, *Bridgeport Hospital, Bridgeport, CT*; Ruben Kier, MD; Shrey K. Thawait, MD; Lawrence D. Lo, MD

PURPOSE: The purpose of this study was to find out the additional value of axial oblique fat-saturated proton density (FS PD) images in diagnosis of acetabular labral tear utilizing magnetic resonance (MR) arthrographic imaging of the hip. Most of these tears occur in the anterior superior labral location, which limits evaluation on conventional T1 fat-saturated images in the axial, coronal, and sagittal planes.

METHOD AND MATERIALS: Institutional review board approval was obtained for this HIPAA-compliant study. Informed consent was waived. MR arthrograms of the hip (1.5 and 3 T) performed at our institution from August to October 2010 were reviewed retrospectively. Patients who were imaged with axial oblique FS PD sequence along with standard coronal, sagittal, and axial planes were included in the study. Two radiologists with fellowship training in musculoskeletal MRI blinded to the final diagnosis reviewed all of the standard coronal, sagittal, and axial MR arthrogram images with and without the additional axial oblique FS PD images. The reviewers evaluated for presence or absence of an acetabular labral tear on axial oblique FS PD planes in comparison to the standard planes. If an additional confidence level for diagnosis of tear was provided from the axial oblique sequence, it was recorded.

RESULTS: A total of 37 patients (25 females, 12 males; age range, 14–60; mean, 32.6) met the study criteria and were included in the analysis. Review of routine orthogonal sequences permitted diagnosis of labral tear in 19 of 37 patients (51%). The additional axial oblique FS PD sequences allowed diagnosis of tear in an additional 8/37 (22%) and an increased confidence of tear in 17/37 (46%) patients. Surgical confirmation data are not yet complete and will be provided at the time of presentation. Interobserver agreement measures will be provided.

CONCLUSION: This retrospective study shows that the addition of axial oblique FS PD images to the standard MR arthrogram protocol resulted in both increased detection of acetabular labral tears not seen on routine orthogonal views and an increased confidence in diagnosis of tears suspected on routine orthogonal views.

(SS04-05) 2:40 PM
Verification Bias: An Underrecognized Source of Error in Assessing the Efficacy of Meniscal MR Imaging

Michael L. Richardson, MD, *University of Washington, Seattle, WA*; Jonelle M. Petscavage, MD (*mrich@uw.edu*)

PURPOSE: Sensitivity and specificity of MRI in the diagnosis of meniscal tears have been extensively studied—usually relying on arthroscopic verification of meniscal tears. However, surgically unverified cases are often not considered in the sensitivity and specificity calculations. This leads to verification or work-up bias, which can falsely increase the sensitivity and decrease the specificity estimates. Our study suggests that verification bias is common and offers techniques for dealing with this potential bias.

METHOD AND MATERIALS: PubMed was searched for articles estimating the sensitivity and specificity of MRI for meniscal tears. These articles were reviewed to determine the possibility of verification bias, which was defined as potentially present if the study included any patients whose MRI findings were not surgically verified. A retrospective global sensitivity analysis (GSA) was performed on reports that included sufficient information about unverified patients.

RESULTS: A total of 314 studies were retrieved from the PubMed keyword search; 43 of the 314 had available PDF files. All 43 studies included unverified patients and hence potential verification bias. Only six articles included sufficient information to perform GSA analyses. Of these, only two showed no obvious verification bias. One article showed definite bias, and three others showed bias within certain ranges of disease prevalence. Only four of these six articles acknowledged the possibility of verification bias.

CONCLUSION: Verification bias is a common source of bias in published estimates of the sensitivity and specificity of meniscal MRI. When possible, it should be avoided by proper study design. When it cannot be avoided, it should be acknowledged, and unverified proportions should be published.

* Faculty financial disclosures are located in the Faculty Index.

Online software makes it easy for investigators to use global sensitivity analysis to demonstrate potential verification bias and to estimate corrected values of sensitivity and specificity. Readers should keep this bias in mind when using reported values of these indices to make clinical decisions.

(SS04-06) 2:50 PM
Use of ACR Appropriateness Criteria® for Imaging of Acute Cervical Spine Injury

Kiran Sheikh, MD, BA, *New York-Presbyterian Hospital, Weill Cornell Medical Center, New York, NY*; Michael Baad, BS; Lily M. Belfi, BA, MD; Pina C. Sanelli, MD, MPH

PURPOSE: The purpose is to evaluate the rate of acute cervical spine injury and the use of radiography and CT imaging with the established American College of Radiology (ACR) Appropriateness Criteria®.

METHOD AND MATERIALS: A retrospective review of all radiographs and CT imaging of the cervical spine was performed in adult patients presenting with suspected acute blunt cervical spine trauma from July 2009 to July 2010. Exclusion criteria were children ≤ 17 years, nonacute trauma of ≥ 72 hours, and penetrating trauma. All acute cervical spine fractures were designated as “clinically significant acute cervical spine injury” except if they involved the transverse process (with no involvement of the facet joint), spinous process (with no involvement of the lamina), or an osteophyte (not “corner” or “teardrop” fractures). In patients who had both radiographs and CT imaging of the cervical spine, the ACR Appropriateness Criteria® were used to evaluate the appropriateness of the use of imaging.

RESULTS: A total of 906 cervical spine imaging studies were reviewed; 15% (140/906) were cervical spine radiographs, and 85% (766/906) were CT exams. According to age stratification, 285 patients were 18–39 years old, 299 were 40–65 years old, and 322 were ≥ 65 years old. A total of 12/906 studies (1.3%) demonstrated clinically significant acute cervical spine injury (92% on CT; 8% on radiographs). There were 28 patients who had both cervical spine radiographs and CT imaging. By using the ACR guidelines for acute cervical spine trauma, 32% (9/28) of patients inappropriately had cervical spine radiographs before CT imaging was performed.

CONCLUSION: In adult patients presenting with acute cervical spine injury at our institution, there is a 1.3% incidence of clinically significant acute cervical spine fractures (comparable to the 1.7% incidence in the National Emergency X-Radiography Utilization Study [NEXUS]), demonstrating that the vast majority of cervical spine imaging for acute trauma results in negative studies. By using these baseline data, our plan is to implement the established ACR criteria as a quality improvement project to elucidate the effectiveness of these guidelines in decreasing the amount of unnecessary cervical spine imaging.

(SS04-07) 3:00 PM
Cysts within and Adjacent to the Lesser Tuberosity: Correlation with Shoulder Arthroscopy

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PURPOSE: The purpose of our study is to determine if cysts in and adjacent to the lesser tuberosity are associated with rotator cuff pathology found at arthroscopy.

METHOD AND MATERIALS: A retrospective review of 286 consecutive arthroscopic procedures performed by a single orthopedic shoulder surgeon from February 2001 to June 2009 was compared to magnetic resonance (MR) imaging of the shoulder. Images were reviewed by an experienced fellowship-trained musculoskeletal radiologist, reader 1, and a musculoskeletal fellow, reader 2, for the presence and location of lesser tuberosity cysts. Cysts were grouped by their location into those within the lesser tuberosity and those adjacent to the lesser tuberosity. Interreader agreement was calculated by using κ values.

RESULTS: A total of 26 patients (17 men, 9 women; age range, 14–84 years; mean, 61 years), had cysts in or adjacent to the lesser tuberosity. For reader 1, patients with cysts located in the lesser tuberosity were found to be significantly older ($P = .03$) and more likely to have subscapularis tendon tears ($P = .02$) than patients with cysts located adjacent to the tuberosity. For reader 2, no significant differences were identified in any category between patients with a cyst located in the lesser tuberosity and those adjacent to the tuberosity. Interreader agreement of imaging findings varied from fair to nearly perfect agreement.

CONCLUSION: Cysts located in the lesser tuberosity at the insertion of the subscapularis tendon are indicative of subscapularis tendon pathology and occur in older individuals.

(SS04-08) 3:10 PM
Resorption of the Femoral Head after Acetabular Fracture: A Rarely Discussed Complication

Durga Singh, MD, *University of Rochester, Rochester, NY*; Meena Moorthy, MD; Gwy Suk Seo, MD, PhD; Kenneth Badillo, MD; Johnny U. Monu, MD (meena_moorthy@urmc.rochester.edu)

PURPOSE: Resorption of the femoral head (RFH) has been described in association with previous situations, including steroid treatment and neuro-osteopathy. We have, however, observed cases of RFH after significant or complex acetabular fractures. We present our observations in an effort to improve understanding of this phenomenon.

METHOD AND MATERIALS: Our hospital database over the past 6–8 months was searched for cases of acetabular fractures that resulted in RFH. Radiographs, CT, and MR images were used to determine the extent or severity of injury and to assess for the presence of and pattern of osteolysis. The presence of osteopenia, osteoarthritis, and other comorbidities were noted. The radiologic findings were correlated with clinical information.

RESULTS: During this period, 166 patients were found with significant or complex acetabular fractures. Ten patients (M:F = 6:4) aged between 45 and 84 years from this group were found with RFH. Three patients had posterior dislocation. Six had central dislocation, and one patient had no dislocation but had a comminuted fracture of the acetabulum. Eight patients showed the eccentric type and two had the transcervical type of osteolysis. In two, the eccentric-type osteolysis subsequently evolved into the basicervical type. CT showed bony fragmentation and debris ($n = 5$). MRI showed pannus-like features in one case. Comorbidities included chronic renal disease ($n = 5$), diabetes mellitus ($n = 4$), steroid use ($n = 2$), hypothyroidism ($n = 2$), and carcinomas ($n = 2$).

CONCLUSION: RFH is not an uncommon complication after acetabular fractures. It may present imaging features similar to osteolysis of the femoral head associated with entities like steroid use or the so-called rapidly progressive osteoarthritis. We propose that this is an atypical response to trauma—posttraumatic osteolysis.

(SS04-09) 3:20 PM
Traumatic, Nontraumatic, and Postoperative Tears of the Deltoid: A Prospective Study and Pictorial Essay

Pratima Karia, MD, *Wayne State University, Detroit, MI*; Vijay Karia; Peter Miller

PURPOSE: Rupture or dehiscence of the deltoid muscle at the acromial origin is a well-recognized complication following open rotator cuff repair or open acromioplasty and has been described extensively. Tears of the deltoid muscle or tendon associated with rotator cuff tears in patients without prior surgical intervention have also been previously reported. To our knowledge, there have been only a few isolated case reports of traumatic deltoid disruptions, and the imaging findings of this entity have not been described except twice in a case report in orthopedic literature only. We report, in 26 patients, the MRI findings of deltoid muscle and tendon tears, most of which were traumatic.

METHOD AND MATERIALS: Deltoid tears were prospectively recorded by two experienced musculoskeletal radiologists in two institutions from February 2008 to February 2009. The MRI examinations were re-reviewed, in consensus and in a nonblinded fashion, to evaluate the location of the deltoid tears, the presence of rotator cuff tears, the degree of tendon retraction, and other associated imaging findings. The etiology of the tear was also determined.

RESULTS: The incidence of deltoid tears is 5.4% in patients with rotator cuff tears. The age range was 21–79 years. The right side was involved in 15 cases and the left in 11 cases. Only five were full thickness; the remainder of them were partial thickness. Full-thickness tears of the muscle belly were all posttraumatic in origin. Among the partial tears, 14 were at the acromion attachment site, five were bursal surface, and two were at the clavicular attachment. Shoulder pain was the most common presenting symptom. Most patients had limited range of motion and difficulty raising the arm above the head.

* Faculty financial disclosures are located in the Faculty Index.

CONCLUSION: Tears of the deltoid muscle or tendon are an unusual finding. They can be traumatic and nontraumatic in origin and are mostly seen in association with or are secondary to rotator cuff tears. Most postoperative dehiscence or attrition is located at the acromion origin, as previously described in the literature. Associated findings such as intramuscular cyst or ganglion in the deltoid muscle belly in a patient with a rotator cuff tear should raise the suspicion of a deltoid tear.

Thursday, April 14, 2011
2:00–3:30 PM

SS05: Scientific Session 5
Neuroradiology; Interventional Radiology
Location: Commonwealth Ballroom C
Moderators: Carolyn C. Meltzer, MD
Donald P. Harrington, MD, MA



(SS05-01) 2:00 PM
Posttreatment Relative Cerebral Blood Volume and Percentage Change in Relative Cerebral Blood Volume Can Help to Distinguish Pseudoproggression from True Progression of Glioblastoma after Radiation Therapy and Temozolomide

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PURPOSE: The purpose is to assess the role of posttreatment relative cerebral blood volume (rCBV) and the percentage change in rCBV in the phenomenon of pseudoproggression of glioblastoma after radiation therapy and temozolomide (RT/TMZ).

METHOD AND MATERIALS: Institutional review board approval was obtained, and HIPAA compliance was followed. The findings in 36 patients (24 male; median age, 61 years) with glioblastoma treated with RT/TMZ were retrospectively reviewed. Clinical and conventional magnetic resonance (MR) imaging and perfusion parameters like posttreatment rCBV and percentage change of rCBV were evaluated as potential predictors of pseudoproggression.

RESULTS: Of the 36 patients, 19 patients had increase in the size of tumor on contrast-enhanced images that was suggestive of progression/pseudoproggression. On subsequent follow-up, the tumor in seven of these 19 patients showed a decrease in size or remained stable on two subsequent MRI examinations without any intervention. These seven patients, who were assumed to have had pseudoproggression, had a mean decrease in rCBV of 41%. The remaining 12 patients showed true progression on the follow-up imaging, with a mean increase in rCBV of 12%. The mean posttreatment rCBV was 5.22 in the progression group and 2.54 in the pseudoproggression group. The ROC analysis for differentiating between progression and pseudoproggression showed an AUC of 0.85, with a sensitivity of 76.9% and specificity of 85.7%.

CONCLUSION: Posttreatment rCBV and percentage change in rCBV after chemoradiotherapy are potential imaging biomarkers of response that may be helpful in distinguishing pseudoproggression from true progression in patients with glioblastoma.

(SS05-02) 2:10 PM
Screening Cervical Spine CT in a Level I Trauma Center: Overutilization?

Brent D. Griffith, MD, *Henry Ford Hospital, Detroit, MI*; Carrie Bolton; Nikhil Goyal; Manuel L. Brown, MD*; Rajan Jain, MD*

PURPOSE: The purpose is to analyze the use of screening cervical spine CT performed after trauma and to establish the opportunity to potentially avoid studies when evidence-based clinical criteria are applied prior to imaging.

METHOD AND MATERIALS: All cervical spine CT examinations performed in the emergency department of a level I trauma center between January and December 2008 on adult patients with trauma were analyzed. A total of 1589 studies were evaluated. Radiology reports and clinical data were reviewed for the presence of fracture or ligamentous injury and mode of injury. We also looked for documentation of clinical criteria used to obtain the CT study. In particular, we looked for mention of posterior midline

cervical tenderness, focal neurological deficit, level of alertness, evidence of intoxication, and clinically apparent distracting injury. These five criteria are used in the National Emergency X-Radiography Utilization Study (NEXUS) low-risk criteria.

RESULTS: Of 1589 studies reviewed, 41 (2.6%) were positive for an acute cervical spine injury, and 1524 (95.9%) were negative. A total of 24 (1.5%) studies were indeterminate on the initial CT examination but failed to demonstrate acute injury on subsequent imaging and clinical follow-up. Of the 1524 examinations with no acute injury, 364 (23.9%) had no documentation of any of the five NEXUS low-risk criteria.

CONCLUSION: The strict application of the NEXUS low-risk criteria could potentially reduce the number of screening cervical spine CT scans in the setting of trauma in more than 20% of cases, thereby avoiding a significant amount of unnecessary radiation and cost.

(SS05-03) 2:20 PM
Comparison of Time-resolved Contrast-enhanced MR Angiography to Nondynamic High-Spatial-Resolution Contrast-enhanced MR Angiography at 3 T, with DSA as a Reference Standard, in a Porcine Carotid Aneurysm Model



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PURPOSE: Time-resolved contrast-enhanced 3D MRA (TWIST), optimized for either spatial or temporal resolution, was compared to conventional nondynamic contrast-enhanced MRA (CE-MRA), with DSA performed as the reference standard.

METHOD AND MATERIALS: In eight domestic swine, bilateral aneurysms of the common carotid artery were surgically created, in this IACUC-approved study, by using a pouch derived from a segment of the left external jugular vein (modeling an intracranial aneurysm). CE-MRA was performed at 3 T (Verio; Siemens Medical Systems, Erlangen, Germany) employing gadobutrol (Gadovist; Bayer HealthCare, Berlin, Germany). CE-MRA sequences optimized for temporal (TWIST_t) versus spatial (TWIST_s) resolution were performed (0.5-second acquisition with a 1.4 × 1.1 × 3.0-mm³ voxel size versus 2.2 seconds with 1.2 × 1.2 × 1.2 mm³) and compared to nondynamic high-spatial-resolution CE-MRA (0.9 × 0.9 × 0.9 mm³). Biplane DSA was performed for further quantitation. The dimensions of the aneurysm ($n = 16$), as well as the aneurysm neck, were measured independently on all images in three dimensions by two viewers. The MRA sequences were also ranked in a consensus read assessing four qualitative measures.

RESULTS: The mean absolute difference in size from DSA to TWIST_t, TWIST_s, and conventional CE-MRA was as follows: AP, 7.2, 1.5, and 1.5 mm; CC, 1.7, 1.1, and 1.0 mm; RL, 1.1, 1.0, and 0.6 mm; and neck, 2.6, 1.5, and 1.4 mm, respectively. CE-MRA was more accurate than TWIST_t in all measurements and showed no statistical difference with TWIST_s in all but one measurement; CE-MRA was marginally superior to TWIST_s in measuring the RL diameter. The CE-MRA and TWIST_t ranked similarly on the qualitative assessment, with the exception of venous overlay, where CE-MRA ranked the worst, and depiction of aneurysm boundaries, where CE-MRA was marginally superior to TWIST_s.

CONCLUSION: Dynamic CE-MRA using TWIST, applied in combination with a 1M gadolinium chelate formulation, is capable of depicting fine vascular anatomical detail and is likely suitable to replace, in some applications, more conventional nondynamic imaging, allowing a reduction in administered contrast dose.

(SS05-04) 2:30 PM
CT Perfusion Pitfalls: The Case of Fetal Origin of the Posterior Cerebral Artery

Benita Tamrazi, MD, *University of Rochester Medical Center, Rochester, NY*; Rajiv Mangla, MD; Jeevak Almast (btamrazi@gmail.com)

PURPOSE: Fetal origin of the PCA is an anatomic variant of the circle of Willis that causes changes in collateral circulation and cerebral hemodynamics. Prior MR imaging studies demonstrate left-right asymmetry in perfusion secondary to the anatomic variant. The purpose of this study was to characterize the effect of unilateral fetal PCA on CT perfusion parameters.

* Faculty financial disclosures are located in the Faculty Index.

METHOD AND MATERIALS: A total of 77 patients were included in this retrospective study with review of CT perfusion studies to characterize the relationship between vascular asymmetry and CT perfusion parameters. The degree of vascular asymmetry was expressed as an index, assigned on the basis of the posterior cerebral artery P₁ segment caliber in relation to the posterior communicating artery. Statistical analysis was utilized to determine significant differences in CT perfusion parameters of mean transit time (MTT), cerebral blood flow (CBF), and cerebral blood volume (CBV) between fetal and nonfetal PCA vasculature. Changes in perfusion parameters associated with varying degrees of vascular asymmetry were examined in terms of left-right hemispheric differences involving the posterior circulation alone, as well as anterior-posterior hemodynamic differences.

RESULTS: In the case of left-right asymmetry, lower values of MTT and CBV were observed in the posterior circulation of unilateral fetal-type PCA, which correlated with a higher degree of vascular asymmetry. CT perfusion parameters of the anterior and posterior circulation were also compared in fetal- and nonfetal-type PCA, and no statistically significant difference was observed in MTT, CBV, or CBF with fetal-type PCA. However, in cases of nonfetal PCA, there is marked difference in anterior and posterior values of CBV and MTT, with statistically significant *P* values.

CONCLUSION: Minimal information exists regarding the limitations and drawbacks of CT perfusion. Due to inherent changes in cerebral hemodynamics caused by fetal origin of the PCA, this anatomic variant invariably presents a potential pitfall for CT perfusion imaging. It is critical for the radiologist to be aware of this pitfall in order to prevent diagnostic inaccuracies that can ultimately affect clinical management.

(SS05-05) 2:40 PM

Risk of Thyroid Cancer Associated with US Findings: Results from a Population-based Cohort Study

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PURPOSE: The purpose is to determine the prevalence of thyroid nodules on US and to determine features predictive of cancer. The goal was to identify nodules with a low risk of cancer so that fine-needle aspiration can be deferred in patients at lowest risk.

METHOD AND MATERIALS: Patients who underwent a thyroid US at a single academic institution between January 2000 and March 2005 were included (4370 patients and 6684 exams), and their data were linked with the Northern California SEER population-based cancer registry. Patients in whom cancer was diagnosed within 2 years of the US were considered cancer cases, and patients in whom cancer was not diagnosed within 2 years were considered controls. US images of all cases (*n* = 105) and a random sample of controls (*n* = 378) were prospectively reviewed by two radiologists blinded to cancer status.

RESULTS: The results reflect the preliminary analysis of 158 patients (54 cancers, 104 controls), and results of the entire sample will be presented in April. Overall, 325 nodules were identified among 158 patients. Among the controls, 49% (93/191) had at least one nodule >10 mm. Several nodule features were significantly associated with the risk of cancer, including microcalcifications (29% of cancers, 1.9% of controls; likelihood ratio [LR], 15.92) and central coarse calcifications (4% of cancers, 2% of controls; LR, 3.73). US features significantly associated with benign outcome include hyperechoic echotexture (5% of cancers, 9% of controls; LR, 0.60). Some features previously reported as predictive of cancer, such as shape, or predictive of benignity, such as ring-down artifact, did not discriminate between cancers and controls. A multivariate analysis will be used to develop a scheme for combining the different nodule features for interpreting thyroid US that will parallel the BI-RADS system for mammography.

CONCLUSION: The prevalence of benign thyroid nodules is high. Clinical guidelines that recommend FNA of all lesions >10 mm would result in large numbers of benign thyroid biopsies. Several US features are significantly associated with the risk of cancer and should prove useful for the development of an evidenced-based management algorithm for thyroid US.

AUR Trainee Prize: 1st Place

(SS05-06) 2:50 PM

Prevention of Radiocontrast-induced Nephropathy: A Critical Appraisal of Meta-analyses Evaluating Effectiveness of Sodium Bicarbonate

Gelareh Sadigh, *University of Michigan, Ann Arbor, MI*; Ben A. Dwamena, MD; Aine M. Kelly, MD, MS; Paul P. Cronin, MBBCh; Ruth C. Carlos, MD, MS*

PURPOSE: The effectiveness of sodium bicarbonate for minimizing the risk of contrast-induced nephropathy (CIN) remains controversial. This is more prominent when meta-analyses including the same set(s) of randomized controlled trials (RCTs) produce conflicting results. We performed a critical appraisal of published meta-analyses to determine the magnitude and validity of the reported preventative effect of sodium bicarbonate in patients undergoing contrast-enhanced procedures and to assess the methodological differences in previous meta-analyses.

METHOD AND MATERIALS: We conducted a literature search to identify relevant articles in PubMed, Embase[®], ISI Web of Knowledge, and Cochrane database through to 5 June 2010 without any language restriction. Published meta-analyses of intravenous sodium bicarbonate that prespecified the outcome of CIN as a 25% or 0.5-mg/dL increase in baseline serum creatinine after radiocontrast exposure were included. A measurement tool for the "assessment of multiple systematic reviews" (AMSTAR) was used for validity assessment.

RESULTS: Eleven published meta-analyses with information on 4–24 RCTs and 573–3598 patients were included. Four and seven of them reported odds ratios and relative risks (RRs) as effect measures for CIN, respectively. Nine meta-analyses reported a beneficial effect for sodium bicarbonate. The remainder of the studies reported inconclusive results. Publication bias was assessed in 63% of the studies, either visually (by funnel plots) or formally (using a linear regression test). The mean quality score of all meta-analyses was 8.7 out of 11 (range, 6.5–10). Overall, we identified 26 unique RCTs of 3739 patients, reporting a total of 398 CIN events. In a reanalysis of these RCTs, the pooled RR was 0.63 (95% confidence interval, 0.45–0.87; *P* = .003). Publication bias was present when tested with the Egger test, while the Harbord test suggested a low probability for publication bias.

CONCLUSION: The marked differences in design, sample size, and effect size measurement of the different meta-analyses may account for divergent and conflicting reports. A reanalysis suggests that sodium bicarbonate may be better than placebo within the limits of current meta-analytic practice.

A³CR² Advisor's Award

(SS05-07) 3:00 PM

Novel Percutaneous Method for the Treatment of Obstructive Vaginal Anomalies

Akash P. Kansagra, MD, MS, *University of California, San Francisco, San Francisco, CA*; Christine B. Miller, MD; Anne C. Roberts, MD* (akash.kansagra@ucsf.edu)

PURPOSE: Obstructive anomalies of the vagina that impair uterovaginal outflow have traditionally required expedited surgical intervention, but emerging percutaneous therapies may offer an attractive alternative to forestall the need for invasive treatment. We describe a novel method of serial balloon dilation over a percutaneously inserted microwire to create a durable outflow tract from the uterus to the distal vagina, and we report its successful use in two patients.

METHOD AND MATERIALS: Two female patients (10 and 13 years old) with cyclic abdominal pain elected to undergo percutaneous therapy following MRI confirmation of hematocolpos related to low vaginal atresia and to a transverse vaginal septum, respectively. A transvaginal ultrasound probe was inserted into the vagina, and a Chiba needle was placed through the needle guide of the probe and into the hematocolpos under ultrasound guidance. A microwire was then placed, and the tract was dilated to 8-F caliber via a micropuncture dilator. This tract was further dilated by using 40 × 5-mm and 40 × 10-mm angioplasty balloons. A 28-F Foley catheter was placed within the tract and allowed to drain the vaginal contents for 6 weeks, permitting time for tract healing.

* Faculty financial disclosures are located in the Faculty Index.

RESULTS: Percutaneous balloon tract dilation was successfully performed in both cases, with immediate drainage of hematocolpos through a Foley catheter placed through the new tract. Both patients tolerated the procedure well and experienced an uneventful postprocedural course with marked and immediate improvement in pain. Reexamination at 6 weeks revealed a patent outflow tract, and both patients subsequently reported ongoing painless menstruation through the new tract.

