Emerg Radiol (2016) 23:275–289
DOI 10.1007/s10140-016-1384-3

REVIEW ARTICLE

Highlights from the scientific and educational abstracts presented at the ASER 2015 annual scientific meeting and postgraduate course

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Received: 29 January 2016 / Accepted: 4 February 2016 / Published online: 16 February 2016

Abstract The American Society of Emergency Radiology (ASER) 2015 Annual Scientific Meeting and Postgraduate Course offered dedicated learning sessions, oral presentations, and digital exhibits on a broad spectrum of topics in emergency radiology, including traumatic and non-traumatic emergencies, quality, communication, education, technological innovations, and the evolving identity of the emergency radiology subspecialty. This article highlights the scientific and educational abstracts presented at the meeting.

Keywords American Society of Emergency Radiology (ASER) · Emergency · Radiology · Imaging · 2015, highlights

Introduction

The annual meeting of the American Society of Emergency Radiology (ASER) took place in Key Biscayne, Florida, from September 15 to September 29, 2015. Over 400 participants were in attendance for the conference, of whom over half were members-in-training. Attendees and presenters represented the USA and 26 other countries. Headlining the program was a Founders' lecture entitled, "Putting the patient at the center of emergency imaging: how are we doing?" by ASER past president, Dr. Susan John, who spoke of an emerging culture shift in radiology in which the role of the radiologist primarily as an interpreter of medical imaging is transforming to that of a dynamic and collaborative contributor to the provision of patient care. The two-day Trauma Head-to-Toe review course covered imaging of mass casualties and vascular imaging, as well as trauma of the brain and spine, head and neck, musculoskeletal system, and the torso. Following the core trauma review course, there were two more days of educational sessions on research and ultrasound in the emergency department (ED), non-traumatic abdominal and vascular imaging, and imaging of infections and iatrogenic emergencies. Self-assessment modules were offered on the subjects of vascular traumatic emergencies and stroke imaging in the ED. Each day was kicked off with a Case of the Day, designed to challenge even the most seasoned emergency radiologist's diagnostic acumen.

This year, there were a record 180 educational poster exhibits and 18 oral presentations on original research in emergency radiology. Most of the abstracts of the educational exhibits and oral presentations presented at the conference were published in the October 2015 issue of *Emergency Radiology*. A synopsis of select posters and oral presentations from the conference follows. Unless otherwise indicated, the works highlighted represent educational poster exhibits.

Traumatic emergencies

Neuroradiological trauma

The detection of orbital trauma on CT is essential, as physical examination of the orbit is often limited in the acute setting. Stone et al., in "Orbital trauma: beyond blowout fractures," emphasized the morbidity of orbital trauma. Common ocular injuries diagnosable at CT include hyphema (high density in the anterior chamber), choroidal detachment (box-like configuration or tennis ball appearance of high density within the periphery of the globe), retinal detachment (V-shaped

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morphology to the retina flanked by high density in the periphery), and open globe injury, which is associated with a foreign body in 41 %. Retinal hemorrhage, in addition to intravitreous hemorrhage (layering high density in the vitreous or thin layer of preretinal hyperdensity), in a pediatric patient in the absence of demonstrable evidence of accidental injury, should raise the concern for non-accidental trauma (NAT). Vision loss may be delayed in the setting of optic nerve injury and may demonstrate T2 hyperintensity on MRI. In ischemic optic neuropathy, abnormal restricted diffusion can be apparent. Of all imaging modalities, CT has the highest sensitivity for the detection of intraorbital foreign bodies, capable of detecting particles as small at 1 mm [1].

Using high-quality planar reformatted and 3D-rendered CT images to illustrate normal anatomical structures and classic fracture patterns, Herrmann et al. reviewed the range of midface fractures that are often daunting to characterize owing to involvement of complex bony anatomy. Salient interpretive strategies were suggested. For example, the mandible can be thought of as a ring, and if one fracture is identified, a diligent search for at least one other fracture on the opposite side of the "ring" should be carried out [2]. In an original study of 844 cases of facial trauma, Friedman et al. determined that hemorrhage within the maxillary sinus is associated with a positive predictive value of 85 % for any facial fracture and 99 % negative predictive value for a fracture in contiguity with the affected maxillary sinus. These data suggest that vigilance for the detection of facial fracture adjacent to the maxillary sinus can be relaxed if hemorrhage is absent. On the other hand, the presence of maxillary sinus hemorrhage is a poor predictor for more remote facial fractures [3].

Rohling et al. reviewed injury mechanisms for cervical spine fracture. Compression and 2- and 3-column burst fractures can be thought of as occurring through an axis of rotation posterior to vertebral body and, in flexion and flexion-distraction injuries, the axis of rotation can be described as anterior to the vertebral body. Three-column burst fracture severity relates to amount of retropulsion of the bone into the spinal canal. Flexion and flexion-distraction injuries are characterized by anterior and middle column compression with widening of the posterior column, leading to ligamentous or bony injury. Fracture dislocations are characterized by comminuted fractures of adjacent vertebral bodies with lateral translation of the spinal column [4].

Spence and West, in "Spinal variants and congenital anomalies that mimic acute injuries," quip that "the vast majority of cervical spine variants are asymptomatic, benign and seemingly designed to confuse first year residents," but caution that others, such as os odontoideum, predispose to injury and may warrant surgical fixation. The authors then cataloged a number of findings assigned to a color code, green for benign, red for an increased risk for injury, and orange to represent unknown significance. Examples of benign variants include arcuate foramen variants of C1, mimicking "fracture of uncertain age," nuchal ligament ossification and limbus vertebra adjacent to the anterosuperior endplate of a vertebral body. Fractured osteophytes without corticated margins or fractured nuchal ossification, on the hand, are speciously insignificant, but in reality signal potentially devastating injury [5].

In a pilot study of 45 subjects, Becker et al. evaluated diffusion tensor imaging (DTI) of the cervical spine in trauma patients in order to correlate diffusion tensor values with findings of spinal fracture, neurologic deficit or both on CT and/or MRI. There was perfect correlation between trauma-related neurologic deficits and abnormal tensor values (5/5 subjects), even when neurologic deficit was present without cervical spine fracture. Traumatized cervical spine tensor values without fracture or neurologic deficit were similar to values in their normal cohort and from published data for normal subjects [6].

Dental trauma is often overlooked on emergent imaging, particularly when there are distracting facial fractures discovered at radiography or CT. Furthermore, emergency radiologists may consider themselves ill-equipped at interpreting dental pathology, which is perceived as more of within the purview of the dentist or oromaxillofacial surgeon. Nonetheless, dental injuries are common in the ED. Krishnasarma and Sanhaji described normal dental anatomy on radiography and CT and illustrated important injuries to the teeth, periodontal soft tissues, and supporting bone. As a cautionary tale, the authors described complications of failed diagnosis or treatment of traumatic dental pathology, such as osteomyelitis, persistent fracture, and submandibular abscess following surgical fixation [7].

Thoracic trauma

The CT "pan-scan" dominates the trauma imaging landscape despite the direct and indirect costs associated with near full-body CT imaging in terms of financial and other resource utilization and risks associated with cumulative lifetime ionizing radiation exposure. Patient selection criteria for the pan-scan in the setting of trauma continue to be debated in an effort to tailor-select imaging based on pretest likelihood of significant, clinically actionable injury. Kelleher et al. presented a retrospective review of 150 patients who had undergone CT head, CT cervical spine and CT chest, abdomen, and pelvis for trauma. Patients in whom injury was evident on physical exam or plain radiography, who had undergone cardiopulmonary resuscitation, experienced hypotension or had chest and/or abdominal pain during the ED assessment period were excluded from analysis. Of the remaining 126 low-risk patients, no acute traumatic findings were identified on CT. This investigation is among the first to individualize CT selection criteria for low-energy trauma instead of the one-size-fits all pan-scan in place at many institutions [8].

Continuing on the theme of image optimization in trauma, Liang et al. presented work on the use of dual-source CT (DSCT) in thoracic trauma. DSCT has the benefit of improved temporal resolution over single-source CT, which is particularly useful in imaging of the traumatized chest but is plagued by aortic pulsation and respiratory motion artifact. The drawback of DSCT is the need to utilize a smaller field-of-view (FOV) in order to minimize reconstruction artifact at the expense of potentially excluding injury at the periphery of or beyond the FOV. In their study, Liang et al. compared standard 330-mm FOV with an expanded 450-mm FOV to determine whether the larger FOV could deliver diagnostic quality images. Their results revealed no significant reduction in image quality with this expanded FOV. Furthermore, peripheral injuries were better characterized when compared to the smaller FOV. These findings offer the potential for an imaging technology that enjoys a reduction in pulsation and respiratory artifact without compromising imaging quality [9].

Millet et al. provided an imaging review of traumatic aortic injury, prefacing that familiarity with this spectrum of injuries is critical owing to the high mortality associated with unrecognized injury. Partial transection, traumatic dissection, pseudoaneurysm, and intramural hematoma were reviewed with examples. The authors enumerated imaging pitfalls, including pseudodissection of the aortic root from aortic pulsation artifact, ductus bump mimicking a pseudoaneurym at the aortic isthmus, and atelectasis in the medial left lung, which can be misinterpreted as contrast extravasation. Features of aortic injury that should be mentioned in a comprehensive report include the presence or absence of periaortic hematoma, intramural hematoma, intimomedial intraluminal soft tissue, luminal thrombus, aortic contour abnormality, contrast extravasation, and anatomic variants that should not be misinterpreted as pathology [10].

Nummela et al. reported on the entity of costal chondral fractures, whose importance is emphasized by the fact that these types of fractures heal poorly and can be associated with prolonged posttraumatic pain. In their retrospective study of 185 thoracic injuries, costal chondral fractures occurred predominately in motor vehicle or motorcycle collisions (37 and 20 %, respectively) and bicycle collisions (17 %). The authors reported an accurate initial diagnosis in only 27 %, indicating that these types of fractures often go underreported. Their case illustrations leaned heavily on coronal reformatted images, suggesting that reviewing coronal reformats of the chest should be a part of the search pattern in the setting of blunt thoracic trauma [11]. In addition to a description of costal chondral fractures, Myers et al. reviewed other important anterior thoracic traumas, including sternal fractures as well as sternoclavicular and sternocostal dislocations [12]. Both groups cautioned that linear areas costal chondral calcification sparing, especially involving the first ribs, can mimic fractures. The presence of interfragmentary gas or displacement points to a fracture and can help provide valuable clues in these confounding cases.

Abdominopelvic trauma

Several exhibits offered pearls in the CT evaluation of blunt bowel and mesenteric injury, especially since these injuries not infrequently evade detection, with sensitivity ranging from 70 to 95 % [13]. Specific CT findings of bowel injury in blunt trauma include bowel discontinuity, extraluminal enteric contrast, and free gas, but focal bowel wall thickening, abnormal bowel mucosal enhancement, and free fluid are often additional, though less specific, clues [14]. The most reliable features of mesenteric injury are active extravasation or abrupt cut-off of mesenteric vessels, but important less specific findings include mesenteric (interloop) fluid or stranding, mesenteric hematoma, and free fluid [14, 15]. In the setting of trauma, specific injury remote from the bowel and mesentery should heighten vigilance for subtle findings of bowel or mesenteric injury, such as the presence of a flexion-distraction spinal injury (chance fracture), transverse lower anterior abdominal wall subcutaneous contusions (seat belt sign), and multiple solid organ injury [16]. Batohi et al. presented anecdotal support for repeat CT imaging in select patients with bowel or mesenteric injury detected on initial CT. In some instances, significant additional or worsening injury can be detected and addressed [17]. Blomquist et al. proposed a CT scoring system devised to predict the need for surgical intervention for bowel and mesenteric injury. Combining major and minor criteria, consensus scores could reasonably discriminate patients undergoing conservative management versus surgical intervention [18].

There were two posters on hepatobiliary trauma. Gross et al. focused on challenges in applying the American Association for Surgery of Trauma (AAST) Organ Injury Scale (OIS) of hepatic injury to CT findings. In particular, intraoperative findings, such as parenchymal hematoma and laceration, are not clearly distinguishable at imaging, and definitions of spatial dimension, like length, depth, and width, are ambiguous and may be interpreted variably by surgeons and radiologists [19]. Wong et al. presented original prospective data on 22 patients with known major blunt hepatic trauma (AAST grades III and IV), who subsequently received abdominal MRI with a hepatocyte-specific contrast agent imaged at progressively longer time intervals. Their data determined that a 90-min delay was superior to all shorter time intervals for the detection of biliary extravasation [20].

In "Don't forget the abdominal wall! Important traumatic injuries not to be missed," Matalon et al. reviewed CT features of abdominal wall injury, including traumatic abdominal wall hernias, Morel-Lavalée soft tissue shear injury, rectus abdominus strain and rectus sheath hematomas. Computer-animated figures were used to illustrate important anatomy

of the anterior abdominal wall. One notable imaging pearl offered was that rectus abdominus hematomas formed below the arcuate line of Douglas may present clinically as peritonitis. Since the aponeuroses of the lateral abdominal wall form only an anterior sheath below this landmark, a rectus sheath hematoma will make direct contact with the peritoneum [21].

Musculoskeletal trauma

A handful of electronic exhibits highlighted classification schemes of appendicular and axial skeletal fractures. In broad terms, patellar fractures can be described as either displaced or non-displaced [22]. The Orthopedic Trauma Association has proposed a classification system of patellar fractures based on the degree of articular involvement and the number of fragments, although this system has not been validated clinically [22]. Spindle et al. presented an algorithm for determining the mechanism of injury for pelvic fractures based on the Young-Burgess classification. The presence of pubic diastasis indicates an anterior compression or vertical sheer-type mechanism. In the absence of pubic diastasis, the presence of pubic ramus fractures indicates a lateral compression-type injury [23]. As reviewed by Stavrakis et al., familiarity with the Schatzker tibial plateau classification is important when communicating findings to the orthopedic surgeon. A type I fracture is characterized by a lateral split fracture with < 4-mm depression. A type II fracture is a type I with ≥ 4-mm depression. Together, these represent around 30 % of all tibial plateau fractures. The most common fracture is the type III, described as pure compression of the lateral tibial plateau without split. Types IV, V, and VI involve the medial tibial plateau to some extent and account for about 35 % of tibial plateau fractures. These invariably require surgical fixation [24]. Marshall et al. reviewed the Vancouver classification of periprosthetic femoral fractures. These fractures are classified according to fracture location at the greater or lesser trochanter (A_{GT} and A_{LT}, respectively), along the femoral stem (B1, B2 or B3), or distal to the prosthesis (C). Accurate classification aids in determining management, either generally nonoperative (type A) or surgical (type B). Type C is treated in a manner independent of the presence of the prosthesis [25].

Friedlander and Yadavalli presented imaging examples of commonly missed bone and soft tissue pathology in the emergency setting. Avulsion fractures can be exquisitely subtle on radiography, such as a finding of a fine, curvilinear sliver of the bone adjacent to the lateral malleolus, reflecting a superior peroneal retinaculum avulsion fracture. Stress fractures of the calcaneus and metatarsals can be easily overlooked if subtle trabecular thickening or periosteal reaction is not recognized on plain radiography or CT. Common "blind corner" misses on radiography include thoracolumbar discitis, destructive lesions in regions of bony overlap, such as the medial clavicles, and a soft tissue mass resulting in asymmetric widening of the scapulothoracic distance [26].

Chao et al. made use of developments in three-dimensional (3D) printing technology to investigate the utility of 3D printing models of complex fractures in surgical planning. 3D-printed models were constructed retrospectively on several fracture types, and plain radiographs, CT images and physical 3D models were presented to orthopedic surgeons, who were asked whether the 3D models would have provided additional value in surgical management. Acetabular and pilon fractures demonstrated the greatest potential for clinical application, assisting in the selection of the most ideal surgical approach [27].

Non-traumatic emergencies

Neuroradiological emergencies

An approach to spontaneous intracranial hemorrhage was submitted by Eldaya et al. based on patient age and intracranial location. For example, in older patients, basal ganglia hemorrhage most likely represents hemorrhage from long-standing hypertension. In a patient younger than 40 years, this finding more likely reflects an acute elevation in blood pressure from illicit sympathomimetic drug use. Other causes for nontraumatic intracranial hemorrhage in younger patients include vascular malformation and vasculitis. Calles et al. reviewed conditions that simulate intracranial hemorrhage. For example, dural metastases, invasive fungal sinusitis, and frontal sinusitis mucocele can mimic epidural hematoma on cross-sectional imaging. Neymotin et al. also focused on entities that can be confused with intracranial hemorrhage, such as meningioma, laminar necrosis, and partial volume averaging with bone. The authors emphasize that clinical history, specific imaging characteristics, and prior imaging studies are paramount in minimizing misdiagnosis [28].

Love and Nickerson and Millare et al. provided a comprehensive review of the range of nontraumatic head and neck conditions that can present in the emergency setting. Advanced sinus disease can result in orbital subperiosteal abscess (ethmoid air cells), subdural empyema and meningitis (frontal sinus), and coalescent otomastoiditis (mastoid air cells). Findings of cavernous-carotid fistula or cavernous sinus thrombosis can be subtle on CT. Aside from asymmetry in the cavernous sinus, additional signs relate to intraoribital venous congestion, including extraocular muscle and superior ophthalmic vein enlargement. While Ludwig angina is a clinical diagnosis, imaging clues include inflammation/abscess in the submandibular space with enlarged reactive local lymph nodes [29, 30].

Raff et al. provided a synopsis of neuroimaging presentations of a variety of conditions associated with the immunocompromised state. These conditions can be broadly

categorized as infectious, toxic/metabolic, vascular, or neoplastic. Herpes encephalitis will present as hypoattenuation in the mesial temporal lobes on CT, correlating to T2 hyperintensity on MRI. Involved brain parenchyma may demonstrate restricted diffusion, which can be mistaken for ischemia. A case illustration of posterior reversible encephalopathy syndrome (PRES) was discussed in a renal transplant patient on immunosuppressive chemotherapy. This condition is characterized on CT by hypoattenution usually, but not exclusively, in the watershed region of the parietal and occipital lobes. Ischemia from superior sagittal sinus thrombosis, for which cancer patients are at increased risk, may appear identical, but is more reliably associated with restricted diffusion in the acute period. Immunocompromised individuals are also susceptible to developing central nervous system lymphoma, which is usually hyperdense on CT. Extension into the contralateral cerebral hemisphere via the corpus callosum improves diagnostic confidence for this entity [31].

Cancer patients present to the ED for a wide range of neurologic complaints, of which headache is notably common. Although the American College of Radiology Appropriateness Criteria (ACR AC) recommends MRI brain with and without contrast across-the-board for presentation of new headache in cancer or immunocompromised state, this recommendation appears to be based on limited data. Sauter et al. reviewed brain imaging modality and a number of clinical variables over a 3-year period in patients with a diagnosis of malignancy presenting to the ED with headache. Emergency department providers ordered unenhanced CT of the head in 97 % on initial presentation. Neither nausea nor emesis was associated with an increase in yield on imaging. Although the long-term clinical outcome of these patients is not known, the heavy reliance on noncontrast head CT in the ED for these patients suggests that providers have sufficient confidence in this modality to exclude relevant conditions readily apparent on CT, such as hemorrhage, mass effect, and herniation. An accurate picture of intracranial metastatic burden, while better depicted with MRI, is presumably of lesser import in the emergency setting. Accordingly, additional research is needed to determine whether the ACR AC should introduce an additional set of recommendations for "new onset of headache in cancer in the emergency setting" that relies more on noncontrast head CT [32].