CONCLUSION: We report a percutaneous method of serial balloon dilation that may represent a simple means to create a durable uterovaginal outflow tract in patients with obstructive vaginal anomalies. In two such patients treated to date, our technique provided rapid pain relief and avoided the immediate need for surgery.

(SS05-08) 3:10 PM
Fluoroscopic Time for Placement of Right-sided Implantable Chest Ports: Comparisons among Attending Interventional Radiology Physicians, Interventional Radiology Fellows, and Radiology Residents

Avnit S. Kapur, MD, BS, *University of Chicago Hospitals, Chicago, IL*; Brian Funaki, MD, BS; Lorenzo Pesce, PhD, MS

PURPOSE: The purpose is to compare the fluoroscopic time for placement of right-sided implantable chest ports among attending interventional radiology physicians, interventional radiology fellows, and radiology residents, to determine if level of training has an impact on fluoroscopy time.

METHOD AND MATERIALS: A total of 300 procedures were retrospectively evaluated over a 1-year period from October 2008 to October 2009. Complicated cases, as well as cases in which multiple procedures were performed at the same time, were excluded. Among the 300 procedures, 122, 98, and 80 procedures were performed by attending interventional radiology physicians, interventional radiology fellows, and radiology residents, respectively, as primary operators.

RESULTS: The mean fluoroscopy time for placement of right-sided chest port was 0.66 minutes (range, 0.1–3.3 minutes), 1.09 minutes (range, 0.1–5 minutes), and 2.35 minutes (range, 0.1–10 minutes) for attendings, fellows, and residents, respectively. Statistical analysis determined that the distribution of fluoroscopic time was skewed right. Using the Shapiro-Wilk test, we determined that the variance in fluoroscopy times among the three groups was 0.322, 1.14, and 4.72, respectively, which was highly statistically significant. Because of the nonnormal distribution and high degree of variance, we applied the nonparametric Kruskal-Wallis rank sum test, which was also highly significant ($P < 1E-10$). The Wilcoxon rank sum test with multiple comparison corrections was used to establish that all of the possible pairs are in fact different.

CONCLUSION: There is a considerable amount of variability among the three groups in the fluoroscopy time required to place a right-sided implantable chest port. Specifically, for any patient, it is very likely that the fluoroscopy time will be increased for a fellow when compared to an attending and further increased when the procedure is performed by a resident. Moreover, the less training a physician has, the less predictable will be the time required to perform such an operation.

AUR Trainee Prize: 2nd Place

(SS05-09) 3:20 PM
Cryotherapy of Metastatic Lesions from Colorectal Cancer: Initial Cost and Survival Observations

Hyun J. Bang, MD, *Karmanos Cancer Center, Detroit, MI*; Peter J. Littrup, MD; Dylan J. Goodrich; Brandt P. Currier, BS; Monica A. D'Agostini; Hussein D. Aoun, MD, et al

PURPOSE: The purpose is to assess the effectiveness of cryotherapy in the palliative treatment of metastatic colorectal cancer by addressing survival, cost, and ablation zone resorption considerations, while also monitoring complications and recurrences in our patient group.

METHOD AND MATERIALS: A total of 104 CT- and/or US-guided percutaneous cryotherapy procedures were performed for 45 patients on 104 metastases located in the liver, 36 tumors located in the lung in 11 patients, and eight tumors in six patients in three soft-tissue locations:

intrapertitoneal, retroperitoneal, and bone. Median survival was determined using a Kaplan-Meier estimator (MedCalc 11.3). The incremental cost-effectiveness ratio was calculated into cost per life-year saved, based on median survival times and liberal estimates of procedural costs. Resorption was calculated from ablation zone measurements grouped into 1-, 3-, 6-, 12-, 18-, and +24-month statistical bins. Complications were graded according to CTCAE. Patients were followed with CT or MRI, and local recurrence was defined as any asymmetric nodular enhancement or enlargement at the cryotherapy zone.

RESULTS: The cryotherapy zone was well defined by CT as a hypodense ice ball with an average ablation diameter of 5.4 cm, while average tumor diameter was 2.8 cm. Kaplan-Meier estimator determined the median survival rate of patients in this study was 35 months. The incremental cost-effectiveness ratio for cryotherapy procedures was calculated to be \$11,657 per life-year saved. By 12 months, the average ablation volume involution was 72% and at 24 months was 89%. A major complication (grade ≥ 3) occurred after six procedures (6%). After an average follow-up of 12 months (range, 1–80), 17 local recurrences of 148 tumor sites (11%) were noted, and 11 (65%) of those recurrences were satellite lesions (ie, <10 mm beyond ablation zone).

CONCLUSION: Percutaneous cryoablation of metastatic colorectal cancer lesions is a well-tolerated treatment alternative for patients with anesthesia risks or painful lesions or those seeking local control during chemotherapy. Preliminary calculations of high patient survival and cost-effectiveness suggest that cryotherapy could effectively and economically augment the palliative care of metastatic disease.

AUR Memorial Award

(SS05-10) 3:30 PM
Distinguishing Recurrent High-Grade Gliomas from Radiation Injury: A Pilot Study Using Dynamic Contrast-enhanced MR Imaging

Sotirios Bisdas, MD, *Eberhard Karls University, Tübingen, Germany*

PURPOSE: The accurate delineation of tumor recurrence and its differentiation from radiation injury in the follow-up of adjuvantly treated high-grade gliomas present a significant problem in neuro-oncology. The aim of this study was to investigate whether hemodynamic parameters derived from dynamic contrast-enhanced (DCE) T1-weighted magnetic resonance (MR) imaging can be used to distinguish recurrent gliomas from radiation necrosis.

METHOD AND MATERIALS: Eighteen patients who were being treated for glial neoplasms underwent prospectively conventional and DCE-MRI using a 3-T scanner. The pharmacokinetic modeling was based on a two-compartment model that allows for the calculation of K^{trans} (transfer constant between intra- and extravascular, extracellular space), v_e (extravascular, extracellular space), k_{ep} (transfer constant from the extracellular, extravascular space into the plasma), and iAUC (initial area under the signal intensity–time curve). Regions of interest (ROIs) were drawn around the entire recurrence-suspected contrast-enhanced region. A definitive diagnosis was established at subsequent surgical resection or clinicoradiologic follow-up. The hemodynamic parameters in the contralateral normal white matter, the radiation injury sites, and the tumor recurrent lesions were compared by using nonparametric tests.

RESULTS: The K^{trans} , v_e , k_{ep} , and iAUC values in the normal white matter were significantly different from those in the radiation necrosis and recurrent gliomas ($.001 < P < .01$). The only significantly different hemodynamic parameter between the recurrent tumor lesions and the radiation-induced necrotic sites were K^{trans} and iAUC, which were significantly higher in the recurrent glioma group than in the radiation necrosis group ($P \leq .0184$). A K^{trans} cutoff value higher than 0.19 showed 100% sensitivity and 83% specificity for detecting the recurrent gliomas, while an iAUC cutoff value higher than 15.35 had 71% sensitivity and 71% specificity. The v_e and k_{ep} values in recurrent tumors were not significantly higher than those in radiation-induced necrotic lesions.

CONCLUSION: These findings suggest that DCE MR imaging may be used to distinguish between recurrent gliomas and radiation injury and thus assist in follow-up patient management strategy.

* Faculty financial disclosures are located in the Faculty Index.

Thursday, April 14, 2011
2:00–3:30 PM

SS06: Scientific Session 6
RAHSR (Health Services Research)
Location: Carlton

Moderators: Edward Y. Lee, MD
Marie Staunton, MBBCh

HP

(SS06-01) 2:00 PM
Quality Improvement in Radiology: Improving Adherence to Recommended Hand Hygiene Standards by Using Multimodal Approaches in a Trauma Hospital Setting

Brian W. Bresnahan, PhD*, *University of Washington Harborview Medical Center, Seattle, WA*; Cindy Hokanson; Ken F. Linnau, MD; Robert Linville, MD; Saeed Elojeimy; Jeffrey G. Jarvik, MD, MPH*; et al (*bres@uw.edu*)

PURPOSE: The purpose is to conduct a radiology-focused multidimensional hand hygiene (HH) quality improvement (QI) program in a level-1 trauma hospital. Our program goals are to create awareness, educate staff, measure and improve adherence to recommended HH practices, recognize leaders, disseminate findings, and maintain improvement.

METHOD AND MATERIALS: This ongoing HH QI project incorporates a multifaceted approach and a multidisciplinary leadership team including economics, health services research, infection control, operations, radiology, residents, senior administration, and technologists. Our awareness campaign improved HH signage, verified appropriate sanitizer dispensers, educated staff about standards and performance data, disseminated metrics/goals in clinical areas, recognized employees, and developed teaching skits; and we are creating a radiology video. HH adherence data (yes/no) is collected monthly by direct observation of physicians, nurses, and technologists. The radiology resident leaders conducted a microbiological inoculation pilot using skin swabs from a person's hand before and after hand washing. All HH efforts were directed by the radiology HH QI team and communicated to the hospital infection control team.

RESULTS: A radiology HH best practice environment was verified (eg, dispensers, signage). At baseline (Jan–June 2010), an overall radiology department adherence to HH of 66% (285/434 total; 39/72 physicians, 37/43 nurses, and 209/319 technologists) was recorded. Initial implementation of the HH QI program was associated with an increased HH adherence (July–Oct 2010, 82% “yes” scores; 267/325 total; 53/71 physicians, 9/13 nurses, 205/241 technologists). HH improvement trends were strongest among physicians and technologists. Assessing HH data by radiology modality helped to identify areas for QI targeting (eg, focus on procedure and control areas). The resident-led scientific prewash/postwash pilot study and the “teaching skits” were examples of using creative approaches to educating medical staff in order to modify behavior.

CONCLUSION: Preliminary results from a multidisciplinary multimodal HH QI program in radiology indicate a strong trend toward improvement in good HH practice. The long-term goal is to maintain high levels of HH adherence.

(SS06-02) 2:10 PM
Not All Trauma Centers Have Experienced an Escalating Trend in the Use of CT in Their Emergency Departments: Potential Influence of Imaging Protocols on Resource Utilization

Gabriel C. Fine, BA, MD, *University of Washington, Seattle, WA*; Bahman Roudsari, MD, PhD; Alan C. Kwan, BA; Jeffrey G. Jarvik, MD, MPH*

PURPOSE: The purpose is to evaluate whether strict adherence to trauma protocols can prevent substantial increases in the utilization of advanced imaging technology, specifically CT in the ED of a level I trauma center.

METHOD AND MATERIALS: The Harborview Medical Center (HMC) trauma registry (2005–2009) was used to extract the following variables: age, gender, type and mechanism of injury, injury severity score, length of stay, type of CT, and the day CT was performed. We used negative bino-

mial regression to evaluate the association between number of CTs per patient during the first 24 hours of hospital arrival and the year of admission, after adjustment for other variables. The results are presented as incidence rate ratios (IRRs) with their relevant 95% confidence intervals.

RESULTS: A total of 27,274 patients were admitted to HMC during the study period. The average number of CTs decreased slightly for CT of head, C-spine, pelvis, abdomen, and thorax, while the use of other CTs remained nearly unchanged. After adjustment for other variables, the use of head CT remained almost constant through 2009. Utilization of head CTA increased substantially between 2007 and 2009. Relative to 2005, the incidence rate of CTA in 2009 was 3.8 (95% CI, 3.1–4.7). No significant change was observed for the use of C-spine CT between 2005 and 2007, with a slight decrease in utilization in 2008 and 2009. Pelvic CT use decreased from 2005 to 2009 (IRR, 0.93; 95% CI, 0.89–0.99). Abdominal CT use also decreased, with the lowest utilization rate in 2009 (IRR, 0.81; 95% CI, 0.75–0.87). Utilization of thoracic CT showed the most pronounced reduction in utilization rate among all CTs, with the incidence in 2009 relative to 2005 of 0.35 (95% CI, 0.31–0.40).

CONCLUSION: Our study is one of the first to evaluate the utilization of advanced imaging technology in level I trauma centers. In contrast to previous studies, we observed an unchanged and, in some instances, a declining trend in the utilization of CTs during the past 5 years. This may relate to the presence of well-defined utilization protocols. Future studies should compare utilization rates at HMC to similar level I trauma centers to determine whether this observed trend is unique to HMC or applicable nationally.

(SS06-03) 2:20 PM
Repetitive Stress Symptoms among Radiologists: Prevalence and Perceived Major Contributing Factors

Daniel S. Siegal, MD, *Beth Israel Deaconess Medical Center, Boston, MA*; Deborah Levine, MD*; Ronald L. Eisenberg, MD, JD; Bettina Siewert, MD; Jack Dennerlein, PhD, MS; Phillip M. Boiselle, MD (*pboisell@bidmc.harvard.edu*)

PURPOSE: The purpose is to determine the prevalence of repetitive stress symptoms among radiologists working in a fully digital radiology department and to assess which work-related factors are perceived as major contributors to their symptoms.

METHOD AND MATERIALS: A survey instrument was designed in conjunction with occupational health and ergonomic specialists and administered in June 2010 to staff (attending radiologists) and trainee (residents and fellows) radiologists ($n = 123$) working in a large academic medical center's radiology department. Data gathered included the presence of repetitive stress symptoms, prior diagnosis of repetitive stress syndrome, and number of hours spent at a computer workstation daily. Respondents were also asked to identify which workstation-related factors among a list of items contribute to their symptoms and to rate each on a 1–5 scale regarding its perceived contribution to any repetitive stress symptoms (1 = does not contribute; 2 = <25%; 3 = 25%–50%; 4 = 50%–75%; 5 = >75%).

RESULTS: A total of 73 responses were received (overall 59% response rate), including 43 staff radiologists (72% staff response rate) and 30 trainees (48% trainee response rate). Repetitive stress symptoms were reported by 36 (49%) of 73 respondents, and a previous diagnosis of repetitive stress injury was reported by 22 (30%) of 73 respondents. Forty-three (59%) of 73 respondents reported spending more than 8 hours per day at a computer workstation (a reported threshold for increased risk of repetitive stress injury). Of the workstation factors perceived as contributing most to repetitive stress symptoms, physical factors, including fixed table height (mean response, 2.43) and monitor-related issues (mean response, 2.00), were frequently cited, as well as input-device-related factors, including the mouse (mean response, 2.71) and keyboard (mean response, 2.04).

CONCLUSION: Repetitive stress symptoms are highly prevalent among radiologists working in a fully digital department and are perceived to result from a combination of physical factors related to workstation setup and input device factors related to work flow. Thus, efforts to reduce the risk of injury should be focused on both improved workstation ergonomics and streamlined input devices.

* Faculty financial disclosures are located in the Faculty Index.

(SS06-04) 2:30 PM**Honorary Authorship in Radiologic Research Articles: Its Frequency and Associated Factors**

Ronald L. Eisenberg, MD, JD, *Beth Israel Deaconess Medical Center, Boston, MA*; Phillip M. Boiselle, MD; Long Ngo, PhD; Alexander Bankier, BS, MD (*rleisenb@bidmc.harvard.edu*)

PURPOSE: Our purpose was to quantify the frequency of perceived honorary authorship in *Radiology* and *European Radiology* and to identify specific factors that increase its prevalence.

METHOD AND MATERIALS: An electronic survey was sent to 1338 first authors of original research articles published in *Radiology* and *European Radiology* over 3 years (July 2006 through June 2009 issues). Questions addressed the perception of honorary authorship, the contributions of coauthors, and demographic information. Univariable and multivariable logistic regression models were used to assess the independent factors that were associated with the probability of perceiving honorary authorship.

RESULTS: The response rate to our survey was 29.3% (392/1338). Of these respondents, 26.0% (102/392) perceived that one or more coauthors did not make sufficient contributions to merit being included as an author and, thus, was granted honorary authorship; 58.9% (231/392) of respondents stated that one or more coauthors performed only "nonauthor" tasks according to ICMJE criteria. Factors associated with an increased first-author perception of honorary authorship included lower academic rank (adjusted odds ratio [aOR] = 2.89; 95% CI = 1.66–5.06), as well as working in an environment in which the section or department head was automatically listed as an author (aOR = 3.80; 95% CI = 2.13–6.79). Among those who perceived honorary authorship, 27.4% followed the journal requirements for authorship, and 40.9% did not ($P = .019$).

CONCLUSION: Despite existing efforts to limit honorary authorship, more than one-quarter of first authors of original scientific articles in *Radiology* and *European Radiology* who were included in our survey perceived that at least one of their coauthors did not merit this distinction. As adherence to the ICMJE guidelines has the potential to substantially decrease the prevalence of the perception of honorary authorship, these guidelines should be more vigorously enforced.

(SS06-05) 2:40 PM**Reducing Lens Dose with Routine Head CT: Can We Do It Utilizing Basic Principles? (A Quality Improvement Project)**

Marianna Zagurovskaya, MD, *University of Kentucky, Lexington, KY*; Steven J. Goldstein, MD; Karsten D. Colwell, BS, RT(R)(CT) (*marianna.zagurovskaya@uky.edu*)

PURPOSE: Dramatic increase in CT brain exams demands careful attention to our daily practice. Optimal beam angulation and head-positioning techniques can reduce the lens exposure dose by 88%. The purpose of our study is to implement a lens exclusion protocol into our university hospital practice by focused CT technologist education/training and prospectively to evaluate technologist compliance with the protocol. Potential pitfalls will be examined, with further strategies to resolve/improve the performance.

METHOD AND MATERIALS: Supraorbital baseline and chin-down head-positioning technique was utilized. Routine CT head studies performed on the scanners (Siemens Somatom Sensation 40, Sensation 16, Sensation Open 40 and AS) were independently analyzed by a resident and a technologist. Patients with proven or suspected acute traumatic neck injuries and those unable to remain motionless were excluded from the study. Four-month technologist performance was evaluated. One month prior to the project initiation was considered as a baseline. Standard deviation, mean values, and Student *t* coefficient were used in monthly data comparisons.

RESULTS: A total of 2855 CT head studies were evaluated. Analysis before and immediately after the start showed an initial 2.8-fold improvement (10% vs 28.2% for the 1st and 2nd months, respectively; $P < .05$). No further significant improvement in the lens exclusion approach was observed (28.2% vs 38.1% vs 40% for 2nd, 3rd, and 4th months, respectively; mean, $31\% \pm 14\%$; $P > .05$). Inclusion of the lenses was associated with poor adherence to the protocol, with the most caudal slice being too low and/or insufficient neck flexion.

CONCLUSION: CT head "lens-excluded" performance at our institution showed initial 2.8-fold improvement, with only further 30% success rate following technologist training. Incomplete understanding of proper head-

positioning technique and occasional challenges from the life-support system are likely to contribute to low compliance with established scanning protocols. Reassessment of education techniques and consideration of a checklist protocol installation may be needed to increase adherence to basic and cost-effective improved protocols and will be evaluated further.

(SS06-06) 2:50 PM**E-mail Notification Combined with Off-site Signing Substantially Reduces Time from Resident Approval to Faculty Verification of Radiology Reports**

Lori A. Deitte, MD; Patricia P. Moser, MD, *University of Florida College of Medicine, Gainesville, FL*; Brian S. Geller, MD; Chris L. Siström, MD, MPH* (*deitl@radiology.ufl.edu*)

PURPOSE: The goal of this study was to assess the impact on attending report signing time of (a) distributing notebook computers with preloaded software to sign radiology reports off-site and (b) the initiation of daily automated e-mail notifications.

METHOD AND MATERIALS: Two simultaneous interventions, consisting of (a) distributing a notebook computer with preloaded software for each attending to sign radiology reports off-site and (b) daily automated e-mail notifications to attending radiologists with unsigned reports, were initiated in early February 2010. Our digital dictation system archive and radiology information system were queried for all radiology reports produced from January 2009 through August 2010. The time between resident approval and attending signature before and after intervention was analyzed. The potential detrimental "side effects" of the intervention were also studied.

RESULTS: There was a highly significant ($P = .003$) decrease in attending signing time (AST) after the intervention. Resident-authored reports were signed, on average, 2.53 hours sooner (95% CI = 1.12–3.95). Postintervention reports were authored by residents at the same rate (approximately 70%); however, attendings were less likely to make changes to resident-authored reports. When attendings did make edits, the text was altered to the same extent.

CONCLUSION: E-mail notification combined with off-site signing can reduce attending signing time (AST) substantially. E-mail reminders increase awareness by radiologists that reports need their signature. Notebook computers with preloaded software streamline the process of accessing, editing, and signing reports. The observed decrease in AST reflects a positive change in the radiologists' behavior and in the timeliness of report signature.

(SS06-07) 3:00 PM**Frequency and Classification of Errors in Voice-Recognition Templates Created by Staff Radiologists and Radiology Residents**

Jeffrey M. Zerlin, MD, *Children's Hospital of Michigan, Detroit, MI*; Gurpriya Sethi (*mzerin@med.wayne.edu*)

PURPOSE: We reviewed electronic voice-recognition (EVR) templates used by staff radiologists and radiology residents at our hospital to determine the frequency and nature of errors in the templates.

METHOD AND MATERIALS: Voice-recognition templates created by staff radiologists and residents in our department were reviewed for language errors (missing words, word duplication, extra words, nonsense phrases, inconsistent tense, subject-verb mismatch, wrong word substitution, and misspelling), misplaced or missing bookmarks, context errors (overdefined content and collisions), intermixed sentences and fragments, and errors in technique description. Errors were tabulated by error type and compared between staff and residents by using Fisher's exact χ^2 test.

RESULTS: A total of 369 templates were reviewed from 10 staff and 11 residents, of which 131 (35.5%) were created by staff and 238 (64.5%) by residents. The overall error rate was not significantly different between staff and residents, with errors in 79 (60.3%) of staff templates and 151 (63.4%) of resident templates. Analysis of error frequency by type showed 25.7% with language errors, 45.3% with bookmark errors, 7.0% with context errors, 16.0% with inconsistent formatting, 6.8% with sentence fragment errors, and 6.8% with technique description errors.

CONCLUSION: The primary advantages of EVR are (a) lower cost compared to using trained transcriptionists and (b) more rapid report turnaround. While EVR continues to advance, transcription errors due to inaccurate voice recognition and limited radiologist training remain a problem. Templates are user-defined preformatted segments of text that can be used

* Faculty financial disclosures are located in the Faculty Index.

with EVR. Advantages of templates include (a) improved dictation efficiency, (b) improved consistency of report format and content, and (c) reduction in recognition-related errors. Because text in templates will always be faithfully inserted into reports, errors in templates will also invariably be reproduced. As a result, the potential benefits of using templates will be diminished when templates contain errors. Careful attention to template creation and editing to eliminate errors in the template text will enhance the value of templates and improve efficiency in using EVR.

(SS06-08) 3:10 PM **The Business of Radiology: What Trainees Do and Don't Learn in Residency**

Richard E. Sharpe, Jr, MD, MBA, *Thomas Jefferson University Hospital, Philadelphia, PA*; Rajni Natesan, MD, MBA

PURPOSE: ACGME requires radiology training programs to educate future radiologists in business of radiology topics. It is not known which of these topics are presently learned by residents during the course of their training. This nationwide survey seeks to describe radiology trainees' knowledge growth in business of radiology areas during residency.

METHOD AND MATERIALS: An online survey distributed nationwide to diagnostic radiology trainees asked them to rate the quality and frequency of business of radiology training during residency. Trainees described their competence in 16 areas using a 6-point scale. Respondents' training year and institution were asked. Weighted response averages and differences between 1st- and 4th-year residents were analyzed.

RESULTS: Surveys were received from 118 radiology trainees: 53 first-year and 65 fourth-year residents (from 43 institutions). Weighted average responses are presented by increasing level of knowledge attained over residency (presented as 1st-year average competence, 4th-year average competence, difference) using the survey scale (no knowledge = 0, trace knowledge = 1, below competent = 2, competent = 3, more than competent = 4, and highly competent = 5): health care policy (2.2, 2.3, +0.1), imaging study patient costs (1.9, 2.0, +0.1), personal finance (2.2, 2.4, +0.2), practice management (1.4, 1.7, +0.3), insurance (1.9, 2.2, +0.3), equipment costs (1.6, 1.9, +0.3), debt management (2.1, 2.4, +0.3), compensation (1.9, 2.2, +0.3), marketing (1.4, 1.7, +0.3), radiologist lawsuits (1.7, 2.0, +0.3), patient safety (2.4, 2.8, +0.4), information technology (2.0, 2.4, +0.4), job search (1.6, 2.1, +0.5), contract negotiation (1.3, 1.8, +0.5), deciding between academics and private practice (1.9, 2.5, +0.6), and quality assurance (1.7, 2.4, +0.7).

CONCLUSION: Residents report learning about career search, quality management, and information technology more than health care economic environment, personal finance strategies, and radiology enterprise management topics. More attention should be focused in specific deficient radiology business aspects. Self-reporting bias may limit these findings. Further research should determine whether these topics are of most interest to trainees and which formats are preferable.

RAHSR-ACR Award

(SS06-09) 3:20 PM **Medicare's National Coverage Determinations in Diagnostic Radiology: Setting the Limits**

Hansel J. Otero, MD, *Tufts Medical Center, Boston, MA*; Maki S. Kamae, MD, MPH; James D. Chambers, MSc; Edgar K. Yucel, MD*; Peter J. Neumann, ScD (*hotero@tuftsmedicalcenter.org*)

PURPOSE: The purpose is to systematically review the Centers for Medicare & Medicaid Services (CMS) national coverage determinations (NCDs) concerning diagnostic imaging technologies and to summarize the frequency and nature of restrictions placed on coverage.

METHOD AND MATERIALS: We selected all NCDs issued by CMS between 1999 and 2009 pertaining to diagnostic imaging. NCDs were reviewed as to the technology, indication, and coverage determination. Coverage was categorized as positive coverage, noncoverage, or coverage with restrictions.