Thoracic emergencies

The challenge in patient selection for imaging work-up of suspected pulmonary embolism (PE) has formed the basis for the creation of clinical prediction rules, such as the Wells score and the Pulmonary Embolism Rule Out Criteria (PERC). Garg et al. set out to determine the positive yield on CT pulmonary angiography (CTPA) ordered out of the ED at their institution over a 6-week period and compare institutional CTPA positivity rates for low, intermediate, and high pretest probability of PE to published data. Their findings revealed an overall positivity rate of 15.6 %, which is similar to published values. Furthermore, positivity rates for low, intermediate, and high pretest probability compared favorably to prior published studies using Wells criteria. Once the decision to obtain CTPA is established, however, diagnostic limitations can still arise [33]. Bates et al. studied outcomes in patients for whom CTPA was ordered over a 25-month period to determine in what proportion study limitations were reported, and, in cases of study limitations, what additional imaging work-up was subsequently obtained. A review of 1444 consecutive CTPA examination reports was undertaken. Of these, 4.2 % were reported as suboptimal. Suboptimal opacification of the pulmonary arteries attributable to incorrect timing was cited as the most common cause for a limited examination (43.4 %). Of the 60 suboptimal CTPA studies, 7 patients (11.7 %) underwent additional imaging, including repeat CTPA (5 patients) and nuclear scintigraphy (2 patients), with a yield of one positive study in the immediate period. Finally, CTPA ordered to exclude PE is valuable as a tool to exclude other thoracic causes of chest pain that mimic PE [34]. Hermann et al. reviewed a number of these entities related to cardiac and coronary artery pathology. A filling defect in one of the coronary arteries may be directly visualized in the acute coronary syndrome. Subendocardial infarction may be depicted as a curvilinear hypoenhancing portion of the myocardium paralleling the ventricular cavity. Atrial and valvular thrombus can present as filling defects. Pericardial thickness ≥ 4-mm should raise the suspicion for constrictive pericarditis, though this CT finding is not specific. An interarterial course of the left coronary artery can also sometimes be detected [35]. Misono et al. retrospectively reviewed cases of anomalous coronary artery origins in patients who had undergone coronary CT angiography (CCTA) as part of ED assessment for chest pain. In cases for which conventional CT chest had also been performed at some point in the patient's care, these studies were reviewed to determine whether an anomalous coronary artery origin diagnosed on CCTA was reported and, if not, whether it was detectable in retrospect. The authors determined that this entity, when diagnosed on CCTA, was retrospectively visible on conventional chest CT in 78–100 % of cases but reported on in only 33–25 %. Of the retrospectively visible cases, 43–50 % were of a malignant course. Emergency radiologists are encouraged to incorporate an assessment of coronary artery anatomy into their search pattern on standard CT chest despite limitation from aortic pulsation artifact. The authors predict that technological advances that improve temporal resolution on conventional chest CT will result in improved conspicuity and diagnosis of abnormal coronary artery origin [36].

In a scientific session, Misono et al. shared data on 135 Doppler ultrasound studies on patients with below-the-knee

deep venous thrombosis (DVT) to characterize their risk of PE. Thirty-seven percent received either conventional post-contrast chest CT or CTPA, of which 62 % had PE. Furthermore, the presence of involvement of two venous territories, such as gastrocnemius or peroneal, was statistically significantly associated with PE [37].

The acute aortic syndrome encompasses three historically distinct but histologically overlapping entities of aortic dissection, intramural hematoma, and penetrating atherosclerotic ulcer. Other vascular pathologies that may be clinically indistinguishable from these entities include aortitis, unstable or rupturing aortic aneurysm, and aortoduodenal fistula. McGill et al. reviewed the pathological bases for these conditions and provided imaging examples of each and strategies to distinguish one from another on CT. The intimomedial flap is the sine qua non of aortic dissection; intramural hematoma is characterized by crescentic hyperattenuation relative to unenhanced blood pool, situated eccentrically within the aortic lumen on noncontrast CT; penetrating atherosclerotic ulcer, the least common of these entities, is characterized by a mushroom-like outpouching of endoluminal contrast most often in the descending thoracic aorta [38].

Abdominopelvic emergencies

Drawing on the same principle of the sonographic Murphy sign, Kelleher et al. devised the sonographic McBurney sign, defined as maximum tenderness over the appendix during real-time ultrasound scanning. Positive predictive value of 100 % and negative predictive value of 98.9 % were reported. Primary limitations of this study were its retrospective design and exclusion of patients on whom abdominal tenderness was not recorded and whose appendix was not visualized [39]. Ojili et al. chose to look "Beyond the Appendix" and reviewed both usual and unusual "suspects" in lower gastrointestinal emergencies. Colonic intussusception and ischemia as well as cecal and sigmoid volvulus would count among the "usual suspects." Uncommon entities that were described include colonic obstruction with cholecystocolic fistula, colonic perforation from lung metastases, and colonic obstruction secondary to colonic diverticular stricture [40]. Ditzler et al. discussed the classic mimicker of acute appendicitis in the pediatric population: mesenteric adenitis. Classic CT features of mesenteric adenitis are a cluster of prominent-sized mesenteric lymph nodes with associated small bowel wall thickening. On ultrasound, the lymph nodes appear hypoechoic. Colonic wall inflammation can alternatively be present. A cluster of enlarged mesenteric lymph nodes without bowel wall thickening suggests resolving disease. The lymph nodes in this condition can act as a lead point for intussusception [41].

Shampain et al. offered case illustrations of a spectrum of pelvic conditions in the non-pregnant female patient, such as adnexal torsion, acute appendicitis, and ovarian neoplasm [42]. Guirguis et al. discussed imaging features of additional pathologic conditions unique to the non-pregnant patient, including ruptured dermoid cyst, pelvic inflammatory disease spectrum, and urinary obstruction [43]. Several presenters created imaging compendia of genitourinary emergencies of the male. Testicular torsion was featured in each. On ultrasound, testicular torsion is characterized by decreased blood flow on Doppler interrogation of the affected testis. Initially, arterial diastolic resistance is diminished, but as torsion progresses, total absence of arterial flow will be demonstrated. A helpful caveat to keep in mind, however, is that recent spontaneous detorsion may be associated with relative hyperemia. Testicular parenchymal changes may not be evident in the first 4–6 hours. Comparison with the normal contralateral testis is essential [44–46]. Ultrasound plays an important role in evaluating traumatic injury to the external male genitalia. In penile fracture, a focal hematoma is seen with associated interruption in the normally echogenic tunica albuginea, representing disruption. Blunt trauma to the scrotum can result in a hematoma, which can compress venous outflow of the testis, leading to ischemia. In testicular rupture, abnormal testicular parenchyma is apparent, and fragments of the torn tunica albuginea may be detected [46].

Siddaiah et al. presented on the subject of imaging appearances of bariatric surgery and complications. The Roux-en-Y gastric bypass (RYGB) procedure is the most commonly performed bariatric surgery. A non-distended excluded portion of the stomach and jejunojejunostomy in the left hemiabdomen are expected findings. Anastomotic leaks, marginal ulcers, jejunal ischemia, small bowel obstruction, gastrogastric fistula formation, small bowel intussusception, and internal hernia count among the possible complications. Complications of the laparoscopic adjustable gastric banding (LAGB) technique include gastric outlet obstruction due to tight banding and banding tube disconnection. The phi angle measured at the intersection between a vertical line drawn along the spine and through the long axis of the band should measure between 4 and 58°. Laparoscopic sleeve gastrectomy is an additional procedure that involves dividing the stomach along its long axis, resulting in a functional stomach with a capacity reduced to around 100 mL. Complications include gastric leak, distension, stricture, and gastroesophageal reflux [47]. Hanley-Knutson et al. focused their attention on internal hernias, which can occur spontaneously due to congenital defects in the mesentery or secondary to gastric bypass surgery. As a group, complicated internal hernias are characterized by a group of dilated segments of bowl with engorgement of mesenteric vessels converging towards the hernia opening. In the event of volvulus, a swirl pattern to the mesenteric vessels may be seen. The most common type of internal hernia (53 %) is the paraduodenal hernia, of which most (75 %) are of the left-sided variety. A left-sided internal hernia will manifest as a saclike cluster of dilated small bowel segments

located between the stomach and the pancreas. The transmeseteric internal hernia is the most frequently encountered in the pediatric population and in some patients who have undergone gastric bypass or liver transplantation. This type of internal hernia is of particular significance because it is the most likely to be complicated by volvulus and ischemia. In the setting of gastric bypass, the Roux loop will typically herniate through the defect [48]. Siddaiah et al. also reviewed the range of external hernias. An external hernia is described as a protrusion of intra-abdominal contents through a defect in the abdominal wall and is clinically important related to their association with bowel incarceration/obstruction and ischemia. Direct and indirect inguinal hernias are distinguished based on their location relative to the hypogastric vessels (indirect = lateral, direct = medial). An obturator hernia can be identified by the appearance of bowel herniating between the pectineus and obturator externus muscles. The definitive sign of a femoral hernia is protrusion of bowel medial to the femoral vessels with consequent indentation on the femoral vein [49].