RESULTS: Thirty-two of 142 (22.5%) NCDs concerned imaging technologies, 19 (13.4%) of which evaluate diagnostic imaging, while the remaining 13 were image-guided therapy or procedures. The technologies evaluated were based on PET ($n = 13$), MR ($n = 3$), CT ($n = 2$), and ultrasound

($n = 1$) imaging. None of the diagnostic imaging technologies are completely covered. A total of five (26%) technologies are completely noncovered, two (11%) received an initial noncoverage decision (ie, magnetic resonance spectroscopy for brain tumors and PET-FDG for infection and inflammation), and three other technologies remain noncovered after a reevaluation of the evidence following the availability of additional evidence (screening CT colonography, FDG-PET for Alzheimer disease, and FDG-PET for soft-tissue sarcomas). The remaining 14 (74%) technologies are covered with restrictions. The most common restrictions applied were (a) only covered for patients with an established diagnosis ($n = 9/14$; 64%) and (b) only covered as subsequent test after inconclusive work-up ($n = 7/14$; 50%). Less-common restrictions concerned coverage with evidence development (coverage of clinical cost of research) ($n = 3/14$; 21%) and coverage in specific care settings (eg, ICU or intraoperative imaging) ($n = 1/14$; 7%).

CONCLUSION: Diagnostic imaging technologies represent an important portion of NCDs issued by CMS. A quarter of technologies are not covered, and an overwhelming three-quarters of them are covered with restrictions. These restrictions are consistent across technologies and most commonly involve an established diagnosis or initial imaging triggers before the new modalities can be utilized.

GERRAF Sessions **Thursday, April 14, 2011** **7:00–8:15 AM**

Senior Fellows: Research in Progress

(G-01) High-Resolution MR Neurography in a Prospective Cohort of Patients with Injured Peripheral Nerves Treated with Surgery

Avneesh Chhabra, MD*, *Johns Hopkins Medical Center, Baltimore, MD*; John Eng, MD; John A Carrino, MD, MPH*

Background: An estimated 100,000 surgeries are performed annually for nerve injuries and entrapments. The current reference standard for evaluation of these lesions is clinical examination supplemented by electrodiagnostic (ED) study. However, ED studies may be uncomfortable and provide only limited detail about the precise location and cause of nerve injury and entrapment. MR neurography (MRN), with its superb soft-tissue contrast, would be ideal for presurgical evaluation.

Objectives: We have three primary objectives:

A. *MRN Effect on Diagnostic Thinking and Therapeutic Decisions:* Determine if preoperative MRN impacts the diagnostic confidence of location and degree of nerve injury, decision whether to pursue surgery, timing of surgery, surgical approach, and estimated length of surgery. Surgeon will complete the survey questionnaire at two different times: one with all available clinical information before MRN exam and the second one after MRN exam results are available, with above outlined measures. (Hypothesis: MRN impacts the diagnostic thinking and surgical plan.)

B. *Correlation of MRN Findings with Surgical Findings as the Reference Standard:* Determine the correlation of MRN findings with surgical findings in terms of the anatomy, which nerve(s) are involved, the characterization and extent of nerve abnormality, and the status of regional muscles. (Hypothesis: MRN accurately characterizes and depicts the extent of nerve injury.)

C. *Predictive Value of Postoperative Imaging after Nerve Surgery:* Evaluate the prevalence of postoperative MRN findings in asymptomatic and symptomatic patients after nerve surgery (neurolysis, coaptation, nerve conduit, nerve graft, etc). The postoperative MRN imaging will be performed in all patients, regardless of whether they do well clinically or not. For outcome analysis, MRN findings will be correlated with validated clinical response tools (DASH, FAAM) and QOL scale before nerve surgery, at 2–4 months following surgery. (Hypothesis: Postoperative MRN can predict clinical response.)

Progress: IRB approved in September 2010. Two industry grants procured to cover postoperative MRN scans for 100 patients. Recruitment of patients successfully started. Two-week research course attended. Multiple (4) retrospective studies on MRN completed and multiple papers (9) published, currently in press, and under review.

* Faculty financial disclosures are located in the Faculty Index.

(G-02) Genomic Profiling of Non-Small Cell Lung Cancer for Personalized Targeted Therapy with CT-guided Transthoracic Needle Biopsy: Technological Assessment

Ritu R. Gill, MBBS*, Boston, MA; Andretta R. Hunsaker, MD; Pasi A. Janne, MD, PhD; Scott J. Swanson, MD; David M. Jackman, MD; Mohit Butaney; et al

PURPOSE: The purpose is to assess the utility, efficacy, and safety of CT-guided transthoracic core needle biopsy of non-small cell lung cancer (NSCLC) for genomic profiling for targeted therapy.

METHOD AND MATERIALS: Patients with NSCLC underwent CT-guided transthoracic needle biopsy (TTNB) for genetic profiling of their tumors prior to starting chemotherapy, using 18-gauge core biopsy needles (Tempo) after the administration of local anesthetic (2% lidocaine) and intravenous conscious sedation. Adequacy of tissue for genetic profiling was assessed qualitatively by a pathologist, and testing for EGFR and KRAS was performed when tissue was adequate. Frequency and severity of procedural complications, such as pneumothorax, intraparenchymal hemorrhage, and hemoptysis, were recorded, along with hospital admissions and lengths of stay.

RESULTS: Forty-five patients (14 men, 31 women) were biopsied, with an average age of 53.2 years (range, 29–78 years) and an average tumor diameter of 3.9 cm (range, 2.7–5.5 cm). Thirty-nine patients (86.7%) had sufficient tissue for genetic profiling: Fourteen tumors (31.1%) were found to harbor EGFR mutations (exon 19-21 deletions), 10 tumors (22.2%) had KRAS mutation, 13 tumors (28.9%) had neither EGFR nor KRAS mutation, and eight specimens (17.8%) had insufficient tissue for mutational analysis. Twenty-one patients (46.7%) had small pneumothoraces (<10%). Three patients (6.7%) required chest tube placement and admission, two of whom were discharged the following day, while one patient was admitted for 3 days. Three patients (6.7%) had grade I hemoptysis. Forty-two (93.3%) patients were discharged home with follow-up instructions.

CONCLUSION: CT-guided TTNB is a feasible, safe, and efficacious technique for genomic profiling for targeted therapy and enables personalized therapy based on mutational analysis.

(G-03) Functional Imaging with FDG PET and MR Imaging during Chemoradiation of Locally Advanced Head and Neck Cancer: Do Early Intratreatment Changes Predict Treatment Outcome?

Jenny K. Hoang, MBBS*, Duke University Medical Center, Durham, NC

Background and Aims: Noninvasive functional imaging modalities such as FDG PET, DCE-MRI, and DW-MRI have emerged as techniques that can detect different physiologic changes in tumor before volumetric changes occur. The aims of this proposal focus on the use of FDG PET in head and neck cancer (HNC) and will be complemented by a concurrent study by our group using DCE-MRI and DW-MRI. The first aim is to quantify the test-retest reproducibility of FDG PET in HNC patients before treatment and to compare this to early intratreatment change. The second aim is to determine if intratreatment FDG PET or the posttreatment FDG PET can predict treatment response. The third aim is to define the relationship between the functional biomarkers of FDG PET, DCE-MRI, and DW-MRI performed concurrently at pretreatment and intratreatment periods.

Methods: Adult subjects with HNC (AJCC stages III-IV, M0) will be recruited from the multidisciplinary head and neck clinic. FDG PET and MRI will be performed in patients receiving a standard course of curative-intent concurrent chemoradiation (CRT). Double baseline imaging will be performed before CRT, followed by single FDG PET and MRI scans at 1 week after commencing CRT (intratreatment) and at 10–12 weeks after completion of CRT. SUVmax will be measured at each time point and will be correlated with (a) MR biomarkers and (b) end points of time to local failure, time to failure-free survival, and absolute survival time.

Implications: Patients with poorer prognosis based on the early FDG PET scan could be selected for different treatment strategies to improve the therapeutic ratio. Intratreatment imaging could be used for early “adaptive” therapeutic planning before options are limited by drug toxicity or before tumor has progressed beyond the therapeutic window. Finally, the future clinical use of functional imaging is dependent on (a) the precision of FDG PET and functional MRI parameters and (b) an understanding of how these functional modalities are independent or complementary to one another for prognosis.

Progress: The IRB has been approved. We have enrolled 16 patients in 2010. All patients completed the imaging regime, with the exception of one patient who did not have a second baseline PET and week 1 PET. We plan to perform interim imaging and data analysis after recruiting 20 patients.

**Thursday, April 14, 2011
8:30–10:00 AM**

(G04) Premature Coronary Artery Disease (CAD) in Severe Psoriasis

Prachi P. Agarwal, MD*, University of Michigan Health System, Ann Arbor, MI

SPECIFIC AIM 1: Compare the prevalence of CAD in patients with and without severe psoriasis, otherwise matched for cardiovascular risk factors, as determined by: CT coronary calcium scoring and coronary CTA (CCTA).

Study Design: This ongoing cross-sectional study design examines patients with severe psoriasis and a control group matched by age, gender, and Framingham risk score to the psoriasis population. Recruitment is targeted in the dermatology clinic by screening for matching variables before enrollment. So far, 14 patients with severe psoriasis and one healthy control have been enrolled.

Assessment after eligibility screening will consist of psoriasis severity grading, cardiovascular risk assessment, laboratory tests, and CCTA.

Outcomes Measured: Overall prevalence of CAD will include patients with calcium score > 0 and/or noncalcified plaque.

Data Analysis: A conditional logistic regression model will be used to examine the effect of psoriasis on the probability of having CAD, conditioning on age, gender, and Framingham risk score.

SPECIFIC AIM 2: Compare the atherosclerotic plaque burden of CAD in patients with and without severe psoriasis, otherwise matched for cardiovascular risk factors, as determined by: (a) CT coronary calcium scoring and (b) CCTA.

Study Design: The study design is identical to that described for specific aim 1.

Outcomes Measured: The calcium score (AJ 130) will be compared between patients with and without severe psoriasis otherwise matched for major coronary risk factors. On CCTA, the number of arterial segments demonstrating more than minimal coronary arterial narrowing (>30% stenosis) will be compared to determine atherosclerotic plaque burden. The overall severity of CAD will be determined using the Duke CAD index model applied to CCTA, as proposed by Min et al.

Data Analysis: The effect of psoriasis on the probability of having more than minimal coronary arterial narrowing (defined as stenosis >30%) and using the modified Duke index, will also be examined using a conditional logistic regression model. Odds ratios with 95% CIs and significance test results will be reported for psoriasis and other factors in the model. An exploratory model of the severity of CAD, measured by overall severity score, degree of stenosis, and calcium score, will be conducted between patients with and without psoriasis using unpaired *t* tests or nonparametric Wilcoxon rank sum tests. Significance levels for all tests will be set at 0.05.

* Faculty financial disclosures are located in the Faculty Index.

Friday, April 15, 2011
7:00–8:30 AM

(G-05) Automated Analysis of Brain Morphometry: A Useful Tool for Radiologists to Contribute to the Diagnosis of Dementia?

Christopher P. Hess, MD, PhD*, *University of California, San Francisco, San Francisco, CA*

PURPOSE: Regional brain parenchymal atrophy is a frequently used adjunct in the differential diagnosis of dementia, and specific patterns of atrophy have been advocated for inclusion in consensus criteria for both Alzheimer's disease (AD) and frontotemporal lobar degeneration (FTLD). The purpose of this study was to enhance visualization of regional patterns of volume loss in a heterogeneous clinical cohort of patients undergoing MRI for routine evaluation for cognitive decline.

METHOD AND MATERIALS: Volumetric T1-weighted gradient-echo sequences were obtained with 1.5-mm isotropic resolution on five different scanners in 52 consecutive patients. Two studies in which structural abnormalities were found (meningioma, suspected glial neoplasm) and seven studies with excessive motion or other technical artifacts were excluded. Age ranged from 51.4 to 84.8 years; there were 25 women and 18 men; and clinical diagnoses were mild cognitive impairment (MCI) in 17, probable AD in 15, vascular dementia (VaD) in 3, Lewy body disease (LBD) in 1, and probable FTLD in 7. Images were automatically parcellated into 41 supratentorial regions per hemisphere, which were then compared to a probabilistic brain atlas constructed from 662 healthy elders between the ages of 63 and 75 (Cyceron, France). The z-scores calculated for each region were overlaid as color maps on the original T1-weighted images for visual inspection.

RESULTS: Color-encoded images revealed areas of disproportionate regional atrophy that were frequently subjectively equivocal. All seven subjects with FTLD showed disproportionate frontal and/or temporal atrophy according to the constructed color-encoded images. 11/15 subjects with AD showed medial temporal atrophy, and 10/17 patients with MCI showed atrophy in one or more regions. No specific pattern of atrophy was observed in patients with VaD or LBD.

CONCLUSION: By allowing confident identification of regional atrophy, automated morphometry may allow the radiologist to better contribute to differential diagnosis. Further work is under way to determine how the proposed approach compares to interpretation without the benefit of automated morphometry.

(G-06) Distinguishing Recurrent High-Grade Glioma from Postradiation Change: Can Advanced MR Imaging Techniques Predict Outcome?

James R. Fink, MD*, *University of Washington School of Medicine, Seattle, WA*

Imaging findings for recurrent glioma and postradiation effects substantially overlap on contrast-enhanced MRI (CE-MRI). Advanced MRI techniques have been suggested to distinguish between glioma recurrence and postradiation change better than CE-MRI alone. The current gold standard for distinguishing recurrent glioma from postradiation change is tissue biopsy. Biopsy may also predict survival in this clinical setting. However, biopsy is susceptible to sampling error, and gliomas may display variable histologies, as well as overlap between radiation effects and tumor recurrence. Tissue sampling is also an invasive and costly procedure with concomitant risks for morbidity and mortality. The application of advanced MRI techniques to this important clinical problem could potentially alleviate the need for tissue biopsy. We therefore propose to investigate whether making this clinically important distinction between glioma recurrence and postradiation change

through advanced MR techniques can provide useful prognostic information regarding progression-free survival, overall survival, functional status, and quality of life in patients with clinically suspected glioma recurrence. We hypothesize that the diagnosis of recurrent glioma by advanced MR imaging will be associated with decreased progression-free survival, decreased overall survival, and diminished functional status and quality of life as compared to patients with postradiation change suggested by advanced MRI. We also hypothesize that patients with postradiation change on advanced MRI will have similar survival and functional performance as patients who do not have CE-MRI findings suspicious for recurrent tumor.

SPECIFIC AIMS: (1) Determine that the quantitative information acquired through advanced MRI techniques, including metabolic peak-height ratios Cho/NAA and Cho/Cr, rCBV ratio, and ADC ratio, distinguishes recurrent glioma from postradiation change using a combined gold standard of surgical histopathology and clinicoradiologic follow-up. (2) Assess the diagnostic accuracy of each of these advanced MRI techniques individually in distinguishing recurrent glioma from postradiation change through ROC analysis, and assess the influence of quantitative information from each technique on diagnostic accuracy through logistic regression analysis. (3) Determine the impact of advanced MRI techniques on clinical outcomes, including progression-free survival, overall survival, functional status, and quality of life.

Friday, April 15, 2011
10:30 AM–12:00 PM

(G-07) The Use of Stress Cardiac MR Imaging as the Initial Imaging Modality for Intermediate-Risk Patients with Stable Symptoms Suspicious for Coronary Artery Disease: Is It More Cost-Effective than Myocardial Perfusion Imaging and Stress Echocardiography?

Saurabh Jha, MBBS*, *University of Pennsylvania School of Medicine, Philadelphia, PA*

Ischemic heart disease continues to a major player in morbidity and mortality in the developed world. Additionally, the costs associated with the diagnosis of ischemic heart disease are coming under increasing public scrutiny. The current study uses decision modelling and Markov analysis for an economic evaluation of various imaging modalities for the initial assessment of the patient with stable symptoms of chronic ischemic heart disease. The modalities evaluated include stress MRI, stress echocardiography, and nuclear scintigraphy.

(G-08) Randomized Prospective Study of FDG PET/CT Surveillance versus Planned Neck Dissection in Management of Patients after Successful Chemoradiotherapy for Advanced Head and Neck Squamous Cell Cancer

Rathan M. Subramaniam, MD, PhD*, *Boston Medical Center, Boston, MA*

PROGRESS: Boston University Medical Campus IRB has been finally approved in December 2009 after amendments. Case report forms have been created. We have started screening patients for the study and are yet to enroll our first patient.

EDUCATIONAL COMPONENT: Application for the Clinical Effectiveness Program (summer 2010) at Harvard School of Public Health is in progress. This will satisfy 1/3 of the credit required to do the MPH.

* Faculty financial disclosures are located in the Faculty Index.

Research Poster Abstracts

AUR 2011 Research Poster Abstracts

Research posters are located in Grand Ballroom A. Each poster will be presented by its author during AMA PRA Category 1 Credit™ poster sessions scheduled for 7:00–8:15 AM, Wednesday and Thursday.

The day and time follow the presentation number.

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

Presentations by trainees (residents, medical students, or 1st-year fellows) are noted in green.

■ Education

(R-29) Thursday • 7:00–8:15 AM

The Resident Education Matrix: A Helpful Tool for Resident Performance Evaluation in Interventional Radiology

Michael V. Beheshti, MD, *University of Arkansas for Medical Sciences, Little Rock, AR*; Linda A. Deloney, EdD (mvbheshti@uams.edu)

PURPOSE: The evaluation and documentation of resident performance in procedural specialties can be challenging, particularly when integrating ACGME-mandated core competencies. In response to this challenge, we developed the Resident Education Matrix (REM), a tool to efficiently outline and document achievement of interventional radiology (IR) training objectives.

METHOD AND MATERIALS: The REM is built into a spreadsheet. The first column outlines specific objectives based on training level. Specific core competencies are listed in subsequent columns. The REM clearly articulates what is expected by level of training and relates each learning task to relevant core competencies. Each resident meets with the section chief on the first and last days of their IR rotation. At the first meeting, level-specific objectives and competencies are reviewed. During the exit interview, the section chief reviews the REM with the resident and documents accomplishment of the assigned tasks. Tasks are either accomplished, or they are not; deficiencies are easily identifiable.

RESULTS: The REM has been in use for a short period of time, and we do not have quantifiable outcomes data. However, our preliminary experience indicates the following: (a) Resident and faculty reaction has been uniformly favorable. (b) The tool is flexible and can be updated rapidly. (c) Residents articulate improved understanding of service expectations. (d) Resident competencies are now uniformly and objectively documented and tracked. (e) Deficiencies can be quantified and followed longitudinally. (f) ACGME competencies can be easily documented.

CONCLUSION: The REM is a flexible tool that integrates both procedural mastery and ACGME core competency assessment into the evaluative process. Its early implementation has facilitated resident understanding of service expectations and affords faculty the ability to longitudinally follow graduated performance for a large number of residents.

(R-30) Wednesday • 7:00–8:15 AM

Fatigue: How to Tell if You Have It

Ronald E. Fraley, BSN, MBA, RN, *Indiana University School of Medicine, Indianapolis, IN* (rfraley@iupui.edu)

PURPOSE: Medical staff can readily identify fatigue in others and witness firsthand the impact fatigue has on patients' and others' lives. However, it is difficult for individuals to realize their own level of fatigue until the situation is critical. This discussion of fatigue includes early signs and symptoms of fatigue, fatigue assessment tools, indicators of when fatigue reduction interventions should be implemented, and the interventions. This combination can be easily incorporated into the individual's personal and professional life, thus avoiding this insidious safety hazard.

METHOD AND MATERIALS: This presentation focuses on five common fatigue symptoms that the individual can readily identify. Additionally, a review is presented of sleep stages, how to nap, and how to use caffeine and other energy drinks.

RESULTS: The attendees will be able to identify fatigue in themselves, incorporate techniques to reduce or eliminate their fatigue, and prevent fatigue as a possible cause of errors.

CONCLUSION: Fatigue is an insidious safety hazard that has subtle symptoms that the individuals may not readily identify in themselves. This

poster is a quick guide to the five most common symptoms of sleep deprivation, which has the same ramifications as fatigue.

(R-31) Thursday • 7:00–8:15 AM

Resident Benefits in Radiology Training Programs

Thomas R. Gates, MD, *Louisiana State University Health Sciences Center, Shreveport, LA*; Shannon Storrs, BS; Mardjohan Hardjasudarma, MD; Horacio R. D'Agostino, MD (mhardj@lsuhsc.edu)

PURPOSE: 1. To identify the types of benefits radiology residents receive from their training programs in addition to their normal annual salary. 2. To determine the benefit dollar amount given over the 4-year period per resident for various radiology training programs. 3. To correlate these benefits based on radiology training program size and geographic location.

METHOD AND MATERIALS: An electronic resident benefits survey was provided to the APDR, and the APDR e-mailed this survey to all radiology program directors and residency coordinators for their responses. Specific responses were requested for the following possible benefits: AFIP tuition, AFIP room and board, conference expenses associated with resident presentations, RSNA expenses, review course expenses, book allowances, board examination fees, and medical licenses fees.

RESULTS: Thirty-two percent (104/329) of contacted programs responded to this survey, allowing us to see the number of programs that provide all, some part, or none of the expenses for the specific benefits mentioned above. Of these, 57 programs gave a specific dollar amount, which ranged from \$1600 plus a conference expense to \$21,500. The average was \$7130 plus a conference expense associated with resident presentation. There were no significant benefit differences between smaller programs (≤ 20 residents), which averaged \$7019 plus conference expenses associated with resident presentations, and larger programs (≥ 21 residents), which averaged \$7181 plus conference expenses associated with resident presentations. The Southeast region gave the most resident benefits on average (\$12,237), followed by the West region (\$9625 plus conference expenses associated with resident presentations), with the North/Northeast regions providing the least amount of resident benefits on average (\$5864 plus conference expenses associated with resident presentations).

CONCLUSION: There is significant variability in total benefits among programs. There was more uniformity in regard to program size. The role of geography remains unclear, but benefits did not appear to parallel expected cost-of-living expenses.

(R-32) Wednesday • 7:00–8:15 AM

How Is the Faculty-Resident Case Review (Previously "by View Box") Process Changing with New Technology (PACS, Teleradiology) and the Limited Number of Resident Working Hours? Developing Guidelines Based on Preferences

Elina Zaretsky, BS, *Robert Wood Johnson Medical School, New Brunswick, NJ*; Judith K. Amorosa, MD; Ian O. Tseng, MD; Keyur Patel, MD; Sandip Basak, MD; Murray Becker, MD, BA (amorosa@umdnj.edu)

PURPOSE: The traditional resident review of cases, with the radiology faculty sitting by the view box, of a few hundred to a few thousand images has given way to PACS, teleradiology, voice recognition, prediction, need for immediate service, and reviewing thousands and thousands of images with residents who may not work more than 16 hours. We surveyed faculty and residents about their review process and preferences.

METHOD AND MATERIALS: Two survey instruments, one for faculty and one for residents, were developed to address issues involving the case review process and preferences, including the number of cases, time spent on review, setting of the review (in person, by PACS, phone, instant mes-

* Faculty financial disclosures are located in the Faculty Index.

saging [IM], or videoconferencing), and topics of the review (findings, work-up, follow-up, etiology, and differential diagnosis).

RESULTS: On average, 42% of faculty spend less than 5 minutes, 31% spend 5–10 minutes, and 26% spend 10–15 minutes reviewing a case with the resident, most of the time in person by the PACS station. 21% discuss findings over the phone; 16% type agree, disagree, and/or additional findings via typing into preliminary box on PACS. Of the residents, 62% say they spend less than 5 minutes per case review, and 37% spend 5–10 minutes. During the day, 63% discuss cases in person by the PACS and 38% via typing on PACS. After 6 PM, 100% of residents spend less than 5 minutes per case, most of the time through PACS preliminary box communication with faculty. During after-hours review, emphasis is on description of findings and follow-up evaluation and less on differential diagnosis and etiology. After hours, 100% of residents prefer review by confirmation typed in preliminary box on PACS; during the day, 63% prefer discussion in person and 37% through PACS preliminary box. 70% of residents prefer to predetermine cases prior to review.

CONCLUSION: Our preliminary data indicate that faculty and residents are reviewing cases by the PACS in person and by telecommunication during daily working hours, as well as after hours, by reviewing the findings and assessing follow-up, with less discussion about differential diagnosis or disease etiology. Residents prefer telecommunication with faculty rather than in-person review, especially after hours.

(R-33) Thursday • 7:00–8:15 AM
Remote Control: The Role of Videoconference in Productivity and Resident Education

Andrew Crane, MD, *University of Virginia Health System, Charlottesville, VA*; Spencer B. Gay, MD*

PURPOSE: While teleradiology in the academic setting provides a unique private practice learning opportunity to residents and opens new financial prospects to academic institutions, as teleradiology becomes more ubiquitous, it also increases resident workload and stresses the attending's ability to cover an increasing number of studies. This technology does, however, provide the capability to review resident-read studies at a remote locale. The purpose of this study is to determine whether CT exams reviewed with an off-site attending radiologist via video teleconference maintain the same resident educational benefits provided by face-to-face sign-out.

METHOD AND MATERIALS: An attending at a remote locale will review CT examinations with a resident utilizing a videoconference program (ie, Skype). The attending and resident will then complete a questionnaire with parameters graded on a 1–5 scale regarding ease of use, education, image quality, diagnostic accuracy, and time. As a control, the resident and attending will fill out the same questionnaire following a traditional in-person review. Studies will be randomized to either remote or in-person sign-out. Questionnaire totals will then be compared.

RESULTS: The hypothesis is that there will be no statistical difference in the questionnaire parameters regarding video teleconference and traditional by face-to-face sign-out.

CONCLUSION: CT examinations reviewed via video teleconference maintain the same resident educational benefits provided by traditional in-person sign-out as perceived by both the attending and resident.

■ Informatics

(R-45) Thursday • 7:00–8:15 AM
Awareness and Usage of Web-based Radiology Resources: Are Radiologists and Residents Getting the Message?

Sukhvinder S. Dhillon, MBChB, MRCP*, *University of Alberta, Edmonton, AB*; Karen Sealant, BA, MD (*sukhvinderdhillon@med.ualberta.ca*)

PURPOSE: Over the past 5 years, a number of different radiology-specific search engines have been introduced to the Web. They are intended to provide to the reporting radiologist specific information to help with image interpretation at the time of reading. The various engines are designed to search among radiology-specific Web sites, peer-reviewed journals, and articles to find information related to the search term. Some of the search engines use algorithms to drill down into image and teaching databases to provide image and case examples that may not be discovered with tradi-

tional Internet searches. In addition to this, multiple radiology reference sites are available as open access or with free log-ins. It is important for radiologists to make the best use of the newer sources of information to maximize productivity and make information retrieval and its use more efficient. Anecdotal experience suggested these tools were not being used among radiologists within this center. We set out to investigate the level of awareness and use of these Web resources.

METHOD AND MATERIALS: The radiologists and residents in five radiology centers, ranging from a large academic center to smaller community-based hospitals, were surveyed by using a paper data collection form. Questions were structured to assess awareness and frequency of use of various radiology-specific search sites and resources, as well as more-generic search sites.

RESULTS: A total of 75/95 staff and residents were surveyed. The awareness of general medical resources was high: PubMed, 90%; and eMedicine, 83%. The awareness of radiology-specific Web resources was much lower: MyPACS, 36%; ARRS GoldMiner®, 32%; RSNA's MIRC®, 25%; Yottalook™, 12%; and <http://www.radiology-search.com/>, 11%. 83% considered 5 minutes or less as acceptable to retrieve the information they may need to complete a report. 96% would want to learn more about radiology-specific resources.

CONCLUSION: Most radiologists and residents at our center were unaware of the various Web-based radiology-specific resources available to them. This suggests that information regarding useful radiology resources presented at radiologic meetings or in other domains is not reaching the practicing radiologist.

(R-46) Wednesday • 7:00–8:15 AM
Radiology-specific Search Engines and Resources: How Useful Are the Search Responses for Use at the Viewer Side?

Sukhvinder S. Dhillon, MBChB, MRCP*, *University of Alberta, Edmonton, AB*; Gavin Low, MBChB (*sukhvinderdhillon@med.ualberta.ca*)

PURPOSE: Over the past 5 years, a number of different radiology-specific search engines have been introduced to the Web. They are intended to provide specific information to the reporting radiologist to help with image interpretation at the time of reading. The various engines are designed to search among radiology-specific Web sites, peer-reviewed journals, and articles to find information related to the search term. Some of the search engines use algorithms to drill down into image and teaching databases to provide image and case examples that may not be discovered with traditional Internet searches. Our purpose was to assess the value at the viewer side of the various radiology-specific search sites.

METHOD AND MATERIALS: A quasi-controlled environment was created to assess the search sites. Radiologists in the specialties of chest, neuroradiology, body, pediatric, and musculoskeletal imaging were asked to provide three disease search terms they had recently Web-searched at the viewer side in order to complete a report. This resulted in 15 terms. The following open-access search engines or resources were evaluated: Yottalook™, GoldMiner® (goldminer.arrs.org), MIRC® (mirc.rsna.org), MyPACS, and Google. Two radiologists were asked to perform searches using these terms. The radiologists were asked to assume they had a vague understanding of the disease but needed more information to complete a hypothetical report. The radiologists documented the type of suggestion, the usefulness of the suggestions at the viewer side using a 0–10 numerical rating scale, and the time taken.

RESULTS: The average score for usefulness of a Web site to help complete a hypothetical report was Yottalook™, 8.4; GoldMiner®, 6.7; Google, 6.2; MIRC®, 5.0; and MyPACS, 3.5. Open-access peer-reviewed articles as a first suggestion for the 15 search terms entered were returned in 11/15 Yottalook™, 10/15 GoldMiner®, and 2/15 Google; MIRC® and MyPACS (teaching files) were not assessed. Useful information was found within 3 minutes for almost all searches except in MyPACS, where five searches were abandoned after 5 minutes.

CONCLUSION: We found that radiology-specific search sites interrogating a variety of peer-reviewed resources provided the most efficient reference at the viewer side.

* Faculty financial disclosures are located in the Faculty Index.

■ Musculoskeletal

AUR Trainee Prize: 1st Place

(R-47) Thursday • 7:00–8:15 AM Role of MR Imaging in Congenital Lumbar Spinal Stenosis

Majid Chalian, MD, *Johns Hopkins Hospital, Baltimore, MD*; Theodoros Soldatos, MD; Neda Faridian-Aragh, MD; John A. Carrino, MD, MPH*; Avneesh Chhabra, MD* (*mchalia1@jhmi.edu*)

PURPOSE: The purpose is to illustrate the spectrum of abnormal magnetic resonance imaging (MRI) findings of the lumbar spine in young individuals with congenital lumbar spinal stenosis (CLSS). Due to their narrowed spinal canal and altered spinal biomechanics, subjects with CLSS experience neurogenic complications at an early age.

METHOD AND MATERIALS: After a retrospective control-matched cohort study, lumbar spine MRI studies of 100 randomly selected young subjects (50 males, 50 females; mean age, 38 ± 9 years) were retrospectively evaluated. Subjects with midsagittal spinal canal diameter of less than 14 mm on at least one intervertebral level were considered as having CLSS ($n = 52$), whereas subjects with midsagittal spinal canal diameter equal to or greater than 14 mm at all five intervertebral levels were registered as controls ($n = 48$). In each examination, the five lumbar levels were assessed for the presence or absence of (a) shallow annular bulges, (b) circumferential annular bulges, (c) annular tears, (d) anterior and posterior disk herniations, (e) epidural lipomatosis, (f) Schmorl's nodes, (g) spondylolisthesis, (h) pars defects, and (i) stress reaction of the posterior vertebral elements.

RESULTS: Compared to the control individuals, the subjects with CLSS exhibited increased incidence of shallow annular bulges, circumferential annular bulges, annular tears, disk herniations, and spondylolisthesis ($P < .05$).

CONCLUSION: A wide spectrum of abnormal findings is demonstrated in lumbar spine MRI studies of subjects with CLSS, findings which probably result from the altered spinal biomechanics of this entity. Knowledge of the above imaging findings may assist physicians in defining disease burden and tailoring surgical treatment.

■ Nuclear Medicine

(R-66) Wednesday • 7:00–8:15 AM Postsurgical TNM Staging of Differentiated Thyroid Cancer with Diagnostic Iodine SPECT-CT

Ka Kit Wong, MBBS, *University of Michigan Hospital, Ann Arbor, MI*; Ryan Dvorak; Milton D. Gross; Kirk A. Frey; Anca Avram, MD

PURPOSE: Staging systems such as AJCC TNM (7th edition) allow risk stratification of differentiated thyroid cancer (DTC) and guide subsequent patient management. The purpose of this study is to evaluate iodine-131 (^{131}I) planar and SPECT-CT scintigraphy performed using diagnostic activities of ^{131}I and to assess its utility to complete TNM staging before the first radioiodine ablation.

METHOD AND MATERIALS: Fifty patients (15 M, 35 F; mean age, 45 years; range, 10–84) with DTC (42 papillary, six follicular, and two Hürthle cell) had postsurgical diagnostic (1 mCi) ^{131}I planar and SPECT-CT. Two readers, one blinded and one unblinded to clinical, laboratory, pathology, and CXR information, interpreted ^{131}I studies. Incremental value of SPECT-CT over planar imaging was examined, as well as interobserver variability and changes between pathologic stage (pTNM) and final stage (iTNM) after ^{131}I imaging.

RESULTS: There were 109 distinct foci on planar images, read as thyroid remnant ($n = 24$), regional nodal metastases ($n = 13$), equivocal ($n = 11$),

and distant metastases ($n = 2$). Interpretations of SPECT-CT were thyroid remnant ($n = 28$), regional disease ($n = 14$), local residual disease ($n = 2$), and distant metastases ($n = 6$). Interobserver agreement was 36/50 (72%) patients, with $\kappa = 0.52$ (moderate). SPECT-CT helped clarify all equivocal planar interpretations. Diagnostic ^{131}I SPECT-CT influenced TNM staging in 11 patients, upstaging in seven and downstaging in four patients, and detected unsuspected distant disease in four cases. Changes to N and M scoring were greater (clarifying Nx in 18, changing N0 to N1 in four, and changing M0 to M1 in seven cases); however, a feature of DTC staging is that when age < 45 years, N1 does not result in a change to stage. We include pictorial examples of thyroglossal duct remnant, thyroid bed remnant, cervical nodal and distant metastases, and physiological iodine biodistribution on ^{131}I SPECT-CT.

CONCLUSION: Diagnostic ^{131}I SPECT-CT allows completion of TNM staging before first radioiodine ablation. It can be used to accurately determine N and M scoring, including assigning N1a and N1b scores depending on central or lateral compartment location(s), and identifying distant metastases (M1). It changes TNM staging in 11/50 (22%) of patients.

■ Neuroradiology

(R-67) Thursday • 7:00–8:15 AM Ectopic Pituitary Adenoma: Case Presentation and Literature Analysis

Alexander Garger, MD, PhD, *Harlem Hospital Center, New York, NY*; Robert Aria, MD; Leszek Pisinski, MD

PURPOSE: Ectopic pituitary adenomas are exceedingly rare lesions. Identification of these masses is paramount, since a missed diagnosis may lead to resection of normal pituitary, sentencing a patient to a lifetime of hormone replacement therapy without remission of symptoms. We present the case of an ectopic prolactinoma causing galactorrhea and diplopia in a middle-aged woman. Literature review of available reported cases of ectopic pituitary adenomas was conducted in order to analyze the epidemiology of these lesions.

METHOD AND MATERIALS: A 57-year-old woman presented to her primary care physician with complaints of galactorrhea and visual disturbances. Pituitary prolactinoma was suspected based on physical exam and a highly elevated prolactin level. Initial CT and MRI examinations were interpreted as a sellar mass consistent with pituitary adenoma. The patient was placed on bromocriptine therapy, with resolution of symptoms. Dedicated CT and MR imaging were again undertaken when the patient returned with complaints of intermittent headache and persistent hyperprolactinemia despite near-maximal bromocriptine dosing. A lobulated mass was identified centered in the clivus with new erosion of the sellar floor and extension into the sphenoid sinus, most consistent with an ectopic pituitary adenoma. The pituitary gland was normal.

RESULTS: Aggregate data of 137 reported cases in the available literature show that the most common ectopic location of a pituitary adenoma is in the sphenoid sinus (32%), and the most frequent hormonal product is ACTH (34%), without significant association between the location and hormonal product, age, or sex.

CONCLUSION: Even in cases of an abnormal-appearing pituitary gland, ectopic location of a pituitary adenoma should be considered in all patients with unexplained elevated pituitary hormonal levels. As the clinical presentation can vary from patient to patient and can range from nasal congestion to Cushing's syndrome, timely diagnosis and management are essential to avoid resection of normal pituitary gland or to initiate more-aggressive treatment, including resection of the ectopic mass.

* Faculty financial disclosures are located in the Faculty Index.

AUR Trainee Prize: 2nd Place

**(R-68) Wednesday • 7:00–8:15 AM
Emergent CT Angiography in Assessment of Acute
Stroke: Utilization Pattern and Compliance with Guide-
lines in a Primary Stroke Center**

M. Reza Rajebi, MD, *State University of New York Upstate Medical University, Syracuse, NY*; Arbab Iqbal; Jakwei Chang, MD (*rajebim@upstate.edu*)

PURPOSE: The purpose was to determine whether emergent cerebral computed tomographic angiography (CTA) findings alter subsequent emergent therapeutic interventions in patients with a new focal neurologic defect.

METHOD AND MATERIALS: In this retrospective study, from 01/01/2009 to 12/31/2009, a total of 176 consecutive patients (82 women and 94 men; mean age, 62.7 years; range, 20–89 years) with clinically suspected acute ischemic stroke who underwent emergent CTA of the head, neck, or both were included. Presenting symptoms and duration of the onset of symptoms were assessed. Based on the duration of the onset, patients were divided into two groups: duration < 6 hours (group 1, $n = 64$) and duration > 6 hours (group 2, $n = 106$). Duration of the onset was unknown in six patients. This timeline is selected based on the availability of the therapeutic interventions, including intravenous and intraarterial administration of rtPA and mechanical thrombectomy. Subsequent therapeutic interventions and outcomes were reviewed. Estimated effective dose was calculated. Primary outcome was emergent intervention.

RESULTS: There were no substantial differences in age ($P = .27$) and sex ($P = .77$) between the two study groups. The two groups were also similar in the number of unremarkable CTAs and CTAs with minimal findings ($P = .41$ and $P = .48$, respectively). More patients in group 2 had significant CTA findings that did not require emergent intervention (37.7% vs 18.7%; $P = .01$). However, more emergent interventions were indicated in group 1 ($n = 10$) compared to group 2 ($n = 2$) (15.6% vs 1.89%; $P = .001$). In both groups, one patient expired after emergent intervention (10% vs 50%). On average, each patient received an effective dose of 8.8 mSv.

CONCLUSION: Based on our data, in patients with clinically suspected acute ischemic stroke presenting more than 6 hours after the onset of symptoms, emergent interventions are rarely indicated, and medical management is preferred, regardless of the CTA findings. Given the relatively high effective dose and possible adverse effects associated with this modality, CTA may not be indicated as an emergent imaging study in this group of patients.

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Education Poster Abstracts

AUR 2011 Education Poster Abstracts

Education posters are located in Grand Ballroom A. Each poster will be presented by its author during **AMA PRA Category 1 Credit™** poster sessions scheduled for 7:00–8:15 AM, Wednesday and Thursday. The day and time follow the presentation number.

Presenting author is identified by institution name, city, and state (or country if not United States or Canada). Presentations by trainees (residents, medical students, or 1st-year fellows) are noted in **green**.

■ Abdomen

(E-01) Thursday • 7:00–8:15 AM Segmental Testicular Infarction

Penny Saxon, MD; Douglas S. Katz, MD, *Winthrop University Hospital, Mineola, NY*; Jocelyn Luongo, MD; Ruth L. Badler, DO; Mitchell E. Tublin; Terry Desser, MD (*dkatz@winthrop.org*)

LEARNING OBJECTIVES: Segmental testicular infarction (STI) is a relatively rare condition that has been identified on ultrasonography (US) in patients with acute scrotal pain. MR imaging can be confirmatory, and short-term follow-up US is very helpful for further evaluation and confirmation. The purpose of this exhibit is to demonstrate examples of STI and to review the literature.

CONTENT DESCRIPTION: Multiple US examples from three institutions will be shown, demonstrating both wedge-shaped and spherically shaped STIs, along with Doppler imaging and follow-up imaging. Correlative MRI examinations will also be shown. STI usually has a specific appearance, although differentiation from other entities can be problematic in a minority of cases. STI may be idiopathic but has a variety of associations (eg, sickle cell disease). The relevant imaging, clinical, and pathology literature will be reviewed. Segmental testicular infarction generally presents with nonspecific acute scrotal pain and is not likely to be considered clinically, as it is relatively rare. The US findings are usually specific or strongly suggestive, and it is imperative that the radiologist should recognize this entity, as STI is usually managed conservatively, and an unnecessary orchiectomy can be avoided. In problematic cases, follow-up US and/or MRI can be performed for confirmation and exclusion of other diagnoses.

(E-02) Wednesday • 7:00–8:15 AM Advanced Endoscopic Procedures: Indications, Imaging Findings, and Implications for the Radiologist



Jonathan Flug, MD, MBA; Stavros Stavropoulos; Daniel Garnet, MD; Rita Gidwaney, MD; Douglas S. Katz, MD, *Winthrop University Hospital, Mineola, NY*; Gerald A. Irwin, MD (*dkatz@winthrop.org*)

LEARNING OBJECTIVES: 1. Review the indications for several advanced and/or new endoscopically guided procedures. 2. Explain these procedures as well as their implications for radiologists interpreting associated imaging examinations. 3. Demonstrate plain film, CT, US, and EUS findings of representative patients before, during, and after the procedures.

CONTENT DESCRIPTION: The following advanced endoscopic procedures will be reviewed and demonstrated for representative patients on plain films, US/EUS, and CT: the “rendezvous” procedure (biliary access through a transgastric or transduodenal approach); enteral stent insertion (esophageal, gastric, duodenal, and colonic); EUS-guided hepaticogastrostomy with stent placement; pancreatic necrosectomy; EUS-guided coil placement into rectal varices; and radiopaque cyanoacrylate glue closure of a gastric-pulmonary fistula. There are a variety of advanced endoscopic procedures, most of which are guided by endoscopic sonography and are performed by interventional gastroenterologists or minimally invasive surgeons. These procedures may be unknown to radiologists who are interpreting imaging examinations of such patients. After reviewing this exhibit, the radiologist will be more cognizant of such procedures, their indications, and the expected postprocedural findings, particularly on plain films and CT examinations.

(E-03) Thursday • 7:00–8:15 AM Acute Complications of Colonoscopy: CT Diagnosis

Minh Lu; Barry D. Daly, MD*; Nabile M. Safdar, MD*; Douglas S. Katz, MD, *Winthrop University Hospital, Mineola, NY*; Maher A. Abbas (*bdaly@umm.edu*)

LEARNING OBJECTIVES: Colon cancer screening programs have led to an increasing number of individuals undergoing colonoscopy. Acute complications can occur in up to 5% when biopsy and/or therapeutic procedures are performed, and less commonly after screening colonoscopy. The purpose of this exhibit is to review the CT findings of acute complications following colonoscopy.

CONTENT DESCRIPTION: From the past 10 years at three institutions, more than 20 patients with acute complications identified on A/P CT shortly following colonoscopy have been identified. Diagnoses included localized and nonlocalized colonic perforation, diverticulitis, mesenteric injury, splenic hematoma/torsion/injury, bowel obstruction, retroperitoneal hemorrhage, and cathartic colitis. These diagnoses will be demonstrated, as will the superiority of CT to plain films in this setting. The relevant literature will be reviewed. CT can be used to identify a wide range of abdominal and pelvic complications related to colonoscopy that are of importance for radiologists to recognize, some of which are anticipated, such as perforation, and others of which are more unusual, such as splenic injury. CT is superior to plain radiographs in this setting and frequently influences patient management. Radiologists interpreting emergency abdominal CT following colonoscopy need to be familiar with this spectrum of findings.

(E-04) Wednesday • 7:00–8:15 AM Packers, Pushers, and Stuffers: An Update on Imaging Findings in Contraband Smuggling, with Emphasis on the Use of CT and 3D Reconstruction

Sopo Lin; Barry D. Daly, MD*; Douglas S. Katz, MD, *Winthrop University Hospital, Mineola, NY*; Maureen Regan; Jonathan S. Luchs, MD* (*bdaly@umm.edu*)

LEARNING OBJECTIVES: Recent developments in the packaging of contraband concealed in the body have made these materials more difficult to detect. This exhibit describes and depicts contemporary imaging findings on plain radiographs and cross-sectional imaging studies in contraband carriers, with emphasis on the value of CT and 3D CT image reconstruction for diagnosis.

CONTENT DESCRIPTION: Clinical findings and imaging appearances, including radiography, CT, 3D reconstruction, and MRI, are presented in proven cases of contraband detection at international borders, in ERs, or in prison. Categories include (a) “body packers” transporting large volumes in the GI tract; (b) “body stuffers,” who ingest smaller amounts of drugs to avoid arrest; and (c) “body pushers”: prisoners or others who hide weapons or other contraband by retrograde placement in the rectal or vaginal cavities or under the foreskin. Recent developments in illegal drug preparation have made such contraband more difficult to detect on plain radiographs. CT, especially with 3D reconstructions, is a more sensitive alternate method for detection and identification of smuggled materials, especially where the volume of material is small or other bowel content may obscure the contraband. This exhibit will provide an update on current trends in contraband smuggling and the imaging techniques used for detection of these materials.

* Faculty financial disclosures are located in the Faculty Index.

(E-05) Thursday • 7:00–8:15 AM
Multimodality Imaging Approach to Cholangiocarcinoma: A Comprehensive Case Review

Shefali Kothary, MD, BS, *Beth Israel Medical Center, New York, NY*;
 Steven Portale, MD, BS; Gustav Seliger, MD, BS (*skothary@chpnet.org*)

LEARNING OBJECTIVES: 1. Review the epidemiology, pathophysiology, and clinical features of cholangiocarcinoma. 2. Show the imaging findings of cholangiocarcinoma on ERCP, MDCT, and MRI/MRCP, categorized by location and growth pattern. 3. Describe how radiology can assist in the management and treatment of patients with cholangiocarcinoma.

CONTENT DESCRIPTION: Introduction to cholangiocarcinoma: epidemiology, pathophysiology, histology, and clinical features. Types: (a) by location: intrahepatic, perihilar (bismuth classification), and extrahepatic; and (b) by growth pattern: exophytic, infiltrating, polypoid, and mixed. Imaging findings of the different types of cholangiocarcinoma on ERCP, MDCT, and MRI/MRCP will be demonstrated. The role of radiology in the management and treatment of cholangiocarcinoma will be discussed, including staging, planning for possible surgical resection, chemoembolization, radiofrequency ablation, and symptomatic relief through restoration of the bilioenteric pathway.

(E-06) Wednesday • 7:00–8:15 AM
Beyond Portal Hypertension: Abnormalities of the Portal Venous System

Katherine A. Kaproth-Joslin, MD, PhD, *University of Rochester Medical Center, Rochester, NY*; Deborah J. Rubens, MD (*katherine_kaproth-joslin@urmc.rochester.edu*)

LEARNING OBJECTIVES: *Purpose/Aim:* We will discuss the acquired anomalies of the portal venous system, including the posttransplant patient, and the imaging characteristics and modalities best used to study these conditions. In particular, we will address altered flow conditions, including slow flow, reversed flow with and without portal hypertension, localized reversed flow, and occlusion. There will be specific emphasis on technical parameters needed to avoid pitfalls in diagnosis with ultrasound, including both false positives and false negatives, as well as the correct application of corollary imaging with computed tomography (CT) and magnetic resonance imaging (MRI).

CONTENT DESCRIPTION: *Content Organization:* We will review the normal anatomy of the portal venous system. In addition, the ultrasound imaging and the technical difficulties associated with each of the following conditions will be discussed, including the proper use of corollary imaging modalities: I. General. A. Thrombosis and occlusion, both bland and tumor, of the portal vein. B. Intrahepatic arterioportal or portosystemic fistulas. C. Portosystemic or portoportal collateral vessels. D. Portal gas. II. Post transplant. A. Stenosis of the portal vein. B. Portal venous flow disturbances. C. Portal venous fistulas.

Summary: Appreciating the benefits and limitations of imaging when evaluating anomalies of the portal venous system, especially in the post-transplant patient, is extremely important in the long-term evaluation of these individuals. By understanding the techniques and pitfalls unique to ultrasound and knowing when to use corollary imaging with CT and/or MRI, the radiologist is best able to identify the early and late complications associated with these conditions.

(E-07) Thursday • 7:00–8:15 AM
Multimodality Approach to Pathologic Adrenal Lesions

Mike S. Nguyen, MD, *University of Rochester Medical Center, Rochester, NY*; Ravinder Sidhu; Shweta Bhatt, MBBS; Vikram S. Dogra, MD (*mike_nguyen@urmc.rochester.edu*)

LEARNING OBJECTIVES: The purpose of this presentation is to review various benign and malignant adrenal lesions with relevant and significant imaging characteristics by using ultrasound, CT, MR imaging, and nuclear medicine studies. Some rare adrenal entities, such as collision tumors and adrenal rests in the testes, will also be presented.

CONTENT DESCRIPTION: The adrenal glands are located superior to the kidneys bilaterally and are an integral part of the endocrine system. The adrenal cortex synthesizes steroid hormones, including cortisol, aldosterone, and sex hormones, while the adrenal medulla produces catechol-

amines. Clinical symptoms develop with hormonal excess or deficiency. These endocrine syndromes include Cushing's syndrome (cortisol), Conn's syndrome (aldosterone), congenital adrenal hyperplasia (sex hormones), Addison's disease (adrenal insufficiency), and pheochromocytomas (catecholamines). Adrenal lesions can be either benign or malignant. Benign adrenal lesions include adenomas, hyperplasia, calcifications, cysts, hemorrhage, myelolipomas, and pheochromocytomas (can be malignant as well). Granulomatous diseases such as tuberculosis and sarcoidosis can also infiltrate the adrenals. Malignant adrenal lesions include carcinomas, metastases, and lymphomas. Both types of adrenal lesions can be evaluated with ultrasound, CT, MR imaging, and nuclear medicine studies. Examples of these lesions with the aforementioned imaging modalities will be shown, and their clinical significance will be discussed. The presentation will also include rare entities, such as collision tumors and adrenal rests in the testes.

(E-08) Wednesday • 7:00–8:15 AM
US Evaluation of Bladder Pathology

Vikas Datta, MD, *University of Rochester Medical Center, Rochester, NY*;
 Gunvir S. Gill, MD; Ravinder Sidhu; Shweta Bhatt, MBBS; Vikram S. Dogra, MD (*vikas_datta@urmc.rochester.edu*)

LEARNING OBJECTIVES: The full bladder is often used as an acoustic window for the evaluation of other pelvic structures; however, the bladder itself is an ideal candidate for sonographic evaluation. This exhibit will review the optimal technique for evaluating the bladder on ultrasound, discuss the normal sonographic appearance of the bladder, and demonstrate the sonographic imaging characteristics of a variety of bladder pathologies.

CONTENT DESCRIPTION: A wide spectrum of bladder pathologies will be discussed, and their characteristic appearances on ultrasound will be illustrated alongside CT and MR correlation. Sonographic imaging findings discussed will include benign etiologies such as cystitis, bladder hernias, neurogenic bladder, ureterocele, bladder rupture, fistulization, foreign bodies, calculi, bladder endometriosis, and pseudotumors. Malignant processes such as primary bladder malignancy, lymphoma, and metastatic disease will also be included.

(E-09) Thursday • 7:00–8:15 AM
Tips for Evaluating TIPS on Doppler US

Alok A. Bhatt, MD, *University of Rochester Medical Center, Rochester, NY*; Narasimhachar Prativadi, MD; Gunvir S. Gill, MD; Ravinder Sidhu; Shweta Bhatt, MBBS; Vikram S. Dogra, MD

LEARNING OBJECTIVES: In an effort to decompress the portal system in patients with portal hypertension, a transjugular intrahepatic portosystemic shunt (TIPS) is commonly placed. Learning objectives of this poster will include: normal ultrasound findings after TIPS, as well as common complications such as stent or hepatic vein stenoses, and thrombosis. It is important to recognize complications early so that intervention may be considered before complete thrombosis.

CONTENT DESCRIPTION: Background information of TIPS placement will be discussed, including indications and contraindications. Features of a normal TIPS ultrasound will be discussed, including reversal of flow within the right and left portal vein and typical flow velocities. Ultrasound signs of complications seen in TIPS will be reviewed. Examples include elevated maximum and depressed minimum stent velocities, low portal vein velocity, and reversal of flow within the hepatic vein.