There were two exhibits on small bowel obstruction (SBO). This entity accounts for 12–16 % of all hospital admissions for acute abdominal pain in the USA [50]. Both groups emphasized the imaging manifestations of SBO and their underlying causes and associated complications. The classic CT features of SBO is dilatation of small bowel measuring > 2.5 cm with an abrupt transition point, distal to which the bowel is decompressed. The distinction between low-grade and high-grade depends predominantly on the appearance of any enteric contrast present distal to the point of obstruction [51]. Etiologic considerations for SBO can be divided into intrinsic (intramural), extrinsic (extramural), and intraluminal. CT features of ischemic bowel include mural thickening and abnormal enhancement, mesenteric edema, interloop free fluid, pneumatosis, and mesenteric/portal venous gas. Swirling of mesenteric vessels may be noted in closed loop obstruction secondary to volvulus [52].

Uyeda et al. provided a framework for image-guided management of adbominopelvic collections. Indications for percutaneous image-guided intervention include obtaining fluid sample for diagnosis, treating infection, and draining postoperative collections. A notable advantage to percutaneous fluid collection management over surgery is that it is safer, reduces time to recovery, and can be performed without general endotracheal anesthesia. Both size and location of the collection influence amenability to a percutaneous approach. While a transabdominal or transgluteal approach is commonplace, transrectal, transhepatic, and intercostal approaches are possible. The ideal candidate for percutaneous image-guided drain placement is a liquefied collection > 3 cm. Smaller collections (<5 mL) may be best managed with aspiration. The authors list hemorrhage, pseudoaneurysm formation, vascular fistula formation, incorrectly placed catheter, and pain as potential complications. Information about the operative use of hemostatic biogels (such as Surgicel) is important, as these can simulate complicated fluid collections on CT [53].

Musculoskeletal emergencies

Golshani et al. in their exhibit "MR Imaging of the Knee in the Emergency Setting: A Pictorial Review," remark that it is becoming increasingly common for MR imaging of the knee to be performed out of the ED instead of in the outpatient setting. They presented 15 single MR image illustrations of knee pathology that may present acutely and for which plain radiography would not be diagnostic. Traumatic tendinous, ligamentous, articular cartilage, meniscal, and other soft tissue injury were among those illustrated [54].

Sadiq et al. studied the yield and clinical impact of sacrum and coccyx radiographs out of the ED in a retrospective review over a 5-year period. Of 687 radiographs performed, 91.3 % were reported as negative. Of the 8.4 % that were positive for acute or equivocal for fracture, there was no statistically significant change in analgesic administration, clinical follow-up recommendations, or advanced imaging out of the ED. Furthermore, none of the positive radiographs resulted in a single surgical intervention. The aggregate cost of performing these radiographs over the study period was $158,010. Based on the outcome of this study, the authors question the utility of sacrum and coccyx radiographs. It is unclear, however, whether the elimination of these radiographs from the ED would lead to greater CT utilization for the same indications [55].

Pediatric emergencies

Rao et al. examined adherence to the ACR AC for pediatric head trauma at their institution. Over a 2-year period, the medical records of pediatric head trauma patients who received either head CT or brain MRI, or both, were reviewed to evaluate for appropriateness of imaging modality selection. Appropriate indications for neuroimaging in the setting of trauma include high-energy mechanism of injury, decreased Glasgow Coma Scale ≤ 13, suspected skull base fracture, or NAT. Inappropriate reasons include uncomplicated trauma or parental pressure. Of the 100 patient charts reviewed, the authors observed an 89–95 % adherence to the ACR AC. The minority of patients not imaged appropriately according to the ACR AC represents a potential target for quality improvement [56].

Although CT remains the mainstay in the evaluation of traumatic injury to the head, advances in MRI technology leading to faster image acquisition and the lack of ionizing radiation associated with MRI have made this modality increasingly valuable in the emergency setting. An imaging compilation of some of the traumatic presentations diagnosed

at MRI was provided by Amin et al. While most of these conditions are detected at CT, others are imaged to better advantage with MRI. Diffuse axonal injury is often occult or underestimated on CT, whereas MRI is much more sensitive in the detection of microhemorrhages as evidenced by foci T2 hyperintensity. Diffusion weighted (DWI) and diffusion tensor imaging allow for improved detection of white matter injury. In NAT, DWI provides evidence of cerebral injury before parenchymal abnormalities are evident on CT, presenting an early opportunity to protect the child from additional harm [57].

Other groups' exhibits focused exclusively on NAT in the pediatric population. NAT and neglect accounted for a reported 1600 pediatric deaths in 2012 [58]. Chism et al. presented four case studies of NAT to demonstrate that, while plain radiography remains a mainstay in the evaluation of NAT, ultrasound, CT, and MRI are important adjunctive imaging modalities available to the emergency radiologist to increase diagnostic yield in cases where radiography findings may be absent or equivocal. The authors presented a case of a 2-month suspected victim of NAT. The initial bone survey was unrevealing. The clinician, still suspicious of trauma, ordered MRI of the chest, abdomen, and pelvis, which revealed edema associated with several ribs reflecting fractures, an adrenal hematoma, and liver lacerations. The liver lacerations were also evident on ultrasound as linear hypoechoic lesions. A subsequent bone survey identified rib fractures in the early stage of healing [59]. Pfeifer et al. also reviewed imaging findings of NAT in the pediatric age group. The skeletal survey was emphasized as the imaging exam of first resort in the work-up of suspected NAT. Highly specific plain film findings for NAT include metaphyseal (corner) lesions, multiple rib fractures and scapular, sternal, and spinous process fractures. Important mimickers to consider include metaphyseal fraying from osteopenia in rickets, fractures from osteogenesis imperfecta, and a lambdoid suture variant referred to as "inca," or interparietal bone [58].

The pediatric cervical spine affords unique challenges in interpretation due to anatomic variants and developmental changes that can be confused with injury. Guillory et al. reviewed normal measurements of several anatomical relationships in the pediatric cervical spine and presented important developmental variants that are not apparent in adults. Useful normal measurements include the atlantodental interval (4 mm), atlanto-occipital condyle distance (<5 mm), and basion-dental interval (<12 mm). Pseudosublaxation of C2 on C3 should be differentiated from pathologic subluxation by a continuous spinolaminar line. The ossiculum terminale, or summit ossification center, located at the tip of the dens, should not be misinterpreted as a fracture and usually fuses to the body of the dens by age 12 years. Familiarity with these anatomical features will minimize misdiagnosis and allow for more confident diagnosis of serious cervical injury [60]. This caveat was the subject of critical study by Kachramanoglou et al., who reviewed CT of the cervical spine in pediatric patients with major trauma. Of 139 CT scans reviewed, 130 were reported as normal. On retrospective review of the 9 reportedly abnormal studies, 5 demonstrated normal variants, such as non-fusion of the anterior arch of C1, C2/C3 pseudosublaxation demonstrating a normal spinolaminar line, persistent odontoid synchondrosis, and C1/C2 pseudosubluxation. Their findings again stress the importance of familiarity with the appearance of normal developmental variants in the pediatric cervical spine [61].

Pediatric bones are structurally different from adult bones and are associated with particular fracture patterns. They are more porous and elastic than adult bones and are relatively weaker than their supporting tendons and ligaments, conferring a tendency to deform rather than break. Unfused physes are also relatively weak, and injury may result in premature growth arrest, overgrowth, angular deformities, or leg length discrepancy. This background in pediatric bone developmental architecture provides a framework for understanding the unique features of pediatric extremity trauma, as presented by Allgeier et al. Examples of classic injuries in this population include Salter-Harris fractures, overuse injuries, such as Sinding-Larsen-Johansson syndrome due to repetitive strain on the patellar tendon, Osgood-Schlatter disease, characterized by irregularity and fragmentation of the tibial tubercle, and physeal stress injury, which is apparent on MRI as a widened, ill-defined distal medial femoral physis with a normal proximal tibial physis. Apophyseal avulsion fractures are relatively common in children prior to ossification that occurs early in the second decade. The most commonly missed avulsion fracture in the ischial tuberosity avulsion that occurs from forceful hamstring contraction, particularly in athletes, and may necessitate surgical fixation. The slipped capital femoral epiphysis (SCFE) fracture is a Salter-Harris type I injury that can be diagnosed on plain radiography. Congenital and developmental variants that can simulate injury are bipartite patella and focal periphyseal edema (FOPE). The latter entity, reflected on MRI as edema adjacent to a growth plate, is thought to represent an early stage of physis closure at puberty [62].

Imaging in pregnancy

Stone et al. encapsulated the various manifestations of ectopic pregnancy and their ultrasound correlates. Tubal ectopic pregnancies account for 95–98 %, with 80 % located in the ampulla. Interstitial ectopic pregnancies occur in the myometrial portion of the fallopian tube and represent 2–4 %. Other types of ectopic pregnancy are ovarian (1–2 %), cervical (1 %), intra-adbominal (<1 %), and cesarean section (6 %), the incidence of which is increasing due to predominant obstetric practices. A heterotopic pregnancy is a simultaneous intrauterine

pregnancy and ectopic pregnancy and occurs spontaneously in 1:30,000 pregnancies; the incidence increases to 1:2100 in the in vitro-fertilized patient population. The authors reviewed medical management of ectopic pregnancy, which is usually accomplished with methotrexate. Follow-up ultrasound is recommended when ß-hCG levels fail to decline by at least 15 % by 1 week following treatment or when rupture is suspected. The radiologist should be aware that an adnexal mass may be visible to up to three months following methotrexate sterilization of a tubal ectopic pregnancy [63]. In "What could go wrong? An imaging review of first trimester pregnancy complications," Eissa et al. presented the sonographic manifestations of normal, failed, and ectopic pregnancies in early pregnancy. A definitive tubal ectopic occurs when an adnexal mass containing a gestational sac and fetal pole is visualized, no intrauterine pregnancy (IUP) is present, and the ß-hCG is rising but not doubling as it should every 2 days. Under the rubric of failed pregnancy are anembrionic pregnancy, fetal demise, impending fetal loss, retained products of conception, and gestational trophoblastic disease. In general, the pregnancy should be given the benefit of the doubt when a failed pregnancy is being considered, and close interval follow-up is necessary for confirmation. A diagnosis of an anembrioinc pregnancy should only be made when the gestational sac measures > 25 mm with an absent embryo or when a viable embryo is not detected by 14 days following initial documentation of a gestational sac. Fetal demise is defined as the presence of an embryo measuring at least 7 mm but without cardiac activity. A low-lying pregnancy with an irregular morphology and with an open cervix defines impending fetal loss. When an echogenic, vascular endometrial mass following delivery or abortion is present, a diagnosis of retained products of conception should be entertained [64]. If endometrial tissue demonstrates greater blood flow on Doppler than the myometrium, this entity should be the leading consideration [65]. Following dilatation and curettage, the endometrial thickness should measure no greater than 10 mm, else retained products of conception may be present. Abnormally proliferative trophoblastic tissue with cystic and solid components distinguishes gestational trophoblastic disease. Gestational choriocarcinoma will be depicted as a highly vascular, irregular, heterogeneous myometrial mass. Metastatic disease to the lung, brain, liver, and/or vagina is essentially diagnostic [64, 65].

McAdams reviewed imaging of the post-partum pelvis. On ultrasound, a heterogeneous myometrium and fluid, gas or debris in the endometrial cavity are expected findings. Postpartum hemorrhage is most commonly due to uterine atony from a variety of causes. Less common etiologies include retained products of conception, uterine ateriovenous malformation (AVM), placental trophoblastic tumor, and plecenta previa and accreta. The authors caution that endometritis is strictly a clinical diagnosis, and ultrasound findings are entirely nonspecific. Even endometrial gas can be present for 3 weeks following delivery. There are a number of complications attendant to cesarean section. The most frequently encountered complication in the early postsurgical period is endometritis. Bladder flap hematomas measuring >2 cm should be viewed with suspicion and reported as potentially abnormal. Placenta accreta is a notable late complication of cesarean section, characterized histologically by deficient decidua basalis such that the chorionic villi attach directly to the myometrium [66]. A peculiar "Swiss cheese" grayscale sonographic appearance to the placenta resulting from multiple vascular lacunae typifies this entity. Uterine AVM is typically a rare complication of dilation and curettage and cesarean section. A vascular mass within the myometrium with peak velocities exceeding 80 cm/second on ultrasound is strongly suggestive. Most "AVMs" seen on ultrasound are thought to represent incomplete involution of the placental bed and uteroplacental arteries as opposed to true AVMs. If bidirectional, turbulent flow is detected in a suspected AVM, this finding rather represents a post-traumatic pseudoaneurysm [65].

Trends in imaging of the pregnant patient with abdominal or pelvic complaints were the focus of a questionnaire-based study by Hansen et al. The authors queried radiologists across practice settings to determine current practice patterns and compared these to results from a survey performed by a different group of investigators in 2007 [67]. Although the response rate was low (11 %) and the largest group of respondents was comprised of academic radiologists, certain trends were discernible. Notable shifts in reported practice include an increase in the proportion of practices that have an institutional policy in place mandating informed consent prior to an imaging procedure using ionizing radiation (79.4 % versus 74 % in 2007). Reduced-radiation dose CT for pregnant patients was reportedly more commonplace (86.7 % "always" or "sometimes") than in 2007 (78 %). In the 2007 survey, only 67 % of respondents reported avoiding using intravenous gadolinium in pregnant patients, while in the present study, 74.4 % of respondents reported avoiding MRI intravenous contrast. The authors emphasize that respondents may not represent the behavior of the entirety of the practice. Furthermore, the survey presumed accurate reporting of practice patterns [68].

Choudhery et al. and Macrito et al. discussed imaging options for the pregnant patient with abdominopelvic complaints. The Macrito group addressed MR imaging exclusively, highlighting gastrointestinal, genitourinary, gynecologic, vascular, and obstetrical causes of pain [69]. Choudhery et al. addressed the subject of ionizing radiation and the fetus in depth, noting that the deleterious effects of radiation depend on gestational age of the fetus and the mother's body part imaged. Acute appendicitis is the most commonly encountered non-obstetric emergency in a pregnant patient, who will often not present classically. Ultrasound is the modality of

primary resort, despite its well-known limitation in sensitivity in the gravid abdomen. MRI is the next most appropriate imaging study. An inflamed appendix on MRI will measure > 6 mm and demonstrate T2 hyperintensity in the obstructed lumen and periappendiceal inflammation. If MRI is not possible or is not diagnostic, only then should low-dose CT be pursued, ideally after informed consent is obtained. For renal colic in a pregnant patient, ultrasound is generally considered the most appropriate initial imaging study, although it has low sensitivity for urolithiasis. If ultrasound is not definitive, MR urography is considered by some the next most appropriate modality. If the patient fails conservative management and further imaging is needed, low-dose CT may be considered [70].

Pregnant patients are at increased risk for pulmonary embolism (PE) and its complications. Some centers may select to perform bilateral lower extremity ultrasound in a pregnant patient suspected of having a PE. If thrombus is detected, the patient can be treated without a definitive diagnosis of PE, as the treatment would be the same. For definitive workup, both CT pulmonary angiography (CTPA) or ventilation/perfusion (V/Q) scintigraphy have been endorsed. Most studies, however, suggest that fetal radiation dose is lower with CTPA than V/Q scan. The traumatized pregnant patient presents a distinct challenge in the selection of optimal image modality, which balances the risk of fetal exposure to radiation against the potentially life-threatening injuries to the both the patient and the fetus. CT examinations that involve body parts remote from the fetus, such as the head and cervical spine, can be performed without concern for serious exposure to the fetus. In blunt abdominopelvic trauma, some centers may proceed with abdominal ultrasound while others will pursue CT scan. If CT is recommended, an attempt at reducing radiation dose as appropriate should be made. Fetal evaluation on imaging should be performed ideally at the same time as the mother's evaluation or after the mother's stability is established [70].

Vascular emergencies

Al-katib et al. provided a comprehensive image-rich review of examples of non-aortic vascular pathologies that can present emergently. In the chest, pulmonary AVM is depicted on contrast-enhanced CT as vascular nidus with arterial inflow and venous drainage. If multiple, hereditary hemorrhagic telangiectasia should be considered. Treatment is with coil embolization. Patients with head, neck, and upper extremity edema may suffer from superior vena cava (SVC) syndrome due to fibrosing mediastinitis. Soft tissue with calcifications compressing the SVC and prominent collateral vessels are key features. A filling defect in the internal jugular vein with associated inflammatory changes may indicate thrombophlebitis, usually caused by infectious pharyngitis. These patients are at risk for the development of pulmonary emboli, as in Lemierre syndrome. In the abdomen, examples of non-aortic vascular emergencies include portal vein thrombosis and cavernous transformation at the porta hepatis, renal artery fibromuscular dysplasia, and isolated inferior mesenteric vein thrombosis. A beaded appearance to the renal arteries is the classic contrast-enhanced CT appearance of renal artery fibromuscular dysplasia. Angioplasty is the treatment of choice. Inferior mesenteric vein thrombus is typically located near the bifurcation with the splenic vein. This entity accounts for up to 11 % of cases of mesenteric venous thrombosis and can be a life-threatening complication of sigmoid diverticulitis [71].

Hemorrhage from vascular injury is a leading cause of death in blunt abdominoplevic trauma when pelvic ring fractures are present. Cline et al. reviewed normal vascular anatomy of the pelvis, using landmarks on CT to highlight arteries that are commonly implicated in life-threatening vascular injury. After giving three case examples of vascular injury detected on CT and conventional angiography, they reviewed key characteristics of various embolization agents, including Gelfoam, particles, metallic coils, liquid agents, and thrombin [72]. Rahman et al. presented two exhibits on their institution's experience with pelvic CT angiography (CTA). In the first of a two-part series entitled "Pelvic CT angiography in trauma: 10 years of experience at a Level I trauma center," the authors observed a statistically significant difference in the need for vascular embolization in traumatized patients with active extravasation demonstrated on pelvic CTA compared to patients without active extravasation. In addition, they reported a significant association between any vascular injury detected on pelvic CTA and increased mortality. In the companion exhibit, the authors advocate three-phase CT imaging in blunt pelvic trauma. The arterial phase is critical in diagnosing arterial occlusion, dissection, uncontained extravasation, pseudoaneurysm, and AVF. The portal venous phase is helpful in confirming active extravasation, pseudoaneurysm, and AVF. A delayed phase may be valuable when hematoma is present but no contrast extravasation is seen on either of the early phases. Accumulation of contrast within hematoma in the delayed phase represents venous injury, which is usually managed conservatively. The authors point out that small bone fragments adjacent to pelvic hematomas may mimic vascular injury on CT, conferring added value to delayed imaging [73, 74].

During one of the oral scientific presentation sessions, Linnau et al. presented original data from a multi-center, international study on 813 blunt pelvic injury patients who underwent angiographic imaging during treatment. The aims of the study were to assess triage pathways and imaging findings in blunt pelvic trauma patients who underwent catheter angiography and to establish practice pattern variation and effectiveness of contrast-enhanced CT. Although contrast-enhanced CT is widely utilized in the setting of blunt pelvic

trauma, the rate of arterial injury on conventional catheter angiography is not substantially different from that in patients who did not receive contrast-enhanced CT before intervention [75].