(E-10) Wednesday • 7:00–8:15 AM
Imaging of the Postoperative Urinary Tract

Gunvir S. Gill, MD, *University of Rochester Medical Center, Rochester, NY*; Vikas Datta, MD; Ravinder Sidhu; Shweta Bhatt, MBBS; Vikram S. Dogra, MD (*gunvir_gill@urmc.rochester.edu*)

LEARNING OBJECTIVES: 1. Illustrate and describe the anatomy and radiologic appearance (on cross-sectional imaging, retrograde pyelourethrogram, and excretory urogram) of the common urinary diversion procedures, including ileal conduit, orthotopic diversion (neobladder), Indiana pouch, ureterosigmoidostomy, and cutaneous ureterostomy. 2. Review and illustrate the common early and late complications associated with urinary diversion procedures.

* Faculty financial disclosures are located in the Faculty Index.

CONTENT DESCRIPTION: Radiologic examination plays a crucial role in the serial evaluation of urinary diversion systems and in the diagnosis of associated complications. Accurate interpretation of imaging requires a thorough knowledge of the anatomic manipulations employed by the various urinary diversion techniques, as well as a familiarity with the normal early and late imaging appearance of common diversion procedures with various modalities. Awareness of the complications commonly associated with the different types of urinary diversion systems can facilitate accurate diagnosis. This poster will review the radiologic appearance of the more common types of urinary diversion procedures encountered in clinical practice and will illustrate and discuss the commonly encountered early and late complications associated with these procedures.

(E-11) Thursday • 7:00–8:15 AM
Tuberculosis of the Abdominopelvic Organs: A Pictorial Essay

Gunvir S. Gill, MD, *University of Rochester Medical Center, Rochester, NY*; Ravinder Sidhu; Shweta Bhatt, MBBS; Vikram S. Dogra, MD; Naveen Kalra, MBBS, MD; Kushaljeet Sodhi, MBBS, MD (gunvir_gill@urmc.rochester.edu)

LEARNING OBJECTIVES: Review the common sites of involvement and the characteristic cross-sectional imaging appearance of tuberculosis of the abdominopelvic organs.

CONTENT DESCRIPTION: With an ever increasing proportion of immunosuppressed patients, the number of cases of tuberculosis seen in clinical practice is on the rise. Although fulminant pulmonary tuberculosis in an immunocompetent host is not often a diagnostic dilemma, the signs/symptoms of abdominopelvic tuberculosis can be much less specific. The differential of internal organ tuberculosis is often broad and includes multiple infectious/inflammatory etiologies, as well as neoplasms, especially lymphoma. In many cases, it can be up to the radiologist to raise the possibility of tuberculosis as the unifying diagnosis. Thus a familiarity with the radiologic presentation of internal organ tuberculosis is essential. By using US, CT, and MR images obtained from a major medical center in northern India, this poster will illustrate the typical appearance of abdominopelvic tuberculosis on cross-sectional imaging.

(E-12) Wednesday • 7:00–8:15 AM
Liver Transplant Vascular US with Multimodality Comparative Imaging

Daniel T. Ginat, MD, MS, *University of Rochester Medical Center, Rochester, NY*; Wade C. Hedegard, MD; Deborah J. Rubens, MD

LEARNING OBJECTIVES: The basic liver transplant surgical techniques for vessel anastomosis and their normal US features are described and illustrated. In addition, vascular complications and their manifestations, primarily on US and also other imaging modalities, are reviewed.

CONTENT DESCRIPTION: The following conditions will be illustrated: normal liver transplants, including piggyback and end-to-end anastomosis; hepatic artery thrombosis; impending hepatic artery thrombosis; portal vein stenosis and thrombosis; IVC/hepatic vein stenosis and thrombosis; hepatic artery–to–portal vein fistula; and hepatic artery pseudoaneurysm. Vascular complications related to liver transplantation mainly include hepatic artery, portal vein, and outflow vein obstruction, as well as the less-common hepatic artery pseudoaneurysms and arteriportal fistulas. Doppler US is the primary imaging modality for routine evaluation of liver transplants. Familiarity with the different types of transplant configurations and normal Doppler US parameters is necessary for assessing liver transplant vascular complications.

(E-13) Thursday • 7:00–8:15 AM
Cutting the Fat: A Review of Postoperative Anatomy and Common Complications of Roux-en-Y Gastric Bypass and Gastric Banding

Sabina Amin, MD, *University of Texas Southwestern Medical Center, Dallas, TX*; Edward Chen (amin.sabina@gmail.com)

LEARNING OBJECTIVES: 1. Understand Roux-en-Y gastric bypass and laparoscopic adjustable gastric banding procedures. 2. Appreciate the fluoroscopic and CT appearance of postoperative anatomy. 3. Identify common Roux-en-Y gastric bypass complications, such as anastomotic

leak, strictures, obstruction, and transmesenteric herniation. 4. Recognize common laparoscopic adjustable gastric banding complications, such as band slippage, band misplacement, band erosion, stomal stenosis, and port-related complications.

CONTENT DESCRIPTION: Because of the increasing prevalence of morbid obesity and associated secondary health problems, bariatric surgery has emerged as a leading contender in weight management options. As a result, the Roux-en-Y gastric bypass and laparoscopic adjustable gastric banding surgical procedures are being utilized at an exponential rate. An entire set of new complications has arisen with this change, and it is important for the radiology resident to understand their imaging appearance. The purpose of this exhibit is to educate residents about the surgical procedure, postsurgical anatomy, and common postsurgical complications.

(E-14) Wednesday • 7:00–8:15 AM
On-Call Eyepoppers: What Was Your Most Wicked Call Case?

Kyungmin Shin, MD, *University of Virginia Health System, Charlottesville, VA*; Drew L. Lambert, MD

LEARNING OBJECTIVES: Many interesting and complicated cases seem to be encountered at night while residents are on call. This presentation is directed toward residents taking body imaging call. The purpose is to give tips on how to handle these difficult cases and to show interesting cases that occurred after hours at our institution. The objectives are: 1. Using complex cases as examples, we will present tips on how to triage these patients for best patient care and management. 2. Both clinical and imaging follow-up of these cases will be given, including CT, conventional radiograph, and ultrasound modalities, to show how the patients were managed. 3. Provide interesting and complex cases that are not commonly seen, and give educational tips for correct imaging diagnosis.

CONTENT DESCRIPTION: Five different body imaging cases will be presented, encompassing CT, US, and conventional radiograph modalities. Both clinical and imaging follow-up, as well as treatments for these patients, will be provided for learning purposes and viewer interest.

(E-15) Thursday • 7:00–8:15 AM
Fluoroscopic Appearance of the Postoperative Upper Gastrointestinal Tract

Courtney A. Coursey, MD, *Emory Healthcare, Atlanta, GA*; Pardeep Mittal; Ricardo Moreno (courtney.coursey@emoryhealthcare.org)

LEARNING OBJECTIVES: 1. Describe techniques used for upper GI tract surgeries, including those performed for reflux, weight loss, and cancer. 2. Describe the expected fluoroscopic appearance following the above surgeries. 3. List the most common complications associated with each type of surgical procedure, and describe their appearances at fluoroscopy.

CONTENT DESCRIPTION: Upper gastrointestinal surgeries performed for reflux (eg, Nissen fundoplication, Toupet fundoplication), weight loss (eg, adjustable gastric band [LAP-BAND®] procedure, Roux-en-Y gastric bypass surgery, and sleeve gastrectomy), and cancer (eg, esophagogastrectomy, gastrojejunostomy, and colonic interposition) will be discussed. Surgical techniques and indications will be reviewed with anatomic diagrams. Postoperative complications related to each type of surgery will be discussed, such as leaks, afferent loop syndrome, etc. The expected postoperative fluoroscopic appearance will be reviewed for each surgery, with numerous example cases provided. The fluoroscopic appearance of surgical complications will also be reviewed.

(E-16) Wednesday • 7:00–8:15 AM
Adrenal Lesions: A Practical Guide to MR Imaging Interpretation

Ajay Kamireddi, MD, BA, *Emory University, Atlanta, GA*; Sarat Piduru; David Becker-Weidman; Bobby T. Kalb, MD; Diego R. Martin, MD, PhD

LEARNING OBJECTIVES: *Summary:* This exhibit will provide an overview of the MRI features of common adrenal lesions and provide a practical guide to MRI interpretation.

Purpose: MRI provides a comprehensive assessment of adrenal lesions, including lipid, T2 signal, and enhancement features, all key in differentiating benign from malignant lesions. This exhibit will highlight the MRI

appearance of a variety of adrenal lesions and provide a guideline for differentiation of benign and malignant lesions based on MRI features.

CONTENT DESCRIPTION: This exhibit is an autotutorial and has the following sections: (1) Unknown cases with unlabelled images, and then a review of each unknown case with an explanation of the findings. (2) Additional case examples. (3) Appropriate differential diagnoses. (4) Features of the case that are specific for the diagnosis. (5) Overview of imaging methods. (6) Brief summary section highlighting the important points from the presentation.

■ Angiography/Interventional

(E-17) Thursday • 7:00–8:15 AM Resident Education Spotlight: The Rationale for Resident-run Interventional Radiology Clinics

Heath K. McCullough, MD, BS, *Wake Forest University Baptist Medical Center, Winston-Salem, NC*; Curtis L. Anderson, MD, PhD; George Vatakencherry, MD; Derek Mittleider, MD; Cuong H. Lam; Sean Lyman, MD, PhD; et al (hkmccullough@gmail.com)

LEARNING OBJECTIVES: Resident-run IR clinics (RIRCs) enhance resident education and provide a means for residents to acquire general clinical competencies, as outlined by the ACGME. RIRCs provide a concrete solution to the historically nebulous process of evaluating resident clinical performance. The purpose is to establish a model for evaluating the success of RIRCs in line with the ACGME general competencies.

CONTENT DESCRIPTION: Although the clinical model is the established paradigm for the practice of IR, many trainees do not have access to sufficient clinical training to practice successfully as clinicians. Many residency programs still operate under the old paradigm of procedurally oriented IR. For residents in training, this limited experience does not adequately prepare for the modern practice of IR. RIRCs provide an unparalleled clinical education, as well as a venue to evaluate resident clinical competency. Historically, evaluating resident competency in patient care, interpersonal and communication skills, and practice-based learning/improvement was a nebulous process at best. RIRCs provide residents with longitudinal access to direct patient care that is easily documented and evaluated. A resident can be assessed on his bedside manner, physical exam and patient evaluation skills, ability to interpret and apply imaging for both diagnostic and therapeutic purposes, and ability to synthesize an evidence-based plan and then communicate the plan to both the patient and referring physician. Furthermore, patients can be surveyed on resident performance, thus providing a vital new facet to the 360° evaluation. Creating a RIRC demonstrates a departmental systems-based practice initiative to move the IR section in line with current practice patterns. Additionally, this process provides opportunities for multiple residents to fulfill their required quality improvement and system-based problem projects. Establishing RIRCs is a solution to the limited clinical training at the majority of current residency programs, as well as a measurable means for evaluating resident clinical performance. In line with ACGME core competencies, we propose a method for evaluating the success of resident IR clinics.

(E-18) Wednesday • 7:00–8:15 AM Irreversible Electroporation: A Novel Technique for Percutaneous Hepatic Tumor Ablation



Gunvir S. Gill, MD, *University of Rochester Medical Center, Rochester, NY*; Gurpreet S. Dhillon, MD; Charles M. Hubeny, MD; Vikas Datta, MD; Jingbing Xue, MD; George Holland, MD (gunvir_gill@urmc.rochester.edu)

LEARNING OBJECTIVES: 1. Review accepted indications/contraindications for irreversible electroporation (IRE) of hepatic tumors. 2. Describe the technique of IRE. 3. Demonstrate the imaging features of tumors following treatment with IRE.

CONTENT DESCRIPTION: Irreversible electroporation (IRE) is a novel, minimally invasive technique for treating benign or malignant tumors. IRE can be used to achieve precisely delineated ablation zones and to ablate substantial volumes of tissue without inducing a thermal effect. Additionally, IRE can be used to treat tumors adjacent to blood vessels,

since ablation efficacy is unaffected by adjacent blood flow. Knowledge of the expected post-IRE appearance of tumors on cross-sectional imaging is necessary for accurate follow-up management, as well as assessment for recurrence, in this particular subset of patients. We describe our institutional experience in ablating hepatic tumors via IRE.

■ Cardiopulmonary

(E-19) Thursday • 7:00–8:15 AM Acute Pulmonary Thromboembolism: Imaging, Mimics, and Pitfalls

Murthy R. Chamrathy, MD, MS, *Bridgeport Hospital, Bridgeport, CT*; Stephanie K. Burns, MD; Linda B. Haramati, MD, MS*

LEARNING OBJECTIVES: 1. Recognize imaging features of acute pulmonary thromboembolism (PE) on computed tomographic pulmonary angiogram (CTPA). 2. Recognize various pathologic entities that might mimic acute PE on CTPA. 3. Understand the effects of various technical, patient-related, and disease factors that can limit the diagnostic evaluation by CTPA, and suggest further additional or alternative diagnostic tests. 4. Be familiar with complications of PE, and be able to recognize their imaging appearances.

CONTENT DESCRIPTION: CTPA to evaluate for pulmonary embolism is one of the most commonly performed imaging studies in the emergency department and on inpatient wards. Prompt and accurate diagnosis of pulmonary embolism is of paramount importance, with immediate and long-term management implications. We will present images of pulmonary infarction and distinguish them from other types of consolidation. Findings of right heart dysfunction portend a worse prognosis and may guide clinicians to more-aggressive treatments. There are several pathologic conditions that can mimic acute PE clinically and radiographically. We will provide case examples of pulmonary arterial neoplasms, tumor emboli, chronic pulmonary emboli, and foreign bodies and provide guidelines as to how to distinguish these entities from acute PE. Finally, we will discuss various technical and patient-related factors that can result in nondiagnostic or suboptimal CTPA examinations and how to avoid these pitfalls. After reviewing this exhibit, an attendee would have a clear understanding of how acute PE and right ventricular dysfunction would appear on CTPA, be familiar with disease entities that can mimic acute PE, and have the tools to recommend and facilitate the appropriate imaging test for an individual patient.

(E-20) Wednesday • 7:00–8:15 AM Pulmonary Ossification: Have You Missed It?

Wilson B. Chwang, MD, PhD, *Henry Ford Hospital, Detroit, MI*; David Spizarny; Chad Stone

LEARNING OBJECTIVES: 1. Define pulmonary ossification, and review its pathogenesis. 2. Review the radiologic and pathologic findings of pulmonary ossification on plain films and high-resolution CT, as well as the histology. 3. Recognize that pulmonary ossification is often missed on CT images.

CONTENT DESCRIPTION: Pulmonary ossification (PO) is a condition characterized by metaplastic mature bone in the lung in response to chronic injury. We review the pathogenesis, clinical features, histology, and radiologic findings of PO on plain films and high-resolution CT. Increased awareness of the imaging characteristics of PO will help radiologists suggest this unusual and often-missed disorder.

(E-21) Thursday • 7:00–8:15 AM The Many Faces of *Pneumocystis* Pneumonia: A Look at Various Appearances of *Pneumocystis* Pneumonia

Nadia F. Yusaf, *Strong Memorial Hospital, University of Rochester, Rochester, NY*; Susan K. Hobbs, MD, PhD

LEARNING OBJECTIVES: 1. Gain a clear understanding of the populations at risk for *Pneumocystis* pneumonia. 2. Describe the various imaging findings that should suggest the diagnosis in the population.

CONTENT DESCRIPTION: The focus of the exhibit will be on the current incidence, prevalence, and imaging findings of *Pneumocystis* pneumonia. The exhibit will examine disease entities that appear similar to *Pneumocystis* pneumonia, such as hypersensitivity pneumonitis and alveolar hemorrhage, pulmonary edema, and pulmonary alveolar proteinosis.

* Faculty financial disclosures are located in the Faculty Index.

(E-22) Wednesday • 7:00–8:15 AM
Cavitary and Cystic Lesions of the Lungs: Imaging Characteristics

Matthew M. Thrall, BS, *University of Rochester Medical Center, Rochester, NY*; Meena Moorthy, MD; Susan K. Hobbs, MD, PhD; John C. Wandtke, MD

LEARNING OBJECTIVES: 1. Review the imaging appearance of cavitary and cystic lesions of the pulmonary parenchyma on plain radiographs, with correlation to findings on cross-sectional imaging (CT and MR). 2. Identify the lesional characteristics of pulmonary cavitary and cystic lesions that will lead to a narrow differential diagnosis and optimization of imaging approaches.

CONTENT DESCRIPTION: The purpose is to identify those characteristics of pulmonary cavitary and cystic lesions that can lead to an appropriate differential diagnosis. The spectrum of lesions that can lead to these findings includes, but is not limited to, squamous cell carcinoma, tuberculosis, abscess, trauma, and bulla. The pathophysiology of these lesions will be discussed, with a review of imaging findings and illustrative cases.

(E-23) Thursday • 7:00–8:15 AM
Imaging Analysis of HeartMate II® Left Ventricular Assist Device Complications

Scott R. Schiffman, MD, *University of Rochester Department of Imaging Sciences, Rochester, NY*; Susan K. Hobbs, MD, PhD

LEARNING OBJECTIVES: The HeartMate II® left ventricular assist device (LVAD) was recently approved by the Food and Drug Administration for the management of patients with New York Heart Association class IIIB or IV end-stage left ventricular heart failure and for use as a bridge to heart transplantation in patients at risk of imminent death. As implantation of LVADs becomes more widespread, radiologists need to become more adept at reading CT images to identify common and life-threatening complications that stem from LVAD implantation. The device-associated complications include infection of the percutaneous drive line lead, peripheral thrombotic events, postoperative hematoma, and abscesses. The rare but life-threatening device complications include LVAD thrombosis and problems with the inflow and outflow cannulas, such as kinking, rotation, and malposition. A variety of cases highlighting these complications will be presented.

CONTENT DESCRIPTION: Complications of HeartMate II® LVAD systems will be presented in case-based format, with emphasis on their CT imaging appearance. Advanced reconstruction algorithms will be utilized to further demonstrate some of the complications that may be difficult to visualize on routine cross-sectional imaging.

(E-24) Wednesday • 7:00–8:15 AM
Congenital Anomalies of the Great Vessels

Vikas Datta, MD, *University of Rochester Medical Center, Rochester, NY*; Susan K. Hobbs, MD, PhD; John C. Wandtke, MD

LEARNING OBJECTIVES: Congenital anomalies of the great vessels are not uncommonly encountered on plain radiography and cross-sectional imaging. Although these rarely pose a diagnostic dilemma on cross-sectional imaging, they may in some instances prove to be challenging to definitively diagnose with plain radiography alone. Identification of such anomalies is important because they can be of clinical significance for the patient or, alternatively, they may be an incidental benign variant and should be distinguished from more serious pathology. This exhibit will aim to familiarize the radiologist with the varying vascular anomalies of the thorax to facilitate the distinction of benign incidental variants from clinically relevant findings. We will illustrate the various vascular anomalies of the great vessels using plain radiography, with cross-sectional and fluoroscopic imaging correlation where appropriate. The exhibit will also discuss the embryologic basis for the various congenital vascular anomalies, in an attempt to further comprehension of the anatomic variation involved.

CONTENT DESCRIPTION: This exhibit will utilize plain radiography, computed tomography, magnetic resonance imaging, and fluoroscopy to illustrate and help further the understanding of various arterial and venous congenital malformations of the thorax. Arterial anomalies that will be discussed include right-sided aortic arch (mirror image and aberrant left subclavian), double aortic arch, aortic coarctation, pseudocoarctation, aberrant right subclavian artery, diverticulum of Kommerell, anomalous left

pulmonary artery (pulmonary sling), and absence of the pulmonary artery. Venous anomalies that will be discussed include double/left-sided superior vena cava, azygos and hemiazygos continuation of inferior vena cava, and anomalous pulmonary venous drainage. Emphasis will be placed on accurate diagnosis with plain radiography and cross-sectional correlation. The embryologic basis for the varying vascular anomalies will be illustrated with the use of diagrams and brief explanations.

(E-25) Thursday • 7:00–8:15 AM
Imaging Evaluation of Cystic Lung Disease

Vikas Datta, MD, *University of Rochester Medical Center, Rochester, NY*; Susan K. Hobbs, MD, PhD; John C. Wandtke, MD (vikas_datta@urmc.rochester.edu)

LEARNING OBJECTIVES: A wide variety of cystic disease processes affect the pulmonary parenchyma. The imaging similarities of the various cystic lung diseases and the presence of radiologic mimics present a diagnostic challenge to the practicing radiologist. Familiarity with imaging characteristics of the variety of cystic lung diseases can be helpful in narrowing the differential and in facilitating accurate diagnosis. Computed tomography (CT) and high-resolution CT (HRCT) are invaluable in characterizing cystic lung disease by permitting identification of characteristics such as distribution, pattern, size, and associated findings. We will discuss the variety of cystic lung diseases, including focal and diffuse types, along with a brief discussion of their pathophysiologic mechanisms, in order to further comprehension of the various disease processes. This exhibit will aim to familiarize participants with the wide array of cystic lung diseases and their characteristic imaging appearances.

CONTENT DESCRIPTION: Utilizing CT and HRCT, we will familiarize participants with the wide array of cystic pulmonary diseases, with the aim of identifying characteristics to help delineate the various etiologies. We will discuss diffuse cystic lung diseases, including lymphangioleiomyomatosis, Langerhans cell histiocytosis, tuberous sclerosis, lymphocytic interstitial pneumonia, and idiopathic pulmonary fibrosis (with honeycombing). We will also illustrate focal and multifocal cystic disease, including pulmonary sequestrations, bronchogenic cysts, congenital cystic adenomatoid malformations, and pneumatoceles. We will aim to illustrate the imaging characteristics of common mimics, such as cystic bronchiectasis and emphysema, in order to facilitate differentiation and accurate diagnosis.

(E-26) Wednesday • 7:00–8:15 AM
Malpositioned Central Lines: A Pictorial Review

Jason A. Hill, MD; Thomas D. Santoro, MD, *University of Tennessee, Knoxville, TN*; Robert D. Thurman, MD; Peter T. Petruzzi, MD (jahill@mc.utmck.edu)

LEARNING OBJECTIVES: 1. Recognize malpositioned central lines through a pictorial review. 2. Review imaging findings of appropriately positioned central lines. 3. Identify a subtle presentation of a malpositioned central line.

CONTENT DESCRIPTION: A chest radiograph for line placement is one of the most frequently requested imaging studies in medicine. As radiologists, we are asked daily to judge the appropriateness of a central line's position. Through a pictorial review, this exhibit will review cases of malpositioned central lines in the thorax. Also, typical findings in the appropriately positioned central line will be reviewed. Finally, a challenging case of a malpositioned central line will be presented.

(E-27) Thursday • 7:00–8:15 AM
Traumatic Aortic Injuries for Dummies: Recognition and Treatment

Laura L. Gillihan, MD, BS, *Texas Tech University Health Sciences Center, El Paso, TX*; Melhem Ghaleb, MD, BS; Melanie Flores, DO (laura.gillihan@ttuhsc.edu)

LEARNING OBJECTIVES: The objective of this presentation is to appropriately channel the radiology resident's working diagnosis into suspecting and eventually confirming the diagnosis of TAI by the initial chest x-ray. In addition, the benefits and outcomes of endovascular TAI repair versus the traditional surgical approach will be discussed.

CONTENT DESCRIPTION: Traumatic aortic injuries (TAIs) are primordial when it comes to high-energy chest trauma. Aortic dissection, pseudo-

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aneurysm, aneurysm formation, and aortic transection should be quickly and unequivocally recognized so that appropriate treatment can be addressed. The objective of this presentation is to appropriately channel the radiology resident's working diagnosis into suspecting and eventually confirming the diagnosis of TAI by the initial chest x-ray. In addition, the benefits and outcomes of endovascular TAI repair versus the traditional surgical approach will be discussed. Quick identification of signs that suggest aortic trauma is indispensable so that further imaging can be done. Accurate description and identification of aortic injury will allow adequate assessment and treatment by the IR team, since the benefits of endovascular repair outweigh those of the traditional major thoracic surgery alternative.

**(E-28) Wednesday • 7:00–8:15 AM
Acute Aortic Syndrome: A Spectrum of Disease
including Aortic Dissection, Intramural Hematoma, and
Penetrating Atherosclerotic Ulcer**

Elan D. Bomsztyk, MD, BS, *University of Washington, Seattle, WA*; Christopher A. Potter, MD; Annemarie Relyea-Chew, JD, MS; Martin L. Gunn, MBChB

LEARNING OBJECTIVES: Acute aortic syndrome (AAS) is a recently recognized term that encompasses all nontraumatic emergency diseases of the thoracic aorta, including aortic dissection (AD), intramural hematoma (IMH), and penetrating atherosclerotic ulcer (PAU). At the conclusion of this activity, the participant will be able to recognize the unique imaging features of AD, IMH, and PAU in multiple modalities and relate these features to management and outcomes.

CONTENT DESCRIPTION: *Background and Pathophysiology:* We review the clinical presentation, pathophysiology, and incidence of AD, IMH, and PAU, as reported in the imaging as well as the current clinical literature. Illustrative diagrams and histopathology will be presented to enhance understanding.

Imaging Features: The classic features of AD, IMH, and PAU on CT, MRI, echocardiography, and angiography will be described and illustrated. Optimal use of the various modalities will be discussed.

Current Therapeutic and Clinical Considerations: We address the imaging evaluation and clinical management of AD, IMH, and PAU, emphasizing instances where guidelines for intervention are controversial and evolving. The key imaging features that guide intervention will be highlighted. We will summarize the clinical outcomes of AD, IMH, and PAU and the appropriate use of imaging follow-up.

■ Education

**(E-34) Wednesday • 7:00–8:15 AM
Radiology Resident and Fellow Procedure Logs: Where
Are We, and Where Should We Be Going?**

Erik E. Dowden, MD, *Emory University, Atlanta, GA*; Mark E. Mullins, MD, PhD; Deborah A. Baumgarten, MD, MPH

LEARNING OBJECTIVES: 1. Know current requirements for trainee procedure recording and modalities used. 2. Understand qualities that make logging formats appealing to trainees, PDs, ACGME, and employers. 3. Understand how other specialties record procedures and how these methods may be applied to radiology. 4. Discuss what may improve the current state of procedure recording.