CTA is rapidly becoming the dominant imaging modality in the evaluation of vascular injury to the extremities, demonstrating significant advantages over conventional angiography. Although therapeutic intervention is possible only with conventional angiography, CTA delivers a smaller radiation dose, requires less ancillary staff support, is rapid, and is more readily accessible in most trauma centers. Colip et al. examined the utility of CTA in the evaluation of extremity injury in a retrospective review of 446 patients. Of the 130 patients with vascular injury detected on CTA, 32 underwent surgical repair. None of the patients without demonstrable vascular injury on CTA required a vascular intervention, and all were managed expectantly. The same group offered an imaging display of the range of vascular injuries detectable on CTA of the extremity in a separate exhibit. These included focal narrowing from vasospasm or intimal defect, occlusion, pseudoaneurysm, active extravasation, and AVF. They note that, in the rare event of a non-diagnostic CTA, catheter angiography remains alternative option for troubleshooting [76].

Parmet et al. provided guidance for triaging patients with splenic and hepatic vascular injury to endovascular versus conservative management. Indications for subselective endovascular embolization of splenic vascular injury include active extravasation and pseudoaneurysm. In high-grade (AAST OIS grades III–V) splenic injury, some centers may opt to proceed to embolization of the main splenic artery. When greater than 3 foci of active extravasation are noted at CTA, proximal embolization is undertaken as first-line therapy rather than selective embolization. In the absence of pseudoaneurysm or active arterial extravasation, most liver lacerations can be managed conservatively, assuming hemodynamic stability and a normal clotting profile [77].

Quality and safety

Moore et al. discussed the appearance and causes of various artifacts unique to brain MRI that can affect diagnostic quality. For each, they offered potential solutions to minimize the artifact, noting, however, that these strategies are accompanied by image quality trade-offs. Aliasing ("wrap-around") artifact is caused by too small a FOV and can be corrected by increasing the FOV. Doing this, however, will require an increase in scan time and potentially introduce patient motion artifact. Truncation artifact appears as bright or dark lines paralleling borders of abrupt signal changes, such as at the CSF-spinal cord interface. Increasing the number phase encoding steps is a potential solution, but likewise may introduce patient motion artifact. Flow-related artifact is a notable problem in MR vascular imaging and is related to prolonged T1 relaxation time with stronger magnets and faster-switching gradients at higher field strength. Solutions include decreasing the magnetic field strength, applying "flow compensation" pulses or gradient-moment nulling and cardiac triggering. Susceptibility artifact arises from distortion of the local magnetic field in the region of para- or ferromagnetic substances and is accentuated on GRE and SWI sequences. A number of possible strategies are available to reduce susceptibility artifact, such as using spin-echo instead of GRE sequences. Doing so, however, would increase scan time and the potential for motion artifact [78].

Patient safety featured prominent in this year's education exhibits. Mansouri et al. analyzed 1717 confidential safety incident reports at their institution over an 8-year period. They observed an incident report rate of 0.19 % in the emergency radiology setting, in keeping with a published rate in the range of 0.2–3.13 %. The most commonly reported safety incidents were diagnostic test errors, medication/IV safety (such as contrast infiltration), and service coordination (patient waited >1 h or was not dressed appropriately for imaging) [79]. Nia and Gilbertson-Dahdal assembled a list of basic life support items that should be readily available wherever iodinated IV contrast is used. These included pediatric and adult bag valve masks, vital sign monitoring equipment, cardiac defibrillator, supplemental oxygen tank and medication box containing epinephrine, and other pertinent response medications in the event of an adverse contrast reaction. The authors recommended that radiologists be familiar with the ACR Manual of Contrast Media to learn how to manage various contrast-related reactions [80].

Kelleher et al. shared their experience with implementing a quality assurance (QA) program at their institution and examined the impact of having such a program on CT ordering errors and report turn-around time. Strategies at improving workflow and, accordingly, vigilance for potential CT ordering errors, included monthly interdisciplinary meetings involving emergency department leadership, and representatives from information technology, patient services and patient support; an evening medical student triage program in which medical students assisted radiologists with answering the phone and protocolling studies; and the hiring of radiology assistants to help answer the phone, protocol studies and interpret plain films. Following implementation of these components, the authors noted a precipitous decline in CT ordering errors within a few months. Furthermore, emergency radiology turn-around times decreased for most modalities. The authors stress that in today's environment of value-based imaging, radiologists need to be attuned to opportunities for improving quality-based metrics, not just image interpretation capabilities [81].

The use of abbreviated hip MRI protocols is gaining traction in the ED to exclude radiographically occult hip fractures. A typical fast-MRI protocol may consist of coronal T1 and fluid-

sensitive images to assess for trabecular condensation and marrow edema. Hall et al. studied the diagnostic accuracy of preliminary resident interpretations of 55 abbreviated hip MRI examinations over a 2-year period. These preliminary reads were compared to the final attending-level interpretation for discrepancies. There were three significant errors, with two missed femoral neck fractures and one overread of a femoral neck fracture. There were 17 total nonsignificant fracture findings, such as pubic ramus and sacral fractures. The authors conclude that radiology residents only infrequently miss major hip fractures; nonetheless, particularly given the relatively high nonsignificant miss rate, residents at their institution may benefit from additional education to avoid future misdiagnosis [82].

Imaging innovations and the emergency radiology experience

Novel imaging techniques in the emergency radiology setting were discussed by several exhibitors. Using ultra-low radiation dose source CT images of the head and face/sinus, Wu et al. compared model-based iterative reconstruction (MBIR), a relatively new reconstruction algorithm, to the widely available adaptive statistical iterative reconstruction (ASIR) and conventional filtered back-projection (FBP) for differences in image quality and artifact. Compared to ASIR and FBP, MBIR compared favorably in terms of both image quality and reduction of streak and beam hardening artifact in the posterior fossa. Accordingly, MBIR shows promise in optimizing image quality and radiation dose reduction. Young et al. investigated image quality and diagnostic performance of virtual non-contrast (VNC) head CT generated from dual-energy head CTA datasets using simultaneously acquired conventional non-contrast head CT as a control. While sensitivity and specificity for any intracranial hemorrhage for any given patient was 100 % with VNC, it "overcalled" two subarachnoid and one intraventricular hemorrhage. Subjective image quality was rated as "slightly worse" in 12 out of 19 patients and "significantly worse" in seven. These data suggest that VNC head CT is not yet advanced enough to be used in the clinical setting to accurately diagnose intracranial hemorrhage [83]. Godt et al. prospectively examined the utility of the triple-split-bolus technique in 39 abdominal trauma patients. This technique involves CT of the abdomen and pelvis following the administration of a total of 175 mL of iodinated IV contrast at three separate time intervals to optimize arterial, portal venous, and excretory phase enhancement, respectively. The mean attenuation values within the major abdominal vessels and organs and renal pelvis were compared to attenuation values in these regions in the same patient undergoing a subsequent conventional single (portal venous) phase CT of the abdomen and pelvis within the following 6 weeks using a mean of 148 mL of IV contrast. Organ and vessel enhancement were significantly improved using the triple-split bolus technique. Furthermore, excretory phase imaging was obtained simultaneously. The advantages of this novel strategy are dose reduction and improved study completion speed, as separate image acquisitions in the arterial, portal venous, and excretory phases are not necessary. This could consequently have the effect of improving patient turnover in the scanner suite. A potential drawback is the need to administer a higher than normal dose of iodinated contrast in order to achieve optimal enhancement of the arteries, viscera, and urinary tract [84].

In a scientific session, Beenen et al. conducted a multi-institutional study to compare in-hospital mortality (primary endpoint) between trauma patients who were randomly assigned to immediate total body CT scan and those who were randomly assigned to undergo conventional imaging supplemented with selective CT. Secondary outcome measures were clinically relevant time intervals, radiation exposure, missed injuries, and direct medical costs. At the conclusion of the study involving 1083 subjects, there was no statistically significant difference of in-hospital mortality or direct medical costs between the two arms, but whole body CT was more rapid. Conventional imaging with selective CT was associated with lower radiation dose [85].

Rolen et al. charted their experience with a two-residency merger at their institution and laid out a series of their answers to challenges concerning attending staffing and resident call responsibilities that arose out of this new alliance. Although the details were specific to their institution, the central thrust of the narrative was that a successful merger necessitates creative problem-solving [86]. This serves perhaps as an instructive message to the radiology community as a whole, which in recent years has witnessed enormous change with respect to a troubled job market, a shift from a productivity-based to a value-based paradigm ushered in by the Affordable Care Act, and a growing demand for medical imaging.

The image of the radiologist as an obscure, inaccessible figure whose role in patient care is played out in the dark confines of a remote, windowless reading room does no justice to the magnitude of contributions radiologists make at every juncture in the patient's healthcare experience. Furthermore, in the battle to assert radiology's relevance in the emerging environment of cost-effective care, the physical isolation that radiologists have inhabited since the dawn of the picture archiving and communication system (PACS) promises to further fortify the perception of the radiologist as a minor and peripheral character in the treatment team. There is perhaps no better environment in which to begin to dismantle this mischaracterization than the emergency radiology service, where the pace of the action can inspire awe by harried emergency physicians and trauma surgeons alike and where the occasion for interaction with other treatment providers is nearly constant. In "Front line radiology: value-added imaging during the golden hour of trauma," Patel et al. recognized the need for an opportunity for radiologists to assume a more integrated role in the management of the acutely traumatized

patient, particularly in that "golden" first hour of trauma, in which the effectiveness and speed of resuscitative efforts can mean the difference between life and death. Patel's group devised a Trauma Quality control and Preliminary reporting (TQP) system, wherein the on-call radiology resident is required to be present at the CT scanner for all major traumas. With both the radiology resident and trauma team in attendance at the scanner, the surgical team can relay important clinical information to the resident while the resident communicates critical findings in real-time, thus having a direct impact on immediate management decisions. Furthermore, the resident can identify findings that require additional imaging with the patient still in the scanner. The primary outcome measure was the time from review of images to communication of critical findings before and after TQP implementation. To prepare for TQP, residents were exposed to a total of 3 h of simulation, including audio recording of hospital noise while interpreting and communicating critical findings to surgeon-educators. Following the intervention, there was a statistically significant decrease in time from review of images to communication of critical findings post-intervention. Furthermore, residents participating in this project reported overall greater confidence in their ability to provide a preliminary interpretation. The authors concluded that, with proper training, radiology residents can assist in consolidating resuscitative efforts in the "golden hour" of trauma by actively participating in image interpretation and communication alongside the trauma surgical team. What is more, the physical presence of a radiologist at the scene of the action will help promote the value of radiology as a key player in global healthcare enterprise in the eyes of one of its primary stakeholders, the non-radiologist clinician [87].

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Stone M, Rheinboldt M, Delproposto Z, Blaudeau E (2015) Orbital trauma: beyond blowout fractures.
2. Herrmann S, Ditzler M, Calles G, Eldaya R, Eissa O, Uribe T (2015) Managing midface trauma: an overview of complex midface fractures and imaging findings important for clinical management. Emerg Radiol 22:457–510
3. Friedman A, Burns J, Scheinfeld M (2015) Can high density material in the maxillary sinus accurately predict maxillofacial fractures in the setting of low level trauma? Emerg Radiol 22:457–510
4. Rohling N, Yu V, Mohammed N, Mahlon M (2015) Spinal fractures: columns, mechanism and description. Emerg Radiol 22:457–510
5. Spence S, West O (2015) Spinal variants and congenital anomalies that mimic acute injury. Emerg Radiol 22:457–510
6. Becker J, Martirosyan N, Choudhary G, Krupinski E, Erly W, Kubal W (2015) Feasibility study to assess diffusion tensor imaging for evaluation of acute traumatic cervical cord injury. Emerg Radiol 22:457–510
7. Krishansarma R, Sanhaji L (2015) Dental trauma doesn't have to bite.
8. Kelleher M, Gao G, Rolen M, Bokhari J (2015) Completion CT chest, adbomen and pelvis after acute head and neck trauma: incidence of acute traumatic pathology.
9. Liang T, Ali I, McLaughlin P, Nicolaou S (2015) Enhancing our peripheral vision: the utility of full-field image reconstruction in detection of injuries on chest CT in acute trauma patients. Emerg Radiol 22(457–510)
10. Millet J, Chong S, Sundaram B (2015) MDCT imaging of traumatic thoracic aortic injuries. Emerg Radiol 22:457–510
11. Nummela M, Bensch F, Seppo K (2015) Costochondral fractures - an underappreciated injury in polytrauma patients. Emerg Radiol 22:457–510
12. Myers L, Herr K, Jaffray P, Brunner J, Boyko O, Reddy S (2015) Anterior thoracic trauma: sternal and parasternal injuries. Emerg Radiol 22(457–510)
13. Soto JA, Anderson SW (2012) Multidetector CT of blunt abdominal trauma. Radiology 265:678–693
14. Recchimuzzi D, Ikuta I, Hanaoka M, Jayanthi S, Cerri G (2015) Efficacy of CT in diagnosis of bowel and mesenteric injury after blunt trauma and how we can improve it. Emerg Radiol 22:457–510
15. Maller V, Afzal M, Shankar S, Goodin G (2015) Computed tomography in the detection of bowel and mesenteric injuries. Emerg Radiol 22:457–510
16. Bates D, Gorantla V, Anderson S, Soto J, LeBedis C (2015) Lessons from trauma: surgically proven cases of bowel injury in blunt abdominal trauma.
17. Batohi B, Bew D, Dylan L, Meacock L (2015) The role of sequential CT imaging in bowel and mesenteric trauma: the "seat" belt sign and braces approach! Emerg Radiol 22:457–510
18. Blomquist G, Nickels D, Davenoprt D, Chang P, Lee J, Ayoob A (2015) Contrast enhanced CT, a good presurgical screening test for blunt bowel and mesenteric injury?
19. Gross J, Sandstrom C, Aarabi S, Robinson J (2015) Challenges in the grading of heaptic trauma. Emerg Radiol 22:457–510
20. Wong Y, Wang L, Wu C (2015) Efficacy of hepatocyte-specific contrast-enhanced magnetic resonance cholangiography for the diagnosis of blunt biliary injuries. Emerg Radiol 22:457–510
21. Matalon S, Askari R, Patel K, Gates J, Sodickson A, Khurana B (2015) Don't forget the abdominal wall! Important traumatic injuries not to be missed.
22. Diaz L, Arndt W, Roemer F, Guemazi A (2015) Patellar fractures: imaging and management implications. Emerg Radiol 22:457–510
23. Spindle P, Garza-Gongora R, Parman L (2015) Pelvic ring injuries. Emerg Radiol 22:457–510
24. Stavrakis C, Vinh P, Campito M, Cooley M, Whiteside M (2015) What the orthopedist wants to know: Schatzker classification of tibial plateau fractures. Emerg Radiol 22:457–510
25. Marshall R, Weaver M, Sodickson A, Khurana B (2015) Periprosthetic hip fractures in the emergency department: what the orthopedic surgeon wants to know.
26. Friedlander J, Yafavalli S (2015) Look again and check your blind spot: review of commonly missed bone and soft tissue pathology in the emergency setting. Emerg Radiol 22:457–510
27. Chao R, Honowitz S, Chou B, Krygier J, Kang Y (2015) Utility of 3D-printed models in surgical planning for repair of complex orthopedic fractures. Emerg Radiol 22:457–510
28. Neymotin A, Ro M, Hayim M, Kagetsu N (2015) Intracranial hyperdensity: it's not all acute hemorrhage. Emergency radiology (457–510)