CONTENT DESCRIPTION: *Background:* The Radiology RRC of the ACGME has made changes to radiology programs. One requirement is a procedure log; the exact method is not specified. Currently, a unified format does not exist.

Structure: We explore methods used by trainees, desirable qualities of logging systems, and how desires vary among the stakeholders: trainees, PDs, ACGME, and employers. We explore other specialties' systems and how we might adapt them for radiology. We suggest how the current state can be improved.

Discussion: Trainees have many methods for procedure recording. Trainees should prefer a method that is easy, timely, low in cost, and portable between software formats. PDs might prefer unification and continuous updating. For the ACGME, a unified format makes sense. Assessment of competency and documentation are challenging, and establishing stan-

dards is one way to document competency. It would benefit employers if logs were organized, searchable, and grouped by CPT codes. Other specialties currently utilize the ACGME case log system, which offers a unified template, is downloadable to other formats, and uses CPT. Radiology trainees and programs would benefit from the unity and credibility that a single system offers. A system that could query anyone's cumulative experience from a department's information system would be a solution to the logging process.

Conclusion: Although there are many methods for recording and although stakeholders needs differ, unifying themes exist: organization, searchability, compatibility, and easy updating. The radiology community could learn from other specialties and create a unified system, as well as establish standards for procedure documentation to help determine trainee competency.

**(E-35) Thursday • 7:00–8:15 AM
Radiology after Dark: Overnight Attending-Level
Coverage at U.S. Academic Centers and Its Effect on
Radiology Education**

Tarek N. Hanna, MD, *Emory University Hospital, Atlanta, GA*; Keith P. Tomich, MD; Deborah A. Baumgarten, MD, MPH (*tarekhannamd@gmail.com*)

LEARNING OBJECTIVES: 1. Recognize the increasing prevalence of overnight attending-level coverage (OALC) in U.S. academic radiology centers. 2. Gain a better understanding of the effect that OALC has on radiology resident education. 3. Address potential adverse impacts of OALC on resident education.

CONTENT DESCRIPTION: Viewing our own multihospital program as a microcosm of academic radiology residencies, we have seen a concerted effort over the past several years to implement 24-hour overnight attending-level coverage (OALC) in lieu of after-hours coverage by independent on-call radiology resident(s). The reasons to implement OALC are broad and likely vary from institution to institution. However, it is presumed that fundamental issues of quality and patient care (eg, the speed and accuracy of radiologic interpretation) lie at the heart of this shift. With the increasing adoption and spread of OALC, one must then consider the unique problem faced by academic centers: How does OALC affect resident education? In an attempt to quantify the scope of OALC, we have conducted a two-phase national survey of U.S. radiology residency program directors and residents, first in 2005 and repeated in spring 2010. We uncovered a significant increase in overall OALC from 14.6% to 46.2% during the 5-year interval. We also uncovered subtrends in forms of OALC, specifically an increasing trend of in-house faculty coverage and a decreasing trend in off-site teleradiology. At those institutions where OALC had been implemented, we surveyed the perceptions of program directors and residents about OALC and its impact on resident education. Our poster provides a summary of these results from our 2010 survey.

**(E-36) Wednesday • 7:00–8:15 AM
Coastal Capers**

Chockeo Syvanthong, MD, *Savannah, GA*

LEARNING OBJECTIVES: Identify plain film imaging characteristics of the following: stingray barb, fishhook, near drowning, and seashell.

CONTENT DESCRIPTION: The poster is an interesting and informative look at imaging findings particular to coastal towns of the southeast United States. Readers will be informed about and be able to identify plain film imaging findings associated with near drowning victims, stingray barb injury, fishhook injury, and imaging characteristics of seashells.

**(E-37) Thursday • 7:00–8:15 AM
Ten Misused and Misunderstood Terms in Musculo-
skeletal Radiology: A Pictorial Review**

Sukhvinder S. Dhillon, MBChB, MRCP*, *University of Alberta, Edmonton, AB*; Shannon Erichsen; Matthew Frankel, BS (*sukhvinderdhillon@med.ualberta.ca*)

LEARNING OBJECTIVES: The musculoskeletal subgroup, comprising 18 radiologists at our institution, was surveyed with the question: "What radiological terms have you encountered in musculoskeletal radiology reports that you consider misused or misunderstood?" From the responses,

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10 terms were identified for review. A literature search was performed for each term and disease condition to investigate the origin of the term and, where appropriate, the corresponding histopathology. The objectives of this exhibit will be for the learner to: 1. Understand the origin or accepted use of each term. 2. Be able to correctly apply the term in general radiology reporting and discussion. 3. Be familiar with the imaging appearances associated with each radiologic term and the conditions that may cause confusion in the correct use of each term.

CONTENT DESCRIPTION: The poster will be arranged in 10 sections, with each section addressing a misused or misunderstood radiologic term. Each section will discuss the origin or history of the term and the commonly accepted use of the term. The imaging appearances will be demonstrated and, where appropriate, any conditions that may cause confusion in the correct use of the term. Terms and conditions to be reviewed will be dystrophic calcification, heterotopic ossification, ligamentum flavum hypertrophy/thickening, delayed union and nonunion, intervertebral disk bulge and protrusion, syndesmosis, tendonitis, osteochondral defect, subtalar joint, and scoliosis.

(E-38) Wednesday • 7:00–8:15 AM
Utilizing a PACS-integrated Breast Biopsy Simulator to Reinforce ACR Practice Guideline for Ultrasound-guided Percutaneous Breast Interventional Procedures in Residency

Kenneth Meng, MD, *Stanford Hospital and Clinics, Palo Alto, CA*; Amy White, MD, BS; Jafi A. Lipson, BA, MD (jlipson@stanford.edu)

LEARNING OBJECTIVES: 1. Review ACR Practice Guideline for Ultrasound-guided Percutaneous Breast Interventional Procedures. 2. Design a novel PACS-integrated US-guided (USG) breast intervention simulation for residency education. 3. Define criteria for review of postprocedure images stored in PACS to delineate procedural proficiency.

CONTENT DESCRIPTION: *Purpose:* Several barriers exist to learning USG breast procedures in residency, including patient safety and limited clinical time and patients. We propose a PACS-integrated USG breast intervention simulation to teach key aspects of the ACR practice guideline and improve technical proficiency.

Method and Materials: Training materials based on the latest revision (Oct 2009) of the ACR Practice Guideline for Ultrasound-guided Percutaneous Breast Interventional Procedures were provided to residents participating in the simulation. Turkey breast phantoms containing (a) pimento-stuffed olives, simulating solid breast masses, and (b) tied-off water-filled latex glove tips, simulating breast cysts, were provided. An exercise between two residents (an acting US technologist and physician) was developed to include the following USG tasks: (a) FNA of a cyst, with appropriately labeled pre- and postaspiration images; (b) 10-gauge vacuum-assisted core biopsy of a solid mass, with labeled images of the needle positioned beneath the mass and images of the mass within trough during biopsy; and (c) 14-gauge automated core biopsy of solid mass, with labeled images of pre-fire position and post-fire orthogonal views. The two residents then switched roles. The images were transferred from the US machine to the PACS server for faculty review and were evaluated for correct image annotation, needle position/angulation, and adequate imaging documentation of procedural success. Analysis was also performed of surveys sent to residents with and without the simulator experience.

Results: A PACS-integrated USG breast biopsy simulation was developed and is currently being implemented to instruct residency trainees regarding the technical aspects and importance of image documentation according to the ACR practice guideline.

Conclusion: The simulation provides tactile learning of important concepts in the ACR Practice Guideline for Ultrasound-guided Percutaneous Breast Interventional Procedures that can otherwise be learned only in live subjects.

(E-39) Thursday • 7:00–8:15 AM
First-Year Radiology Resident Handbook

Ryan M. Harvey, MD, BS, *University of South Florida, Tampa, FL*; Frank N. Garcia, MD, BS (rharvey@health.usf.edu)

LEARNING OBJECTIVES: 1. Understand the benefits of a broad but basic radiology text that can be assimilated in limited sittings and eas-

ily referenced. 2. Illustrate the content and format of a resident-created, attending-reviewed text that has improved education of 1st-year residents at our institution. 3. Understand the unique challenges faced by 1st-year radiology residents.

CONTENT DESCRIPTION: For the beginner, radiology represents a challenge unlike any other medical discipline. The 1st-year resident assigned to a PACS station must rapidly acquire unfamiliar fundamental skills and knowledge to achieve basic competence. Medical or surgical interns, on the other hand, are more likely to begin with a baseline of experience from medical school clerkships, and they practice in a more rigid hierarchy of responsibility and supervision by senior residents and attending physicians. We recognize that the core entry-level radiology texts are too lengthy to assimilate in a few sittings before starting a new rotation. As 2nd-year residents, we created and distributed a handbook to help beginners rapidly achieve a broad but basic comfort and facility. Each chapter represents a separate modality or organ system, designed to be read before a rotation and organized to allow quick reference. The chapters outline normal imaging characteristics, including evidence-based rules of thumb for organ dimensions, density, and echogenicity. Common abnormalities and differential diagnoses are conveniently tabulated. Figures and tables are included when they enhance clarity or brevity. Basic procedures are outlined step by step. Standard reports and suggested interpretation sequences are included. We also outlined the institution-specific work flow for each rotation. An attending radiologist from each imaging subspecialty reviewed the chapter for his or her area of expertise. The handbook has improved education of 1st-year residents at our institution, who have found that it speeds their assimilation of knowledge otherwise learned on the job and enhances their confidence. The handbook remains a frequently referenced document. Our poster will demonstrate the content and format of this handbook.

(E-40) Wednesday • 7:00–8:15 AM
Resident Education Spotlight: A Blueprint for Creating a Resident-run Interventional Radiology Clinic

Matthew Recker, *Maine Medical Center, Portland, ME*; Cuong H. Lam; Heath K. McCullough, MD, BS; Curtis L. Anderson, MD, PhD; Rachel Hollander, BS; George Vatakencherry, MD, et al (mattrecker@gmail.com)

LEARNING OBJECTIVES: 1. Present a blueprint for creating an IR resident continuity clinic within the framework of an existing DR residency program, based on the experiences of multiple institutions. 2. Outline seven action items to establish a clinic and address anticipated obstacles. 3. Provide electronic resources for programs seeking to implement similar clinics.

CONTENT DESCRIPTION: We represent institutions that have initiated or are developing resident-run IR clinics. We believe that clinical access to direct patient care, from referral through follow-up, maintains the clinical competence developed during internship and provides correlative experiences relevant to radiology training. Outlined below are seven action items essential to starting a resident-run IR clinic. We discuss recommendations for each item, as well as roadblocks encountered during the process. The first, most basic issue addresses space and equipment. A framework must be in place to ensure availability of both the resident and the attending proctor. Referral generation is the most important process for maintaining the resident clinic. Documentation issues in the medical record will vary by institution. Documentation plays an important role in communication with the referring physician. Continuity of care must be managed by the resident service. We provide links to electronic materials that will be useful for a resident and department starting a resident-run clinic. These include a clinic manual, solutions to the issues discussed above, and presentation templates to educate referring services. Resident-run IR clinics are integral to the clinical education of future interventional physicians. In addition, clinics foster the skills of all DR residents and enhance programs' abilities to satisfy the ACGME core competencies. In our shared experiences, we have identified several important action items that require consideration by residents and programs wishing to start their own clinics. We provide electronic resources to assist and encourage more residents to take this step toward improved clinical education.

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(E-41) Thursday • 7:00–8:15 AM
Lines and Tubes Radiology Learning Module

Joo Y. Cho, BS, *Dartmouth Medical School, Lebanon, NH*; Petra J. Lewis, MD* (*joo.y.cho@dartmouth.edu*)

LEARNING OBJECTIVES: 1. Provide basic knowledge of lines and tubes by (a) providing photographs of the lines/tubes and their positioning in a humanoid model and (b) reviewing the purpose, proper positioning, common misplacements, and complications of each of the lines/tubes. 2. Allow the learner to acquire familiarity and in-depth knowledge by providing sample radiographs with correctly and incorrectly positioned lines. 3. Enhance learning by providing instant answers and explanations.

CONTENT DESCRIPTION: *Introduction:* Knowing and recognizing various types of catheters placed in patients, as well as appropriate and inappropriate catheter positioning, are important for medical students and residents. Acquiring such knowledge can be more effective with a comprehensive learning resource. We designed this learning module to provide a systematic review of correct and incorrect line and tube placements.

Methods: The module is a hyperlinked PowerPoint-based module. The initial compilation of radiographs with line placements was acquired through PACS from one of the author's collections. Digital photographs of the lines alone and those positioned in simulation humanoid models were taken for correlation. Lines and tubes included in the module are central venous lines, Swan-Ganz catheters, endotracheal tubes, nasogastric tubes, Dobhoff tubes, Foley catheters, pacemakers, PICC, tracheostomy tubes, umbilical catheters, and misplaced guidewires. Adobe Photoshop was used to edit the images. Images may be accessed by line type or randomly. Each tube/line type includes normal and abnormal placements, as well as text on potential complications. Images can be viewed with or without annotation illustrating the tube/line path. The module is designed to be self-administered over several sessions.

Results: A learning module with over 600 slides was created and distributed among medical students and residents. Overall positive feedback was received, and the module was generally perceived as a useful educational tool. A Web-based version is being developed.

Conclusion: The Lines and Tubes Radiology Learning Module serves as a comprehensive and easy-to-understand learning tool for medical students and residents.

(E-42) Wednesday • 7:00–8:15 AM
Review of "QUIP" (Quality Information Program) for Identifying and Efficiently Communicating Errors within an Academic Diagnostic Imaging Department

Ania Z. Kielar, MD; Joseph O'Sullivan, MD, FRCPC; Matthew McInnes, MD, FRCPC; Matthew Quon, MD, BS, *Ottawa Hospital, Ottawa, ON*

LEARNING OBJECTIVES: 1. Demonstrate a way of semiautomatically communicating errors within the radiology department of an academic institution. Having a process such as this one allows (a) easier communication of suspected erroneous radiology reports and (b) an archiving system allowing more-efficient rectification of detected errors, thereby improving patient safety and care. 2. Demonstrate the educational value of such of a process for the involved radiologists, allowing a learning opportunity from these errors in a constructive manner and in a professional forum.

CONTENT DESCRIPTION: For radiologists in busy practice, detailed and confidential feedback concerning reporting errors and patient outcomes is a scarce commodity. Many benefits can be derived from such feedback, including self-audit and opportunity for timely correction of erroneous reports, thereby improving patient care. In this presentation, we will review the "QUIP" protocol, focusing on the incidence of reporting errors. In 2009, we developed and implemented a system for radiologists to efficiently and semiautomatically communicate errors identified within our department. Errors are usually discovered by radiologists while reviewing prior reports in the course of routine case reporting. This information is communicated via a shortcut in the voice-recognition dictation system or on a template on internal hospital e-mails (the QUIP) to the prior reporting radiologist and automatically also to an administrative assistant and the section chief. From these e-mails, the administrative assistant keeps a password-protected archive updated by body section. Dialogue may be established between radiologists in cases of disagreement,

although no resolution of differences of opinion is mandated. If an addendum is issued by the original radiologist, the treating physician automatically receives a faxed report of the original radiology report with attached addendum. Results of the archived errors by organ type in the abdomen and pelvis will be reviewed, with classification of types of errors (such as false positive, false negative, satisfaction of search, etc).

(E-43) Thursday • 7:00–8:15 AM
Navigating the Maze of Book Publishing

Elvira V. Lang, MD*, *Beth Israel Deaconess Medical Center, Boston, MA*; Joan E. Lewis, MEd, MPH* (*elang@bidmc.harvard.edu*)

LEARNING OBJECTIVES: 1. Understand the differences in the publishing process among various types of publishers: traditional publishing houses, university- or other specialty-based publishers, and self-publishing houses. 2. Appreciate the advantages and potential pitfalls associated with the different types of publishers. 3. Understand implications of the choice of publisher and contract on copyright, marketing, sales price, royalties, and future and ancillary use of the work.

CONTENT DESCRIPTION: Medical authors often accept standard publishing contracts when asked to contribute to a book or when seeking dissemination of their work, without consideration of what alternative approaches would entail. The emergence of electronic and self-publishing options further potentiates the possible consequences of the initial choice of publishing house. When working on a "how-to" book for a broad interdisciplinary audience of doctors, nurses, and technologists, a group that fell outside a single specified medical specialty, the authors were forced to research and engage with various publishing routes to find the best solution for their needs. This exhibit is based on their experiences, as well as those of other authors and professionals, and spans from conception to sales, distribution, and ancillary uses of the work. The exhibit reviews the steps required and potential pitfalls depending on use of a traditional publishing house, a university- or other specialty-based publisher, or a self-publishing house. The exhibit addresses proposal preparation; agents; writing editors; publishing contracts; royalties, copyright, derivative work; coauthor agreement; need for copy editors; indexers; designers of book cover and interior; distribution; obtaining an ISBN; listing on Amazon, the iPad, and similar online sellers; marketing; obtaining low-cost copies for the author's own use; implications for subsequent or prior publications; and use for continuing medical education credits. Thorough familiarization with the process, the assistance of several specialized individuals who are familiar with the trade, and due diligence in evaluating the publisher become essential. Only then can an author make the best decisions as he or she navigates the maze of modern publishing.

■ Informatics

(E-44) Wednesday • 7:00–8:15 AM
Brain MR Imaging Reference: An iPad Application

Paul P. Byra, MD, BS, *University of South Florida, Tampa, FL*; William Pechter, MD, BS

LEARNING OBJECTIVES: 1. Be aware of the new capabilities of electronic resources. 2. Introduce and learn how to utilize a new iPad application as an imaging reference.

CONTENT DESCRIPTION: Traditional radiologic references have included textbooks, journals, and online articles. With the introduction of newer electronic devices, the future of radiology references and education lies in our portable computers, cell phones, and medical Web sites. It is important for radiologists to recognize the capabilities of the newest portable devices. We created a brain MR imaging reference for the iPad that serves as an example of these capabilities. The earliest portable devices date back to the 1970s with the advent of handheld calculators. With the development of higher-resolution LCD screens, faster processors, increased memory storage capabilities, and Wi-Fi and the Internet, devices such as the iPad are becoming an important adjunct to teaching and medical referencing. The Brain MR Imaging Reference is a program developed for the Apple iPad, a tablet-type programmable device with a 9.7-inch multitouch display, 1024 × 768-pixel resolution, 1-gigabyte processor, 512-megabyte SDRAM, and up to 64 gigabytes of storage on flash drive. The program displays a series of sequential axial T2 FLAIR images of the

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brain with a scroll feature utilizing a touch screen. On each axial image, the gyri, sulci, deep brain structures, midbrain, ventricular system, vascular structures, and cranial nerves are labeled, with the user having the ability to remove or add a particular group of labels. This program provides an example of the user-friendly interface of portable devices that can be used as a medical resource. We will be present to personally demonstrate the new program.

■ Musculoskeletal

(E-48) Wednesday • 7:00–8:15 AM Radiographic Interpretation of the Ankle: A Systematic Approach to Interpreting Ankle Radiographs

Rebecca Gurney, BA, MD; Tudor H. Hughes, MD, FRCR, *University of California San Diego Medical Center, San Diego, CA*; Amilcare Gentili, MD

LEARNING OBJECTIVES: 1. We will review the basic anatomy of the ankle. 2. We also will review the normal ankle x-ray views and how to read them properly. To help with this, we will make an ankle checklist that will provide a systematic way to review an ankle x-ray after an injury and not miss important diagnoses. 3. We will review basic injury patterns in the ankle and provide examples of these so as to better help primary care physicians and new radiologists know what to look for.

CONTENT DESCRIPTION: In the case of ankle trauma, the ankle x-ray can be difficult to interpret for primary care physicians and junior radiologists. This poster reviews ankle anatomy and the basics in interpreting a normal ankle x-ray series. We then created an ankle checklist to use to avoid missing any of the key injuries that can occur with ankle trauma. We review a number of basic injury patterns. The ankle checklist will help providers with a systematic way to review an ankle x-ray after an injury and not miss important diagnoses.

(E-49) Thursday • 7:00–8:15 AM Juxtacortical Bone Lesions: Radiographic and MR Imaging Evaluation

Saifuddin T. Vohra, DO, *William Beaumont Hospital, Royal Oak, MI*; David Marcantonio, MD, BS; Ali Shirkhoda, MD*

LEARNING OBJECTIVES: 1. Recognize common appearances of juxtacortical lesions of bone on conventional radiographs and magnetic resonance imaging examinations. 2. Develop understanding of how to differentiate benign tumorlike conditions, such as myositis ossificans, from aggressive tumors. 3. Choose the appropriate imaging test to facilitate accurate interpretation and differentiation of benign and malignant processes.

CONTENT DESCRIPTION: Juxtacortical lesions of the bone include a myriad of conditions—from the well-recognized periosteal osteosarcoma, parosteal osteosarcoma, and chondrosarcoma, to benign tumorlike conditions, such as myositis ossificans. A retrospective review was performed of (a) the tumor board registry from 1990 to 2005 and (b) cases from the Department of Oncology. We depict the salient features and illustrate the appearance of these common juxtacortical lesions of bone on conventional radiography and MRI and place emphasis on differentiation of benign tumorlike conditions, such as myositis ossificans, from aggressive tumors. Accurate imaging interpretation and the choice of an appropriate imaging study are crucial to the process of differentiating malignant from benign processes.

(E-50) Wednesday • 7:00–8:15 AM Imaging of Patella Tracking

Arka Chaudhury; Tudor H. Hughes, MD, FRCR, *University of California San Diego Medical Center, San Diego, CA* (achaudhu@ucsd.edu)

LEARNING OBJECTIVES: 1. Comprehend the normal and abnormal imaging of patella tracking and its pathologic manifestations, utilizing various imaging modalities. 2. Recommend a protocol of appropriate imaging for the various presentations of patella tracking and abnormal tracking. 3. Apply this knowledge to everyday imaging to aid the orthopedic surgeon in both conservative and surgical management decisions.

CONTENT DESCRIPTION: This poster presentation discusses the normal alignment of the patella and its static and dynamic stabilizers. We

then show the numerous methods of measurement of patella tracking using various imaging modalities. Abnormalities of patella tracking and their various degrees are discussed with reference to presurgical planning. Post-operative images of corrective surgery are also discussed.

(E-51) Thursday • 7:00–8:15 AM X-ray Views of the Shoulder: A Clinician's Guide to Ordering Appropriate Views

Angela M. Voight, MD, BA; Amilcare Gentili, MD; Tudor H. Hughes, MD, FRCR, *University of California San Diego Medical Center, San Diego, CA*

LEARNING OBJECTIVES: 1. Identify the most common shoulder x-rays. 2. Assist clinicians in choosing the correct shoulder x-ray based on the clinical picture. 3. Identify which x-ray view is the best for certain pathology.

CONTENT DESCRIPTION: Standard radiography is the most common imaging modality used for the shoulder, and various views can be utilized to demonstrate specific pathology. The purpose of this poster is to assist clinicians in ordering the correct x-ray views of the shoulder, depending on the pathology they are looking to identify. The most common views of the shoulder are listed, including the anteroposterior (AP), internal rotation, external rotation, AP scapula, scapular Y, axillary, Velpeau, supraspinatus outlet, West Point axillary, and Stryker notch views. A description of how to obtain the x-ray is included for the less-common views, along with a diagram demonstrating patient positioning. The shoulder pathologies best identified by the view are listed. This poster can assist clinicians in choosing the most appropriate x-ray view of the shoulder based on the clinical scenario.

(E-52) Wednesday • 7:00–8:15 AM Radiographic Features of Pincer and Cam Femoroacetabular Impingement



Nicholas M. Cardinale, MD, DO; Tudor H. Hughes, MD, FRCR, *University of California San Diego Medical Center, San Diego, CA* (ncardinale@ucsd.edu)

LEARNING OBJECTIVES: 1. Understand the clinical and radiographic features of femoroacetabular impingement (FAI). 2. Describe the best radiographic views for the assessment of FAI. 3. Describe the two categories of FAI known as the cam and pincer types. 4. Understand how structural abnormalities in the hip joint contribute to the pathologic motion that creates FAI. 5. Appreciate the importance of early diagnosis and treatment with arthroscopic hip resurfacing.

CONTENT DESCRIPTION: Femoroacetabular impingement (FAI) is an important clinical entity associated with hip pain in young active people. FAI has been increasingly recognized as a cause of early osteoarthritis (OA). The diagnosis is clinical, based on pain with hip flexion and internal rotation. Properly performed conventional radiographs are very useful in identifying anatomic abnormalities associated with FAI. Patients suspected of having FAI benefit from early diagnosis and operative treatment. Prognosis is poor once radiographic signs of OA become present. The proper application of specific radiographic techniques will uncover associated findings of FAI and facilitate early intervention. This poster discusses radiographic abnormalities found in pincer and cam FAI and illustrates arthroscopic hip resurfacing.

(E-53) Thursday • 7:00–8:15 AM Morel-Lavallee Lesions: Typical MR Imaging Features of These Ancient Hematomas

Charles M. Hubeny, MD, *University of Rochester Medical Center, Rochester, NY*; Scott Wilbur; Jeremy Sykes, MD; Johnny U. Monu, MD

LEARNING OBJECTIVES: Morel-Lavallee lesions usually result from remote trauma and can have variable MR imaging characteristics. These hematomas may have aggressive features and can be confused with other lesions, especially neoplasms. We present several examples of Morel-Lavallee lesions in an attempt to familiarize the radiologist and aid in diagnosis.

CONTENT DESCRIPTION: The material will be presented in poster format, with several examples of Morel-Lavallee lesions of the thigh, as well

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as other less-frequent locations. The typical MR imaging appearance, mainly focusing on T1, T2, and contrast enhancement pattern, will be discussed.

**(E-54) Wednesday • 7:00–8:15 AM
Early and Late MR Imaging Findings in Rheumatoid Arthritis**

Narasimhachar Prativadi, MD, *University of Rochester Medical Center, Rochester, NY*; Alok A. Bhatt, MD; Steven Meyers, PhD (*nprativadi@gmail.com*)

LEARNING OBJECTIVES: 1. Have a strong understanding of the disease process of rheumatoid arthritis, including definition, signs and symptoms, frequency of occurrence, age of onset, gender ratio, and location in adults and children. 2. Have a solid background on the early appearance of rheumatoid arthritis on MRI, since it has been shown to detect changes up to 1 year earlier than conventional radiography. 3. Have a firm foundation in the late findings of rheumatoid arthritis on MRI.