29. Love R, Nickerson J (2015) Non-traumatic emergencies of the head and neck: lost in spaces. Emerg Radiol 22:457–510
30. Millare G, Rasmussen J, Balintona J, Hassan T, Debnam M (2015) Acute non-traumatic emergencies of the head and neck: a review. Emerg Radiol 22:457–510
31. Raff E, Shah G, Chong S (2015) Acute neuroimaging of immunocompromised patients. Emerg Radiol 22:457–510
32. Sauter C, Hanna T, Herr K, Rohatgi S, Khosa F (2015) Neuoimaging in cancer patients presenting to the emergency department with headache: single institution experience.
33. Kalisz K, Garg V, Basques K, Young P, Kosmas C, Robbin M, Gilekson R, Landeras L (2015) CT pulmonary embolism—should emergency personnel rely on the wells score and PERC criteria? Emerg Radiol 22:457–510
34. Bates D, LeBedis C, Tkacz J, Holalkere N (2015) Suboptimal CT pulmonary angiography: what happens to these patients when they are evaluated in the emergency department. Emerg Radiol 22:457–510
35. Hermann M, Chong S, Sundaram B, Chughtai A, Stojanovska J (2015) Unsuspected cardiac and coronary causes of acute chest pain on emergency CTs ordered for pulmonary embolism or aortic dissection. Emerg Radiol 22:457–510
36. Misono A, Scheske J, Choy G, Prabhakar A (2015) Are we missing anomalous coronary artery origins in ED patients with chest pain? Emerg Radiol 22:457–510
37. Misono A, Rajam A, Oklu R, Prabhakar A (2015) Predicting pulmonary embolus in ED patients with isolated below-the-knee deep vein thrombosis.
38. McGill K, Sever A, Rheinboldt M, Delproposto Z, Ibrahim S, Blaudeau E (2015) Acute aortic syndrom: the spectrum of pathophysiology and imgaging features.
39. Kelleher M, Mansour A, Moeini-Naghani I, Rolen M, Bokhari J (2015) Utility of the sonographic McBurney's sign in the diagnosis of acute appendicitis.
40. Ojili V, Lopez-Araujo A, Katkar A, Nagar A (2015) Beyond acute appendicitis: cross-sectional imaging spectrum of lower gastrointestinal emergencies "usual and the unusual suspects.". Emerg Radiol 22:457–510
41. Ditzler M, Herrmann S, Eissa O, Eldaya R, Jain S, Swischuk L (2015) Mesenteric adenitis: a review of a commonly misdiagnosed entity. Emerg Radiol 22:457–510
42. Shampain K, Knoepp U, Maturen K, Weadock W, Chong S (2015) Pelvic pain in the non-pregnant patient: an interactive case based review. Emerg Radiol 22:457–510
43. Guirguis M, Ko A, Chinapuvvula N (2015) Imaging of acute pelvic pain in the premenopausal female: how to ensure timely surgical management. Emerg Radiol 22:457–510
44. Hayes H, Lukaszewicz A, Gerasymchuk M, Trivax C (2015) Acute scrotal emergencies: what you don't want to miss. Emerg Radiol 22:457–510
45. Stone M, Rheinboldt M, Delproposto Z, Blaudeau E (2015) Male genitourinary emergencies: an update on imaging and clinical presentation.
46. Thornton L, Managuli R, Verma N (2015) Differential of scrotal sonographic findings in the emergency department: from diagnosis to disposition.
47. Siddaiah M, Kielar A, Sheikh A (2015) ED visits related to bariatric surgery: review of normal post-surgical anatomy as well as complications. Emerg Radiol 22:457–510
48. Hanley-Knutson K, McAdams C, DelGaizo A (2015) Internal hernias: an increasingly recognized cause for abdominal pain. Emerg Radiol 22:457–510
49. Siddaiah M, Fasih N, Duigenan S, Sheikh A (2015) Imaging of abdominal hernia in the ER: tips and tricks. Emerg Radiol 22:457–510
50. Paulson EK, Thompson WM (2015) Review of small-bowel obstruction: the diagnosis and when to worry. Radiology 275(2):332–342
51. Gatzert S, Eldaya R, Eissa O, Ditzler M, Wolfe G (2015) Small bowel obstruction: how to identify what the ED clinician and surgeon want to know. Emerg Radiol 22:457–510
52. Fulwadhava U (2015) Bowel obstruction: the basic ABC's and beyond.
53. Uyeda J, Shyn P, Sodickson A, Khurana B (2015) Decisions regarding abdominal/pelvic percutaneous image-guided drainages: what the emergency radiologist needs to know.
54. Golshani A, Beckmann N (2015) MR imaging of the knee in the emergency setting: a pictorial review. Emerg Radiol 22:457–510
55. Sadiq M, Hanna T, Ditkovsky N, Datir A, Rohatgi S, Khosa F (2015) Sacrum and coccyx radiographs have limited clinical impact in the emergency department.
56. Rao S, Rao S, Saini S, Prabhakar A, Harvey H (2015) Pediatric neuroimaging in the ED for trauma - is imaging appropriate?
57. Amin K, Yedavalli V, Wilkins N, Chedrawy C, Pilati M, Gopireddy D (2015) MRI assessment of pediatric head trauma. Emerg Radiol 22:457–510
58. Pfeifer C, Hammer M, Veltkamp D, Swan T (2015) The non-accidental tourist in the pediatric ED: a head-to-toe survey of abuse injuries. Emerg Radiol 22:457–510
59. Chism C, Johnston J (2015) Imaging of pediatric non-accidental trauma: a multimodality review. Emerg Radiol 22:457–510
60. Guillory R, Ko A, Boyce W, Hubbell G (2015) CT evaluation of the pediatric cervical spine in the trauma setting.
61. Kachramanoglou C, Lewis D, Sa'adedin F, Meacock L, Haque S (2015) Cervical spine injuries in children following major trauma: should we use CT of the cervical spine more selectively? Emerg Radiol 22:457–510
62. Allgeier S, Hoff C, Pai D (2015) Fracture vs variant? Understanding pediatric lower extremity trauma. Emerg Radiol 22:457–510
63. Stone M, Rheinboldt M, Ibrahim S, Delproposto Z, Blaudeau E (2015) Ectopic pregnancies: a pictorial review of presentation, pathophysiology and treatment.
64. Eissa O, Ditzler M, Eldaya R, Herrmann S, Ross J, Kirschner K (2015) What could go wrong? an imaging review of first trimester pregnancy complications. Emerg Radiol 22:457–510
65. McAdams C, Hanley-Knutson K, DelGaizo A (2015) The postpartum pelvis—making it make sense. Emerg Radiol 22:457–510
66. Tantbirojn P, Crum CP, Parast MM (2008) Pathophysiology of placenta creta: the role of decidua and extravillous trophoblast. Placenta 29:639–645
67. Jaffe TA, Miller CM, Merkle EM (2007) Practice patterns in imaging of the pregnant patient with abdominal pain: a survey of academic centers. AJR Am J Roentgenol 189:1128–1134
68. Katz D, Hansen W, Moshiri M, Lamba R, Bhargava P (2015) Evolving practice patterns in imaging pregnancy patients with acute abdominal and pelvic conditions: a survey of three radiological societies. Emerg Radiol 22:457–510
69. Macrito A, Rakita D (2015) Emergent MRI for evaluation of acute abdominal pain in pregnancy. Emerg Radiol 22:457–510
70. Choudhery S, Gupta P (2015) Non-obstetric emergencies in pregnancy: what to do? Emerg Radiol 22:457–510
71. Al-katib S, Basmaji C, Shetty M (2015) Imaging of extra-aortic vascular emergencies of the abdomen. Emerg Radiol 22:457–510
72. Cline M, Chong S, Kielar A, Willatt J, Boscak A, Hannawa (2015) Pelvic vascular injuries and interventional radiology: principles of diagnosis and management. Emerg Radiol 22:457–510
73. Rahman S, Baghdanian A, Bhaghdanian A, Sax A, LeBedis C, Soto J, Anderson S (2015) Pelvic CT angiography in trauma: 10 years of experience at a level 1 trauma center. Emerg Radiol 22:457–510
74. Rahman S, Baghdanian A, Baghdanian A, Sax A, LeBedis C, Soto J, Anderson S (2015) Utility of pelvic CT angiography in blunt trauma. Emerg Radiol 22:457–510
75. Linnau K, Khurana B, Hippe D, Sheehan K, Soto J, Dreizin D, Heller M, Herr K, Steenburg D, Hanna T, Nickels D, Abujudeh

H, Nicolaou S, LeBedis C (2015) Pelvic Angiography Project ASER (PAPA) Study - a retrospective multicenter cohort study of blunt abdominopelvic trauma patients who undergo catheter angiography.
76. Colip C, Gorantla V, LeBedis C, Soto J, Anderson S (2015) Extremity CTA in penetrating trauma: 10 years' experience in a level 1 trauma center. Emerg Radiol 22:457–510
77. Parmet P, Baxter A, Johnston J (2015) Clinical and imaging features predicting success in endovascular and non-operative management of blunt abdominal trauma. Emerg Radiol 22:457–510
78. Moore A, Srinivasan A, Kraus G, Quint D, Hoff C, Chong S (2015) Recognizing, leveraging and avoiding MRI artifacts in neuroimaging in the ED. Emerg Radiol 22:457–510
79. Mansouri M, Shaqdan K, Singh A, Lev M, Abujudeh H (2015) Safety incident reports in emergency radiology: analysis of 1717 safety incidents. Emerg Radiol 22:457–510
80. Nia E, Gilbertson-Dahdal D (2015) Contrast reaction basic life support kits in outpatient diagnostic centers. Emerg Radiol 22: 457–510
81. Kelleher M, Rolen M, Blanchette S, Bokhari J (2015) Developing and optimizing a quality assurance program in emergency radiology.
82. Hall G, Brooks M, Mazzie J, Gould J, Barzideh O (2015) Evaluation of on-call radiology resident interpretation of fast hip MRI. Emerg Radiol 22:457–510
83. Young J, Daftaribesheli L, Wu M, Pomerantz S, Gupta R, Lev M (2015) Virtual non-contrast post-processed images from dual energy CTA datasets are highly accurate for the detection of intracranial hemorrhage in acute stroke patients.
84. Godt J, Eken T, Schulz A, Johansen C, Pripp A, Dormagen J (2015) Triple-split-bolus vs. single-bolus CT in abdominal trauma patients: a comparative study.
85. Beenen L, Sierink J, Treskes K, Hohmann J, Edwards M, Beuker B, den Hartog D, Dijkgraaf M, Luitse J, Hollmann M, Goslings J (2015) Immediate total-body CT scanning versus conventional imaging and selective CT scanning in severe trauma patients - a randomized controlled traial (REACT-2 Trial).
86. Rolen M, Bokhari S (2015) Reshaping the emergency radiology call experience after the merger of two residency programs—the Yale experience. Emerg Radiol 22:457–510
87. Patel N, Khan M, Chong S, Mazza M, Cherry-Bukoweic J, Machado-Aranda D, Brown L (2015) Front line radiology: value-added imaging during the golden hour of trauma. Emerg Radiol 22: 457–510

ASER 2015 Annual Meeting Awards

Winged caduceus
Robert A. Novelline, M.D., FACR
Harvard Medical School
Boston, MA

Gold medalist and Founders' lecturer
Susan D. John, M.D., FACR
UTMB-Houston Medical School
Houston, TX

2015 ASER Fellow honoree
Martin Gunn, MBChB, FRANZCR
University of Washington School of Medicine
Seattle, WA

Harris award
Alexander Misono, M.D., Massachusetts General Hospital, Boston, MA, for *Predicting pulmonary embolus in ED patients with isolated below-the-knee deep vein thrombosis.*

Novelline award
Andrea Moore, M.D., University of Michigan, Ann Arbor, for *Recognizing, leveraging and avoiding MRI artifacts in neuroimaging in the ED.*

Scientific paper presentation winners
Summa cum laude
Alexander Misono, M.D., Massachusetts General Hospital, Boston, MA, for *Predicting pulmonary embolus in ED patients with isolated below-the-knee deep vein thrombosis*.

Magna cum laude
Ludo Beenen, M.D., Academic Medical Center, Amsterdam-Noord, Holland, for *Immediate total-body CT scanning versus conventional imaging and selective CT scanning in severe trauma patients – a randomized controlled trauma (REACT-2 Trial)*.

Cum laude
Ken Linnau, M.D., University of Washington, Seattle, WA, for *Pelvic Angiography Project ASER (PAPA) Study – a retrospective multicenter cohort study of blunt pelvic trauma patients who undergo catheter angiography.*

Scientific and educational exhibit winners
Summa cum laude
Andrea Moore, M.D., University of Michigan, Ann Arbor, for *Recognizing, leveraging and avoiding MRI artifacts in neuroimaging in the ED*.

Magna cum laude
Patrick McLaughlin, M.D., FFR, RCSI, FRCPC, Vancouver General Hospital, Vancouver, BC, for *The utility of monoenergetic plus reconstruction using dual energy CT to enhance diagnosis of pulmonary emboli.*

Cum laude
Nishant Patel, M.D., MBA, University of Michigan, Ann Arbor, for *Front line radiology: value-added imaging during the golden hour of trauma*.

Certificates of Merit
Charles Colip, M.D., BS, Boston Medical Center, Boston, MA, for *Extremity CTA in penetrating trauma: 10 years' experience in a Level 1 trauma center.*
Armonde Baghdanian, M.D., Boston Medical Center, Boston, MA, for *Life-saving exploratory laparotomy for abdominal trauma: spectrum of imaging findings in the immediate post-operative period.*

Case of the Day winner
Douglas Katz, M.D., FACR,
Winthrop University Hospital
Mineola, NY.