CONTENT DESCRIPTION: Background information on the disease process of rheumatoid arthritis will be discussed, including definition, signs and symptoms, frequency of occurrence, age of onset, gender ratio, and location in adults and children. Early changes of rheumatoid arthritis on MRI will be discussed, including active synovitis and bone erosions in the wrist, metacarpophalangeal joints, and feet, synovial hypertrophy, and joint effusions in juvenile rheumatoid arthritis. Late changes of rheumatoid arthritis will be reviewed, including synovial hypertrophy, soft-tissue swelling, zones of erosion, destruction of hyaline cartilage and other joint structures, cyst formation, joint effusion, and rheumatoid nodules.

**(E-55) Thursday • 7:00–8:15 AM
MR Imaging Appearance of Periosteal Reaction**



Gunvir S. Gill, MD, *University of Rochester Medical Center, Rochester, NY*; Gary Hollenberg, MD; Steven Meyers, PhD; Brett S. Talbot, BS (*gunvir_gill@urmc.rochester.edu*)

LEARNING OBJECTIVES: 1. Identify variations in the appearance of periosteal reaction (PR), as well as associated subperiosteal pathology, on MRI, with CT/plain radiograph correlation. 2. Recognize the sensitivity of MRI for demonstrating nonossified PR and subperiosteal collections/tumor that may not be visible on plain film or CT. 3. Recognize common patterns of PR associated with several disease states as seen on MRI: fracture/stress fracture, osteoid osteoma, chondroblastoma, Ewing's sarcoma, osteosarcoma, osteomyelitis, and lymphoma/leukemia.

CONTENT DESCRIPTION: Periosteal reaction (PR) is the response of cortical bone to tumors, infection, trauma, and various other causes. PR seen on imaging represents either periosteal new bone formation or periosteal elevation. On radiographs and CT, PR appears as linear ossification superficial to or surrounding the adjacent cortex. While CT has the advantage over radiography of demonstrating subtle calcifications and areas of cortical destruction, MRI can best demonstrate early nonossified PR, as well as subperiosteal collections of blood, pus, or tumor. There is considerable overlap between the disease entities that, at various points in their natural history, produce aggressive- or nonaggressive-appearing periosteal reaction. This poster will demonstrate the value of MRI in identifying PR and subperiosteal pathology associated with various bone lesions. This can help add specificity and focus to the differential diagnosis in a manner that is clinically relevant.

**(E-56) Wednesday • 7:00–8:15 AM
Femoroacetabular Impingement: Diagnosis and Treatment**

Meena Moorthy, MD, *University of Rochester Medical Center, Rochester, NY*; Ben Wandtke, MD; Brian Giordano, MD, BA

LEARNING OBJECTIVES: Femoroacetabular impingement (FAI) is a mechanical hip disorder that was first described by Reinhold Ganz et al in 2001. This condition generally affects active young adults and, if not recognized and treated early, can lead to early arthritic changes. This presentation will review the initial radiologic manifestations of FAI by using a multimodality approach. We will then focus on the management and surgical treatment of FAI, as well as review the postoperative imaging findings.

CONTENT DESCRIPTION: We will use a multimodality approach to review the anatomy of the hip and the three types of FAI (cam, pincer, and mixed), as well as the radiologic findings that can be used to aid diagnosis, including the alpha angle and the crossover sign. Illustrative cases with plain radiographs and cross-sectional imaging, including MR arthrography, will be used to demonstrate the types of FAI and the common sequelae, including labral tears, herniation pits, and damage to the acetabular cartilage. Focus will be on the management of FAI, with intraoperative images from corrective hip arthroscopy. Correlation will be made to postoperative imaging findings, which will include not only the lesion itself, but also the appearance of the treated sequelae mentioned above.

**(E-57) Thursday • 7:00–8:15 AM
Musculoskeletal Manifestations of Neurofibromatosis 1**

Gunvir S. Gill, MD, *University of Rochester Medical Center, Rochester, NY*; David Tuttle, MD; Gary Hollenberg, MD; Steven Meyers, PhD (*gunvir_gill@urmc.rochester.edu*)

LEARNING OBJECTIVES: Using CT and MR imaging, and with plain radiographic support, we will illustrate and describe the various primary and secondary changes of neurofibromatosis 1 that involve the musculoskeletal system, including plexiform neurofibromas, focal enlargement/gigantism, tibial bowing/pseudoarthrosis, sphenoid dysplasia/facial bone malformation/harlequin eyes, dural ectasis/vertebral body scalloping/meningoceles, focal kyphosis/scoliosis, neural foraminal widening/osseous erosions, and ribbon ribs.

CONTENT DESCRIPTION: Neurofibromatosis 1 (NF1) is possibly the most common inherited disorder caused by the dysfunction of a single gene. Although inherited in an autosomal dominant fashion, up to 50% of NF1 cases arise by spontaneous mutation. Additionally, the variability of expression of this complex disorder leads to widely differing degrees of severity, even among affected members of the same family. As a result, the diagnosis of NF1 is often not obvious, and it may be up to the radiologist to diagnose this condition or at least to suggest it as a differential consideration. Among the most characteristic lesions of NF1 are those that involve the musculoskeletal system. These are either primary (changes due to mesodermal dysplasia) or secondary (erosive changes, changes due to mass effect, etc). The purpose of this poster is to illustrate and describe the spectrum of primary and secondary musculoskeletal manifestations of NF1 likely to be encountered in clinical practice.

**(E-58) Wednesday • 7:00–8:15 AM
Imaging Spectrum of Collagen Vascular Diseases with Clinical Correlation**

Luke R. Scalcione, MD, *Winthrop University Hospital, Mineola, NY*; Jonathan Flug, MD, MBA; Colin E. Swenson, MD, BA; Joseph P. Mазzie, DO; Douglas S. Katz, MD; Jonathan S. Luchs, MD*

LEARNING OBJECTIVES: The purpose of this education exhibit is to demonstrate the imaging characteristics of various collagen vascular disorders, with emphasis on musculoskeletal imaging, while utilizing a case-based approach. Various collagen vascular disorders will be presented, and disease-specific image findings as well as disease progression will be demonstrated.

CONTENT DESCRIPTION: The education exhibit will be organized by disease: dermatomyositis, polyarteritis nodosa, rheumatoid arthritis, scleroderma, and systemic lupus erythematosus. The disease entity, pathophysiology, and musculoskeletal image findings will be reviewed. Clinical cases from our institution will be utilized to demonstrate disease-specific image findings and disease progression.

**(E-59) Thursday • 7:00–8:15 AM
Bone Marrow Edema on CT in Patients with Known or Suspected Fracture/Trauma**

Jonathan S. Luchs, MD*; Luke R. Scalcione, MD, *Winthrop University Hospital, Mineola, NY*; Michelle Klein; Joseph P. Mазzie, DO; Douglas S. Katz, MD

LEARNING OBJECTIVES: The purpose of this education exhibit is to demonstrate how regions of intratrabecular attenuation seen within fractures (or occult fractures) on computed tomographic examinations may correlate directly with the bone marrow edema seen on magnetic resonance imaging examinations.

* Faculty financial disclosures are located in the Faculty Index.

CONTENT DESCRIPTION: The education exhibit will utilize a case-based approach to demonstrate how subtle regions of intratrabecular attenuation seen within fractures (or occult fractures) on CT examinations correlate with the bone marrow edema pattern seen on MRI. The findings in patients who have undergone CT and MRI examinations at our institution for evaluation of fracture(s) will be utilized to demonstrate our results and lead a discussion on the pathophysiology of bone marrow edema in acute fractures.

(E-60) Wednesday • 7:00–8:15 AM

Name the Mechanism: Pattern Recognition of Acute Musculoskeletal Injuries

Stacy E. Smith, MD; Joseph P. Mazzie, DO; Douglas S. Katz, MD, *Winthrop University Hospital, Mineola, NY*; Luke R. Scalcione, MD; Jonathan Flug, MD, MBA; Daniel Garnet, MD (*sesmd@yahoo.com*)

LEARNING OBJECTIVES: The purpose of this education exhibit is to present a variety of musculoskeletal injuries with regard to characteristic imaging appearance and mechanism of injury. Review of this exhibit should provide the radiologist with a working knowledge of common and uncommon injuries of the skeletal system and their imaging appearances.

CONTENT DESCRIPTION: The purpose of this education exhibit is to present multiple fractures on plain radiographs and CT, as well as bone contusion patterns on MRI. This exhibit will not only test but also reinforce the different mechanisms that are responsible for each injury. This will be organized according to anatomic structures in order to enhance the learning and review of the material. Mechanisms of injuries and their associated types of fracture dislocations that will be reviewed will include many different anatomic regions. If a specific contusion pattern is associated with the particular injury, MR images of the characteristic bone bruise pattern will be presented. The treatment options for each of the described injuries will also be reviewed when appropriate. The clinical severity of the injuries and significant urgent findings that should be reported will be discussed.

(E-61) Thursday • 7:00–8:15 AM

Pictorial Essay of Orthopedic Surgical Sponges Missing in Action

Rebecca Wu, MD, BS, *Winthrop University Hospital, Mineola, NY*; Luke R. Scalcione, MD; Marjorie Kulesa, RN; Jonathan S. Luchs, MD*

LEARNING OBJECTIVES: The purpose of this education exhibit is to demonstrate the radiographic imaging characteristics of various orthopedic sponges to heighten awareness and to aid in the detection of foreign bodies in the intraoperative and perioperative setting.

CONTENT DESCRIPTION: The education exhibit will be organized by using a pictorial approach to demonstrate the radiographic characteristics of various orthopedic sponges. Teaching points would include a literature review of the prevalence of retained operative foreign bodies, as well as the sensitivity of conventional radiographs in detection. Various types of sponges, including laparotomy sponges and peanut dissectors, have been collected, and conventional radiographs have been obtained to document their appearance. The surgical sponges were imaged under wet and dry conditions, both with and without a phantom, to simulate the in vivo appearance of missing sponges. Comparison of radiographs with digital photographs was made.

(E-62) Wednesday • 7:00–8:15 AM

Mimics of Bone and Soft-Tissue Tumors Caused by Trauma

Avnit S. Kapur, MD, BS, *University of Chicago Hospitals, Chicago, IL*; Gregory S. Stacy, MD

LEARNING OBJECTIVES: 1. Understand that many patients referred to orthopedic oncologists present with radiographic and magnetic resonance imaging studies showing sequelae of trauma that mimic bone and soft-tissue tumors. 2. Describe imaging features of posttraumatic pseudotumors that result in unnecessary referral to orthopedic oncologists.

CONTENT DESCRIPTION: This exhibit reviews benign posttraumatic entities mistaken for neoplasia by radiologists, including stress injuries of bone, avulsion fractures, sequelae of impingement, myotendinous injuries, hematoma, myositis ossificans, and iatrogenic lesions. Knowledge of the typical clinical and imaging features of these entities will allow a confident radiologic diagnosis and prevent unnecessary referrals.

(E-63) Thursday • 7:00–8:15 AM

Multimodality Review of the Foot: What the Podiatrist Wants to Know

Joshua A. Nepute, MD, *University of Cincinnati, Cincinnati, OH*; Robert D. Wissman, MD; Nathaniel A. von Fischer, MD (*Robert.Wissman@Healthall.com*)

LEARNING OBJECTIVES: 1. Describe common abnormalities of the foot that are seen in a podiatrist's office. 2. Describe the clinical significance of the abnormalities. 3. Discuss the pertinent imaging findings seen at CT, MR imaging, plain radiography, and ultrasound that will impact the podiatrist's treatment plan.

CONTENT DESCRIPTION: I. The basic anatomy of the foot seen on CT, MR imaging, plain radiography, and ultrasound. II. Imaging findings at plain radiography, CT, MR imaging, and ultrasound examination of common abnormalities of the foot (eg, plantar fasciitis, turf toe, neuroma, hammer toe). III. Discussion of how the imaging appearance of each pathologic process can affect the podiatrist's treatment plan.

(E-64) Wednesday • 7:00–8:15 AM

Secondary Findings of Rotator Cuff Disease: A Multimodality Review

Rupa Radhakrishnan, MBBS, *University of Cincinnati College of Medicine, Cincinnati, OH*; Gunjan Aeron; Robert D. Wissman, MD; Nathaniel A. von Fischer, MD; Joshua A. Nepute, MD; Jerrell Ingalls, MD (*radhakrp@ucmail.uc.edu*)

LEARNING OBJECTIVES: 1. Review abnormalities associated with rotator cuff disease. 2. Review the clinical significance of these secondary findings. 3. Review the imaging findings of these abnormalities on plain radiography, computed tomography (CT), magnetic resonance (MR) imaging, and ultrasound.

CONTENT DESCRIPTION: Articular and the periarticular pathology secondary to rotator cuff disease will be reviewed. The anatomic and the pathophysiologic process of these changes will be discussed. The clinical significance of these changes will be presented. Sample cases with imaging findings of secondary signs at plain film, CT, MR imaging, and ultrasound will be presented.

(E-65) Thursday • 7:00–8:15 AM

Tendons That Snap, Subluxate, and Dislocate

Gunjan Aeron; Robert D. Wissman, MD, *University of Cincinnati College of Medicine, Cincinnati, OH*; Joshua A. Nepute, MD; Nathaniel A. von Fischer, MD (*robert.wissman@uc.edu*)

LEARNING OBJECTIVES: 1. Identify tendons in the appendicular skeleton that commonly snap, subluxate, and dislocate. 2. Review the clinical presentation, the pertinent anatomy, and the pathophysiology of commonly involved tendons. 3. Review the imaging findings of the above. 4. Discuss treatment options for symptomatic patients.

CONTENT DESCRIPTION: The tendons that commonly snap, subluxate, and dislocate at each appendicular joint will be identified. A discussion of the clinical presentation of commonly involved tendons, with anatomical and pathophysiological correlation, will be presented. Sample cases will be provided. A discussion of the treatment options for symptomatic patients will also be included.

■ Neuroradiology

(E-69) Thursday • 7:00–8:15 AM

Vertebral and Carotid Artery Dissections in the Head and Neck: A Case-based Review of the Clinical Presentations and Imaging Manifestations

Brent D. Griffith, MD, *Henry Ford Hospital, Detroit, MI*; Mark K. Kelly, BS, MD; Jayant Narang; Rajan Jain, MD*

LEARNING OBJECTIVES: 1. Recognize the various clinical presentations associated with carotid and vertebral artery dissection, both common and uncommon, and better understand the anatomic etiology for these presentations. 2. Readily identify the various imaging features of vertebral and carotid artery dissections on multiple imaging modalities, including MRI, MRA, CTA, and catheter angiography. 3. Recognize imaging features of potential complications of dissections, including stroke, thromboembolic

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disease, vessel occlusion, and pseudoaneurysm formation. 4. More readily diagnose vertebral and carotid artery dissections in everyday practice, and be able to recommend additional studies to clinicians in order to address potential complications.

CONTENT DESCRIPTION: Utilizing teaching files from our institution, we will examine multiple cases of dissections. The exhibit will focus on the following: I. Clinical manifestations of vertebral and carotid artery dissections—both common and uncommon; the exhibit will also address the potential anatomic and physiologic causes behind these presentations. II. Imaging features of vertebral and carotid artery dissections, with a focus on a multimodality approach to diagnosis including MRI, MRA, CTA, and catheter angiography; the presentation will also include line drawings and sketches where appropriate to provide more in-depth visual models. III. Imaging features of potential complications of dissections, including stroke, thromboembolic disease, vessel occlusion, and pseudoaneurysm formation.

**(E-70) Wednesday • 7:00–8:15 AM
Visual Field Defects: Review of Neuroimaging in
Conjunction with Visual Field Maps**

Neil J. Hansen, MD, *University of Michigan, Ann Arbor, MI*; Wayne Cornblath; Suresh Mukherji*, *Myria Petrou, MA, MBChB (neilhans@med.umich.edu)*

LEARNING OBJECTIVES: 1. Determine protocol for neuroimaging studies optimally, given the history of a specific visual field disturbance. 2. Apply an appropriate differential diagnosis based on neuroimaging findings and knowledge of the most common etiologies to present with a given visual field deficit. 3. Have an expanded knowledge of visual pathway anatomy, and understand and predict expected deficits associated with lesions found at specific locations along the visual pathway.

CONTENT DESCRIPTION: *Background:* Imaging can play a crucial role in the evaluation of visual field defects. Different types of field defects are usually associated with a distinct set of pathologies; awareness of these entities and associated imaging findings can help the neuroradiologist tailor the imaging protocol and interpret the findings to provide the maximum clinically relevant information and enhance patient care. Our education poster will review the imaging findings and corresponding visual field maps of patients with different lesions along the optic pathway.

Method and Materials: In collaboration with the neuro-ophthalmology division in our institution, we identified a number of patients with discrete lesions along the different parts of the optic apparatus and associated visual field defects. All patients had had an MR imaging examination of the brain and/or the orbits performed and a visual field map documented as part of their clinical record.

Results: A number of visual field defects and their corresponding imaging findings will be reviewed. These include, but are not limited to, central scotomas, altitudinal field defects, junctional and bitemporal hemianopias, and homonymous partial or total hemianopias.

Impression: Patients presenting with visual field defects often undergo neuroimaging evaluation as part of their diagnostic work-up. This education poster will review the most common pathologies and imaging findings associated with different field defects, information that is useful in determining the neuroimaging protocol and interpreting neuroimaging studies.

**(E-71) Thursday • 7:00–8:15 AM
Swallowing Complications of Head and Neck Cancer
Treatment Seen on Videofluoroscopy**

Shefali Kothary, MD, BS, *Beth Israel Medical Center, New York, NY*; Azita Khorsandi, MD; Cathy Lazarus, PhD (*skothary@chpnet.org*)

LEARNING OBJECTIVES: 1. Define swallowing physiology in the head and neck cancer patient by using videofluoroscopy. 2. Review the oral, pharyngeal, and esophageal complications seen on videofluoroscopic swallowing studies after treatment of head and neck cancer.

CONTENT DESCRIPTION: Treatment of head and neck cancer includes a combination of surgery, chemotherapy, and/or radiation therapy. With advances in treatment, disease burden is often reduced; however, there are residual functional changes that affect quality of life in patients following treatment. Videofluoroscopy is commonly used to assess function and complications after treatment of head and neck cancers. Frequently, findings seen on videofluoroscopy can be used to direct further management and

effectively help to improve quality of life for these patients. This exhibit will present a wide range of cases, reviewing the spectrum of oral, pharyngeal, and esophageal complications seen after therapy in treated head and neck cancer patients. The discussion for each complication will include the radiographic findings seen on videofluoroscopy, the functional sequelae of those findings, and the anatomic structure(s) whose damage may be causing the abnormality.

**(E-72) Wednesday • 7:00–8:15 AM
Spinal Vascular Malformations**

Jan C. Mazura, MD, *Cornell Medical College, New York, NY*; Apostolos J. Tsiouris, MD*

LEARNING OBJECTIVES: 1. Recognize key defining characteristics of spinal vascular malformations. 2. Properly characterize spinal vascular malformations based on the aforementioned defining characteristics. 3. Understand the key features of spinal vascular malformations that need to be conveyed to treating physicians, as they may alter treatment.

CONTENT DESCRIPTION: Spinal vascular malformations (SVMs) are a heterogeneous group of venous and arterial lesions that affect the spinal cord parenchyma both directly and indirectly. While rare, representing 3%–16% of spinal space-occupying lesions, SVMs are a significant and underdiagnosed cause of morbidity. Their varied and often nonspecific presentation, which ranges from progressive weakness over the course of months or years to an acute painful myelopathy, makes them challenging to diagnose clinically. Diagnostic imaging plays a pivotal role in the identification and proper classification of SVMs. MR imaging serves as the primary noninvasive imaging tool for diagnosing a suspected SVM; however, accurate classification is often only achieved with catheter angiography. The purpose of this poster is to present the spectrum of imaging findings seen with SVMs and discuss the classification system used to characterize these lesions, thus providing the radiologist with the tools necessary to correctly recognize and characterize SVMs. Early detection and proper characterization are paramount, as they allow early and appropriate intervention, which in turn provides the best hope for neurologic recovery.

**(E-73) Thursday • 7:00–8:15 AM
Acquired Toxic and Metabolic Diseases of the Brain: CT
and MR Imaging Features**

Jeremy Sykes, MD; Charles M. Hubeny, MD, *University of Rochester Medical Center, Rochester, NY*; Gunvir S. Gill, MD; Scott R. Schiffman, MD; Jeevak Almast

LEARNING OBJECTIVES: The acquired toxic and metabolic brain diseases demonstrate distinct findings on CT and MR imaging. An understanding of the pathophysiology, affected anatomic structures, and clinical history is essential in diagnosis. A variety of cases will be presented to familiarize the radiologist with their appearance and help aid in diagnosis.

CONTENT DESCRIPTION: Acquired toxic and metabolic brain diseases will be presented in a case-based format emphasizing pathophysiology and the CT and MR imaging appearances of involved anatomic structures. Pathologic entities will include hypoxic ischemic encephalopathy, hypoglycemia, hepatic encephalopathy, osmotic demyelination, Wernicke encephalopathy, Marchiafava-Bignami disease, phenytoin toxicity, heroin toxicity, and postchemotherapy and postradiation changes, among others.

**(E-74) Wednesday • 7:00–8:15 AM
Skull Lesions in Free-roaming Old-World Primates:
Imaging Findings and Gross Pathology, with Correlation
to Modern Man**

Daniel T. Ginat, MD, MS, *University of Rochester Medical Center, Rochester, NY*; Osbert Adjei; Johnny U. Monu, MD; Lawrence Sahler

LEARNING OBJECTIVES: The remains of old-world primates reveal disease processes similar to those that can affect modern man. Both x-ray and CT are helpful in discerning and formulating a diagnosis for lesions in primate fossil skulls. These findings provide insights into the disease process that are applicable to present-day patients. In particular, the following will be addressed: 1. Present the imaging features of skull pathology in old-world primates, and discuss their possible etiologies and differential diagnoses. 2. Correlate the imaging findings with the corresponding gross pathology. 3. Compare the disease counterparts in modern man. 4. Discuss the pearls and pitfalls of paleontological radiology.

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CONTENT DESCRIPTION: CT and x-ray findings of the following conditions in primate fossils and modern man will be illustrated: (a) dolichocephaly; (b) traumatic bone cyst, unicameral bone cyst, and aneurysmal bone cyst; (c) gnathopathy; (d) sickle cell disease, thalassemia, and medullary sclerosis; (e) subperiosteal hematoma, hemangioma, and hemangioblastoma; and (f) periapical abscess and draining sinus.

(E-75) Thursday • 7:00–8:15 AM
Spectrum of Hyperintense Intracranial Lesions on T1-weighted MR Imaging

Daniel T. Ginat, MD, MS, *University of Rochester Medical Center, Rochester, NY*; Steven Meyers, PhD

LEARNING OBJECTIVES: Several substances are bright on T1-weighted MRI. These include the following: fat, hemorrhage, protein, calcification/mineralization, and melanin. The spectrum of intracranial lesions that manifest as hyperintense on T1-weighted MRI is described and depicted in this exhibit.

CONTENT DESCRIPTION: T1 hyperintense intracranial lesions can be categorized as follows: (a) fat-containing lesions: teratoma, hamartoma, fat grafts, dermoid, lipomatous meningioma, cholesterol granuloma; (b) melanin-containing lesions: melanoma, melanocytoma, neurocutaneous melanosis; (c) protein-containing lesions: Rathke's cleft cyst, colloid cyst, craniopharyngioma, epidermoid cysts; (d) calcified or mineralized lesions: Fahr's disease, hyperalimantation, hyperparathyroidism, hepatic encephalopathy, tumor calcifications, Wilson's disease, cortical laminar necrosis; (e) blood product-containing lesions: intracranial and extracranial hemorrhage, intratumoral hemorrhage, giant aneurysms; and (f) miscellaneous: neurofibromatosis type 1, HIV, PKAN, carbon monoxide poisoning, ectopic pituitary. This exhibit provides a comprehensive overview of common and uncommon T1 bright intracranial lesions. A methodological approach for elucidating an effective differential diagnosis is elaborated.

AUR Trainee Prize: 3rd Place

(E-76) Wednesday • 7:00–8:15 AM
Diffusion-weighted Imaging Features of Skull Lesions

Daniel T. Ginat, MD, MS, *University of Rochester Medical Center, Rochester, NY*; Rajiv Mangla, MD; Gabrielle Yeane; Svenkbolm E. Ekholm, MD

LEARNING OBJECTIVES: Skull lesions are common and encompass a wide differential diagnosis. Many of these lesions have characteristic imaging features. Both benign and malignant skull lesions will be reviewed in terms of multimodality characterization and pathologic correlation. In particular, the role of advanced modalities, such as diffusion-weighted imaging, will be explored.

CONTENT DESCRIPTION: The radiographic, CT, MRI, and PET features of skull lesions will be described and depicted. The following types of cases will be included: (a) benign lesions, including hemangiomas, fibrous dysplasia, eosinophilic granuloma, brown tumor, Paget's disease, intraosseous meningioma, aneurysmal bone cyst, sinus pericranii, chordoma, arachnoid granulations, sarcoidosis, epidermoid cyst, CPPD, and osteomyelitis; and (b) malignant lesions, including metastases, chondrosarcoma, lymphoma, multiple myeloma, angiosarcoma, osteosarcoma, and hemangioendothelioma.

(E-77) Thursday • 7:00–8:15 AM
US Evaluation of Intraventricular Hemorrhage in the Preterm Infant

Joseph Reis III, MD, *University of Rochester Medical Center, Rochester, NY*; Vikas Datta, MD; Gunvir S. Gill, MD; Shweta Bhatt, MBBS; Vikram S. Dogra, MD (vikas_datta@urmc.rochester.edu)

LEARNING OBJECTIVES: 1. Highlight the current recommendations for radiologic screening of IVH. 2. Illustrate the normal sonographic anatomy of the periventricular region in the preterm infant. 3. Demonstrate the sonographic appearance of IVH. 4. Grade IVH based on key sonographic features. 5. Identify important complications of IVH on US.

CONTENT DESCRIPTION: Intraventricular hemorrhage (IVH) has a reported incidence of 30%–55% in the preterm infant; therefore, initial diagnosis and identification of associated complications are of the utmost importance. Grades of IVH are prognostically significant and are classified based on radiologic appearance on US. This exhibit will illustrate and discuss the sonographic findings characteristic of IVH. Specific focus will be placed on distinguishing among the different grades of IVH and associ-

ated complications. Screening and follow-up recommendations for at-risk patients will be reviewed.

(E-78) Wednesday • 7:00–8:15 AM
Unanticipated Vertebral Compression Fractures of the Thoracolumbar Spine on Emergent Multidetector CT of the Chest, Abdomen, and Pelvis

Douglas S. Katz, MD, *Winthrop University Hospital, Mineola, NY*; A. Orlando Ortiz, MD, MBA*; Michelle Klein (dkatz@winthrop.org)

LEARNING OBJECTIVES: Bring attention to the phenomenon of unanticipated acute and chronic thoracolumbar vertebral body compression fractures identified on MDCT examinations of the chest, abdomen, and pelvis—particularly on reformations—performed in the ED setting, fractures that were ultimately thought to be the cause of patient symptomatology and/or of potential importance.

CONTENT DESCRIPTION: Over a 2-year period at one institution, an experienced body imager identified over 50 patients with unanticipated acute and chronic thoracolumbar spine fractures on ED MDCT examinations in patients without known trauma or back pain; fracture identifications were facilitated by the routine use of coronal reformations for the abdomen and pelvis and relatively routine use of coronal reformations for the chest. Representative case examples will be shown, and the limited literature on this specific phenomenon will be reviewed. Radiologists are very aware of the utility of multiplanar CT reformations for spine evaluation in trauma, but when “routine” MDCT of the chest and/or abdomen/pelvis is performed without known trauma, the situation is quite different. Radiologists need to be aware that unanticipated thoracolumbar spinal compression fractures can and should be identified on MDCT data sets, particularly on multiplanar coronal and/or sagittal reformations. Such fractures may explain patient symptoms and/or be relevant.

(E-79) Thursday • 7:00–8:15 AM
Fractures of the Nasal Complex: Radiologic Characterization and Current Management

Matthew Fiesta, MD, BS, *University of Texas Southwestern Medical Center, Dallas, TX*; Mrudula Penta, MD, BS; Richard Suss, MD; David P. Chason, MD (david.chason@utsouthwestern.edu)

LEARNING OBJECTIVES: 1. Understand the anatomy of the nasal bones and septum. 2. Characterize fractures of the nasal complex in terms of mechanism, clinical presentation, key imaging findings, and potential complications. 3. Know the treatment of fractures of the nasal complex, including their expected appearance on follow-up imaging studies.

CONTENT DESCRIPTION: Fractures of the nasal complex are the most common type of facial fracture, and the septum is frequently involved. Although these fractures may generate little attention beyond their detection, it is helpful for radiologists to have a solid understanding in order to effectively convey the pertinent imaging findings to the treating physicians. Additionally, radiologists should be aware of the treatment options for nasal complex fractures, as well as their expected appearance following treatment. This exhibit illustrates the anatomy of the nasal complex and discusses the clinical presentation, CT and radiographic imaging characteristics, and potential complications. We will also address management of these fractures, with attention to surgical outcomes and potential treatment complications.

(E-80) Wednesday • 7:00–8:15 AM
Skull Base Anatomy: A Radiologic Overview

Jeffrey C. Markham, MD, *University of Texas Southwestern Medical Center, Dallas, TX*; Colby Engar, BS, MD; Harold D. Scott, BS, MD

LEARNING OBJECTIVES: 1. Recognize the radiographic, CT, and MRI appearance of important skull base structures in the axial, coronal, and sagittal planes. 2. Identify the pathologic and surgical significance of bony skull base landmarks, as well as clinically important neural and vascular structures that abut or traverse the skull base. 3. Understand the advantages and potential pitfalls of various imaging modalities relevant to the skull base, including CT and MRI protocols relevant to skull base imaging and possible artifacts.

CONTENT DESCRIPTION: A firm understanding of the anatomic and pathologic considerations related to the skull base is vital for every radiologist, in order to provide useful and accurate interpretations. Our poster (part

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I in a two-part series including a companion poster on skull base pathology) will present an overview of skull base anatomy. Our intent is to provide an image-rich reference guide to the skull base for radiology residents or general radiologists. First, the boundaries of each of the three skull base regions (anterior, central, and posterior) will be described and graphically portrayed by using 3D volume renderings with color overlays. Another color-enhanced 3D volume rendering will display the bones that comprise the skull base. The major bony landmarks and foramina will also be described and illustrated. Next, the major neural and vascular contents of the skull base will be presented by using illustrated tables and labeled images. Finally, the poster will include a section on the advantages and disadvantages of various imaging modalities and common pitfalls, with examples.

(E-81) Thursday • 7:00–8:15 AM
Skull Base Pathology: A Radiologic Overview

Colby Engar, BS, MD, *University of Texas Southwestern Medical Center, Dallas, TX*; Jeffrey C. Markham, MD; Harold D. Scott, BS, MD

LEARNING OBJECTIVES: 1. Review common and uncommon pathologic entities involving the skull base, including the anterior, central, and posterior regions, and the typical CT and MRI appearance of these diseases. 2. Identify major categories of disease that can involve the skull base (eg, congenital, vascular, neoplastic). 3. Describe familiar differential diagnostic considerations of general and location-specific skull lesions.

CONTENT DESCRIPTION: A discussion of the various pathologic entities involving the skull base will be included. Illustrated tables will provide a useful overview of both common and uncommon pathology of the skull base, categorized by both region and etiology. A variety of differential diagnosis lists (including those specific to the skull base and those generalized to the entire skull) will complete this section. An image-rich display will provide the learner with a useful reference for considering skull base lesions.

(E-82) Wednesday • 7:00–8:15 AM
Diffusion-weighted MR Imaging of the Head: A Review for Residents

Travis J. Blanchard, MD, *University of Texas Southwestern Medical Center, Dallas, TX*; Zerrin F. Yetkin, MD, BS; Chien I. Yang, MD; Dianne B. Mendelsohn, MD; Carlos L. Perez, MD, BS (*carlos.perez@utsouthwestern.edu*)

LEARNING OBJECTIVES: 1. Review the basic concepts of diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) maps. 2. Understand the theory of restricted diffusion in ischemic stroke. 3. Illustrate the clinical applications of DWI in other disease processes that should not be confused with stroke, including nonischemic cytotoxic edema, demyelination, infection, neoplasm, hemorrhage, and trauma.

CONTENT DESCRIPTION: DWI has many diagnostic applications, including the identification of ischemic stroke. However, radiology residents must be aware of the myriad etiologies of restricted diffusion and be able to identify other causes that should not be confused with stroke. This exhibit describes, illustrates, and discusses DWI, as well as the varied differential diagnoses of restricted diffusion.

(E-83) Thursday • 7:00–8:15 AM
Diseases of the Temporal Bone: A Review for Residents

Ryan E. Berecky, MD, *University of Texas Southwestern Medical Center, Dallas, TX*; Houston Aaron, MD; Chien I. Yang, MD; Carlos L. Perez, MD, BS (*carlos.perez@utsouthwestern.edu*)

LEARNING OBJECTIVES: 1. Outline disease processes of the temporal bone based on classification and location. 2. Understand the application of CT and MR imaging and their associated imaging characteristics in regard to these diseases.

CONTENT DESCRIPTION: The temporal bone is a complex structure both anatomically and compositionally, encompassing multiple tissue types and several important organs. Several disease processes are known to affect the temporal bone and may lead to significant morbidity if not properly identified and treated accordingly. By using CT and MR imaging, this poster aims to present these disease processes based not only on their general disease classification but also on their typical location within the temporal bone, so as to serve the radiologist in narrowing differential diagnostic considerations and to emphasize medical and surgical importance.

(E-84) Wednesday • 7:00–8:15 AM
Temporal Bone Anatomy: A Simplified Visual Approach for Residents

Houston Aaron, MD, *University of Texas Southwestern Medical Center, Dallas, TX*; Ryan E. Berecky, MD; Chien I. Yang, MD; Carlos L. Perez, MD, BS (*carlos.perez@utsouthwestern.edu*)

LEARNING OBJECTIVES: 1. Review multiplanar CT anatomy of the temporal bone. 2. Describe the major landmarks of the temporal bone and their anatomical relationships with one another in a simplified visual manner by using a level-by-level approach. 3. Serve as a reference atlas of temporal bone anatomy.

CONTENT DESCRIPTION: Temporal bone anatomy is both complex and challenging. The subtleties are easily overlooked during a diagnostic radiology residency without frequent reinforcement. Due to the complexity of temporal bone anatomy, residents often demonstrate only cursory knowledge of the subject, which can limit diagnostic interpretation and differential diagnosis. In this education poster, we aim to simplify the interpretation of the temporal bone by suggesting a level-by-level approach used at our institution for analysis and diagnosis.

(E-85) Thursday • 7:00–8:15 AM
Head and Neck Paragangliomas: A Case Series Illustrating the Spectrum of Radiologic Findings and Review of Current Treatment Options

Scott Perrin, MD, *Brandon, FL*; Matthew Assing, BS; Katie Bailey, BS, MD

LEARNING OBJECTIVES: 1. Review the current scientific understanding regarding paragangliomas of the head and neck, including their overall incidences, biologic behavior, clinical manifestations, and categorization schemes. 2. Elucidate the key radiologic findings of each paraganglioma type encountered in the head and neck (glomus jugulare, glomus tympanicum, glomus vagale, and carotid body tumor) through presentation of multimodality cases. 3. Discuss the variety of current treatment options, and explain how the imaging features of these tumors help to guide a personalized treatment approach.

CONTENT DESCRIPTION: Paragangliomas of the head and neck are rare entities with confusing categorization schemes and terminology, including multiple terms such as glomus tumors, carotid body tumors, and chemodectomas. The purpose of this educational project is to review the current scientific understanding of these tumors with respect to their biologic behavior, incidence in the general population, and spectrum of imaging findings encountered across multiple modalities. These educational objectives are accomplished through presentation of selected cases, with each case exemplifying one of the different types of paragangliomas of the head and neck, including glomus jugulare, glomus tympanicum, glomus vagale, and carotid body tumor. Each case presents the pertinent clinical information and imaging findings, with special emphasis on how the imaging findings directly affected the course of treatment for each individual patient.

(E-86) Wednesday • 7:00–8:15 AM
Pneumocephalus: Etiology, Imaging Findings, and Potential Complications

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LEARNING OBJECTIVES: 1. Review the causes of pneumocephalus and associated imaging findings. 2. Discuss the complications that can occur if pneumocephalus persists. 3. Explain the mechanisms of formation of tension pneumocephalus. 4. Illustrate the radiographic findings in tension pneumocephalus.

CONTENT DESCRIPTION: I. Causes of pneumocephalus. II. Locations of pneumocephalus and corresponding CT findings. III. Complications of pneumocephalus, including tension pneumocephalus. IV. Definition of tension pneumocephalus and clinical importance. V. Causes and mechanisms for development of tension pneumocephalus. VI. Imaging findings of tension pneumocephalus, including the Mount Fuji sign, the air bubble sign, and associated coexisting radiographic findings. VII. Presentation of an interesting case of tension pneumocephalus with spontaneous decompression into the ventricular system.

* Faculty financial disclosures are located in the Faculty Index.

(E-87) Thursday • 7:00–8:15 AM
Ruptured Intracranial Dermoid Cyst: The Pathogenesis, Differential Diagnosis, and Radiographic Manifestation

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LEARNING OBJECTIVES: 1. Understand the pathogenesis and etiology of intracranial dermoid cysts. 2. Review the differential diagnosis and radiographic appearance of this entity. 3. Illustrate a unique case of a ruptured intracranial dermoid cyst manifesting as new-onset seizures.

CONTENT DESCRIPTION: *Introduction:* Intracranial dermoid cysts are rare, accounting for less than 1% of intracranial tumors. These cysts are benign and slow-growing but may cause significant morbidity through compression of neurovascular structures and rarely may rupture into the subarachnoid space. We present a rare case of a spontaneously ruptured intracranial dermoid cyst manifesting as new-onset seizures. We also discuss the pathogenesis, radiographic manifestation, and differential diagnosis of this rare entity.

Case Report: A 19-year-old man presented to the ER with a history of new-onset seizures. CT and MRI revealed a large suprasellar lesion, as well as numerous fat droplets throughout the subarachnoid space, indicating that the seizures were due to chemical meningitis caused by spontaneous cyst rupture and widespread subarachnoid dissemination of fat droplets. The patient was placed on anticonvulsant therapy and was neurologically asymptomatic on follow-up.

Discussion: I. Pathogenesis, etiology, and clinical presentation of intracranial dermoid cysts. II. Review of differential diagnosis. III. Radiographic manifestation and treatment options.

■ Pediatric Radiology

(E-88) Wednesday • 7:00–8:15 AM
Special Considerations in Pediatric Breast Imaging

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 Dawn R. Engelkemier, MD; Patricia S. Poole, MD; Cary Goepfert, MD, BS (*dengelkemier@ucsd.edu*)

LEARNING OBJECTIVES: 1. Appreciate the wide spectrum of pathology involving the pediatric breast, including congenital/developmental lesions, cystic lesions, benign masses, and malignant tumors. 2. Understand proper imaging evaluation and management of breast lesions in the pediatric population and how they differ from those in adults. 3. Identify characteristic imaging findings of pediatric breast lesions, and generate an appropriate differential diagnosis.

CONTENT DESCRIPTION: Pediatric breast lesions can be a source of tremendous concern for parents, pediatricians, and radiologists. The radiologist plays an important role in guiding evaluation and management. A thorough knowledge of commonly encountered pathology and the generation of an appropriate differential diagnosis are crucial to this role. The spectrum of pathology and its incidence in the pediatric population vary considerably from those in adults. Pediatric breast lesions may occur due to normal and abnormal development, cystic processes, and benign and malignant tumors. While primary breast cancer is common in the adult population, it is very rare in the pediatric population. Additionally, the potential harmful effects of ionizing radiation and breast intervention are greater in children than in adults. Consequently, imaging evaluation typically begins with US, rather than mammography, and the decision to perform an invasive procedure must be carefully considered. It is crucial that the radiologist should understand the key differences between pediatric and adult breast imaging.

(E-89) Thursday • 7:00–8:15 AM
Caged In: The Chest Wall in Pediatric Restrictive Lung Disease



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LEARNING OBJECTIVES: 1. Comprehend how chest wall abnormalities can result in “restrictive lung disease.” 2. Explore different examples of

pathology in the anatomic and functional components of the pediatric chest wall. 3. Understand chest wall abnormalities seen through radiologic images.

CONTENT DESCRIPTION: Respiration involves not only the lungs but also chest wall components that function to deliver and remove inspired air: rib cage, intercostal muscles, diaphragm, subcutaneous tissues, pleura, nerves, sternum, and spine. The malfunction of any of these components limits the movement of air and decreases compliance of the chest wall, resulting in a restrictive lung disease–like state. Restrictive lung disease can develop from alteration in lung parenchyma or from these chest wall components. We explore representative pediatric disorders affecting the function of each of these thoracic components and present each case with radiologic image.

■ Women’s Imaging

(E-90) Wednesday • 7:00–8:15 AM
The Spectrum of Adenosis Lesions in the Breast, with Radiologic-Pathologic Correlations: A Primer for Radiology Residents

George J. Buse, MD, *David Grant USAF Medical Center, Travis Air Force Base, CA*; Robert A. Jesinger, MD, MS; Scott Zelasko, MD; Jason M. Allen, DO; Beth Z. Clark, MD, BA; Diane M. Lovell, MD, PhD (*robert.jesinger@us.af.mil*)

LEARNING OBJECTIVES: 1. Describe the mammographic, sonographic, and MRI findings in the spectrum of adenosis in the breast. 2. Describe the anatomic and microscopic pathologic findings in fibrocystic breast condition, sclerosing adenosis, adenosis tumors, and the spectrum from lobular hyperplasia to lobular carcinoma in situ (LCIS). 3. Discuss how fibrocystic condition and other adenosis lesions (eg, sclerosing adenosis) can mimic breast cancer (eg, amorphous calcification in both fibrocystic breasts and DCIS).

CONTENT DESCRIPTION: In this education poster, we will present our experience with a retrospective review of biopsy-proven adenosis cases at our institution over the past 6 years. After a background on normal breast anatomy and histopathology, we plan to describe key biopsy-proven cases of adenosis lesions, including their clinical presentation, imaging findings (mammography, ultrasound, MRI), and pathologic findings (gross and microscopic features). We will discuss how adenosis lesions (eg, sclerosing adenosis) can mimic breast cancer. While most radiology residents are aware of the spectrum of ductal hyperplasia to ADH to DCIS, less attention may be given to lobular hyperplasia, ALH, and LCIS. We plan to include a review of this spectrum, as well as discuss the controversies with treatment of these lesions. We will summarize with key take-home points for budding breast imagers so that residents will feel more confident when encountering a case involving an “adenosis” abnormality.

(E-91) Thursday • 7:00–8:15 AM
Uterine Fibroid Treatment Patterns after Introduction of an Interdisciplinary Fibroid Program

Nelly Tan, MD, BS, *University of California Los Angeles, Los Angeles, CA*; Timothy McClure, MD, BS; Christopher Tarnay, MD, BS; Michael Johnson, MD, BS; David Lu, MD, BS; Steven S. Raman, MD (*ntan@mednet.ucla.edu*)

LEARNING OBJECTIVES: 1. Appreciate the clinical and economic significance of uterine fibroids. 2. Know the treatment options for patients. 3. Describe the effect on treatment pattern with a multidisciplinary approach.

CONTENT DESCRIPTION: Fibroids are benign growths of the uterine smooth muscle. They occur in 20%–35% of all reproductive-age women; patients develop symptoms, including pelvic pressure, menometrorrhagia, dysmenorrhea, urinary symptoms, and defecation problems. Treatments available include medical therapy, magnetic resonance–guided focused-ultrasound surgery (MRgFUS), uterine artery embolization, surgery (ie, hysterectomy, myomectomy), and observation. Surgery can cause significant morbidity and is costly due to inpatient stay. Despite abundant literature supporting efficacy of nonsurgical treatments, most fibroids are treated surgically. We instituted a multidisciplinary fibroid center in 2008, and we investigated the effect on treatment pattern. When patients are referred to UCLA, they are seen by a radiologist and a gynecologist. The patient population consisted of health-insured and self-pay patients. All inquiries were recorded in an IRB-approved database. There were 332 patient inquiries from August 2008 to April 2010. Of these, 157 (47.2%) patients requested evaluation by our team; 49.6% (78/157) underwent treatment: 27/78

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(34.6%) had surgery, 7/78 (8.9%) underwent UAE, 35/78 (44.8%) received MRgFUS, and 9/78 (11.5%) were treated with medical therapy. Surgery continues to be the mainstay treatment for patients with symptomatic fibroids. In 2004, 60% of patients with symptomatic myomas were managed surgically, and 79% of these patients underwent hysterectomy. In contrast, 34.6% (27/78) of our patients were treated with surgery, and 18.5% (5/27) underwent hysterectomy. Most patients preferred minimally invasive or noninvasive treatments, and a minority (35%) underwent surgery. Interdisciplinary approach to management of patients with fibroids significantly changes the treatment pattern: Most patients elect nonsurgical treatments. We recommend adoption of this type of program in a university setting.

(E-92) Wednesday • 7:00–8:15 AM Perfecting the Fetal Cardiac Evaluation of Low-Risk Patients

Patricia S. Poole, MD, *University of California San Diego, San Diego, CA*; Dawn R. Engelkemier, MD; Lorene E. Romine, MD; Neha Trivedi; Dolores H. Pretorius, MD* (ppoole@ucsd.edu)

LEARNING OBJECTIVES: 1. Review the components that encompass a routine cardiac survey of a fetus, including a four-chamber view, left ventricular outflow tract, and right ventricular outflow tract; we will also review the three-vessel view. 2. Review the technical features needed for accurate imaging evaluation of each cardiac view. 3. Illustrate how temporal imaging is crucial in the diagnosis of congenital heart anomalies. 4. Illustrate common pitfalls during a fetal cardiac survey that can affect accurate diagnosis and the need for fetal echocardiography by a specialist.

CONTENT DESCRIPTION: Cardiac ultrasound evaluation encompasses imaging of a wide spectrum of anomalies. Despite improvements in ultrasound imaging, 25% of congenital heart disease (CHD) is still not diagnosed prenatally at tertiary centers, and 75% is not diagnosed at community hospitals/offices; 25% of neonates with CHD die, and it is only identified at autopsy. Successful diagnosis in low-risk patients requires accurate evaluation through the four-chamber view, left ventricular outflow tract, right ventricular outflow tract, and, in many centers, the three-vessel view. Accurate interpretation of ultrasound on both 2D and cine imaging plays an important role in identifying fetuses at risk for CHD. It is imperative that the radiologist should have a thorough knowledge of the features that are required to be seen on the basic images included in routine fetal heart evaluation of low-risk patients and should know the common pitfalls to avoid.

(E-93) Thursday • 7:00–8:15 AM MR Imaging of Fetal Central Nervous System Abnormalities with US Correlation

Dawn R. Engelkemier, MD, *University of California San Diego, San Diego, CA*; Patricia S. Poole, MD; Rosalind B. Dietrich, MD; Dolores H. Pretorius, MD*; Lorene E. Romine, MD (dengelkemier@ucsd.edu)

LEARNING OBJECTIVES: 1. Understand indications for MRI evaluation of the fetal central nervous system (CNS). 2. Review commonly used MRI sequences for fetal evaluation. 3. Identify imaging characteristics of commonly encountered CNS pathology on MRI, and correlate with ultrasound findings.

CONTENT DESCRIPTION: MRI has an increasing role in fetal imaging in the second and third trimesters and may be indicated when ultrasound examination suggests specific abnormalities. Fetal MRI often provides additional valuable information when evaluating CNS abnormalities. A working knowledge of frequently used MRI sequences for evaluation of the fetus and an ability to tailor the examination are essential to the generation of high-quality images. A variety of disease processes may affect the fetal CNS, and the radiologist must be familiar with MR imaging characteristics of these entities. Correlation of MRI with ultrasound findings is important to generate or confirm diagnoses and properly guide management.

(E-94) Wednesday • 7:00–8:15 AM Fetal Anatomy and Anomalies in the First Trimester: A Guide to First-Trimester US

Maud M. Morshedi, MD, PhD, *University of California San Diego, San Diego, CA*; Lorene E. Romine, MD; Theresa Maloney; Dolores H. Pretorius, MD*

LEARNING OBJECTIVES: 1. Review indications for fetal ultrasound in the first trimester. 2. Review normal fetal anatomy and sonographic findings at critical time points in the first trimester. 3. Review the sonographic

assessment of first-trimester fetal anomalies and physiologic processes that may simulate anomalies.

CONTENT DESCRIPTION: The first 13 weeks of fetal development are among the most crucial and sensitive in the course of a pregnancy. This time is the period of growth and differentiation of most organ systems, and as such, there is the highest risk of injury, anomaly, or death to the developing fetus. Fetal ultrasound is a crucial tool that allows the tracking and evaluation of fetal development and differentiation, providing an intimate view into the world of first-trimester gestation. Knowing the proper indications and usage of fetal ultrasound is critical to maximizing its effectiveness and limiting its potential risks. In addition, a thorough understanding of normal fetal anatomy, sizes, and measurements by date provides a basis for systematically approaching first-trimester ultrasound. Finally, an overview of various first-trimester anomalous fetal findings and disease processes will serve to familiarize the reader with a wide spectrum of developmental disorders covering many organ systems, including nervous system, craniofacial, cardiovascular, gastrointestinal, and limb anomalies. In addition, physiologic processes that may be interpreted as anomalies (eg, bowel herniation and rhombencephalon) will be reviewed. After examining this exhibit, the reader should understand the indications for first-trimester ultrasound, develop a systematic approach to the evaluation of ultrasound imaging of the fetus at various stages in the first trimester, and recognize first-trimester fetal developmental anomalies.

(E-95) Thursday • 7:00–8:15 AM Breast MR Imaging Artifacts and Pitfalls: High-Quality Dynamic Imaging and Accurate Interpretation

Zachary W. Washburn, MD, *University of Michigan Health System, Ann Arbor, MI*; Mitra Noroozian, MD; Katherine A. Klein, MD; Caroline P. Daly, MD; Marilyn A. Roubidoux, MD (zwashbur@umich.edu)

LEARNING OBJECTIVES: 1. Describe technical requirements for high-quality breast MR imaging for the detection of breast cancer. 2. Recognize common and uncommon breast MR artifacts and potential pitfalls that can cause interpretive errors. 3. Discuss strategies to eliminate or minimize artifacts.

CONTENT DESCRIPTION: I. Introduction. II. Review of dynamic breast MRI technical requirements. III. Examples and discussion of breast MR artifacts and pitfalls, including (a) susceptibility, (b) poor fat saturation, (c) water saturation, (d) chemical shift, (e) motion, (f) ghosting, (g) coil-related signal flare, (h) background enhancement, and (i) anatomic variants. III. Conclusion: Knowledge of breast MRI pitfalls and artifacts is essential for high-quality imaging and accurate interpretation. In this exhibit, we will illustrate a wide variety of breast MRI artifacts and pitfalls, with an emphasis on how to correct them and minimize interpretive errors.

(E-96) Wednesday • 7:00–8:15 AM Current and Future Imaging of Breast Implant Complications



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LEARNING OBJECTIVES: The purpose of this exhibit is to review the normal appearance and complications of breast implants as seen in various imaging modalities, including MRI, as well as in emerging technology such as cone-beam CT. After viewing this exhibit, the attendee will be able to: 1. Describe normal imaging features of an uncomplicated breast implant on mammography, ultrasound, MRI, and cone-beam CT. 2. Recognize the imaging signs of breast implant complications in mammography, ultrasound, MRI, and cone-beam CT. 3. Identify which imaging findings of breast implant complication will prompt surgical removal.

CONTENT DESCRIPTION: A review of the basic structure of silicone and saline breast implants is provided, as well as subsequent physiologic postimplantation changes, including capsule formation. Cases featuring normal findings and imaging signs of intra- and extracapsular rupture are presented, with an emphasis on MRI, and are correlated with similar findings on cone-beam CT. A series of cases is presented illustrating complications of breast implants. Findings and their relevance to management by the referring surgeon are emphasized.

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