Emergency Radiology

Program subject to change until 12/16/2019.



105[™] Scientific Assembly and Annual Meeting December 1–6 | McCormick Place, Chicago







ER001-E<u>B-X</u>

Foreign Body Within the Abdominal Cavity: Emphasis on Its Potential Complications

All Day Room: ER Community, Learning Center Hardcopy Backboard

Awards Certificate of Merit

Participants

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TEACHING POINTS

Describe the CT appearances of common and uncommon intraluminal and extraluminal foreign bodies in the abdominopelvic cavity. Discuss the clinical implications and potential clinical complications of the foreign bodies which need emergency care in the gastrointestinal tract and abdominopelvic cavity.

TABLE OF CONTENTS/OUTLINE

1. Intraluminal foreign bodies 1) Ingested foreign body without complication 2) Ingested foreign body with perforation of bowel loops 3) Acute appendicitis from foreign body 4) Intraluminal foreign body penetrating into adjacent pancreas 5) Inserted intrarectal foreign body 6) Bezoar 7) Gall stone ileus 8) Dislodged tubes of prior procedures (biliary stent, PEG tube) 2. Extraluminal foreign bodies 1) Spillage of gall stones or clips in peritoneal cavity after cholecystectomy 2) Migration of intrauterine devices 3) Migration of ventriculo-peritoneal or subdural -peritoneal shunt tube. 4) Remained bioabsorbable sponges after operation 5) Accidentally introduced foreign body during operation 6) Gossypiboma 7) Intraperitoneal foreign body with abscess formation







ER003-EB-X

Dual-Energy CT: How to Use it to Salvage Suboptimal CT Angiograms

All Day Room: ER Community, Learning Center Hardcopy Backboard

Participants

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TEACHING POINTS

Understand the basic theory of DECT and its various reconstruction techniques. Illustrate how to reconstruct DECT raw data to maximize the conspicuity of Iodine using low keV monoenergy images. Demonstrate methods to suppress calcifications in atherosclerotic plaques to more accurately estimate arterial stenosis.

TABLE OF CONTENTS/OUTLINE

Basic theory of DECT and its various reconstruction tecniques Use of low energy keV monoenergy reconstructions of DECT raw data to maximize density of IV contrast Use of virtual non-constrast images for detection of intramural hematomas Sample cases







ER004-EB-X

Don't Stop Me Now: The CTA Lyrics to a Fast and Accurate Treatment of Abdominal Active Bleeding

All Day Room: ER Community, Learning Center Hardcopy Backboard

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TEACHING POINTS

To review the principal active abdominopelvic bleeding causes. To discuss the role of US and CT angiography in the clinical management of acute abdominopelvic bleeding. To analyze the CT angiography protocol in patients with suspected acute abdominopelvic bleeding. To highlight the importance of unenhanced phases and the utility of MIP & 3D reconstructions when detecting hemorrhage sources. To provide the diagnostic keys findings in CT angiography needed to determine an appropriate treatment.

TABLE OF CONTENTS/OUTLINE

Introduction & main concepts CTA Key findings: fast hemorrhage localization The determinant role of CT Angiography in patient management Abdominopelvic Bleeding Cases Gastrointestinal bleedings Esophageal varices Gastric ulcer Duodenal ulcer Small bowel & colon Hepatic bleeding Splenic bleeding Urinary bleeding Renal Bladder Genital bleeding Uterus Hemorrhagic follicle Ectopic pregnancy Testicular Abdominal aorta bleeding Aneurism rupture Active bleeding simulators and pitfalls Conclusion





ER100-ED-X

The Radiologist's Role in Stratifying Blunt Chest Trauma Incorporating Best Practice Reporting Guidelines

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

Acute rib fractures are common and a sign of significant trauma to the thorax. Multilevel rib fractures can be debilitating and cause significant respiratory compromise particularly in the setting of flail chest. Recent upgrades in surgical stabilization technique for displaced rib fractures have seen increased employment of rib stabilization for the management of flail chest and significant chest deformity. We review classes of chest trauma and associated injury patterns to include hemopneumothorax, pulmonary contusion with laceration, traumatic lung hernia and pulmonary artery pseudoaneurysm. Finally we propose a standardized guideline for reporting and scoring the severity of chest trauma incorporating RibScore and Blunt Pulmonary Contusion-18 scores by the interpreting radiologist to stratify those patients who will benefit from rib fixation.

TABLE OF CONTENTS/OUTLINE

•Introduction •Objectives •Epidemiology and pathophysiology of blunt chest trauma •Features and sequelae of acute rib fractures exploring injury patterns of chest trauma including hemopneumothorax, pulmonary contusion/laceration, traumatic lung hernia, vascular injury and pulmonary artery pseudoaneurysm •ACR appropriateness criteria for imaging •Standardized guideline for reporting and scoring the severity of chest trauma using RibScore and Blunt Pulmonary Contusion-18 score •Summary•References





ER101-ED-X

The Night is Dark and Full of Terrors: A Primer for Overnight Blind Spots for the On-Call Radiologist

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. Describe the normal anatomy of certain anatomical blind spots encountered overnight. 2. Recognize abnormal appearance from normal appearance of certain blind spots. 3. Highlight pitfalls in interpretation of findings in each blind spot. 4. Develop a search pattern to avoid interpretation errors in evaluating overnight imaging studies from the ER.

TABLE OF CONTENTS/OUTLINE

Introduction 1. Blind spots overview 2. Anatomy 3. Neuro Skull base Convexities Inner ear Orbits 4. Head & Neck Paraesophageal soft tissues TMJ 5. Chest Lungs Pleura Bronchi Pulmonary arteries Heart Chest wall/breasts 6. Body Abdominal wall Retroperitoneum Bowel Mesentary 7. Pelvis 8. MSK Upper extremity Lower Extremity 9. Nuclear Medicine 10. Search pattern for on call Summary





ER102-ED-X

Imaging Findings of Rodeo Injuries in the Wild West

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Rodeo events are a high impact sport with a unique pattern of injuries. An analysis of the different mechanisms of injury based on the individual events will aid radiologist pattern recognition and reporting. After viewing this exhibit, the learner should: Understand injury mechanisms for the different rodeo events (roping, bull riding) Be able to identify the imaging findings of several different acute rodeo injuries Be able to identify the imaging findings of several different chronic rodeo injuries

TABLE OF CONTENTS/OUTLINE

Introduction to rodeo events Mechanism of injury for individual events (roping, bull riding etc.) Imaging findings of several different acute rodeo injuries, with example cases Imaging findings of several different chronic rodeo injuries, with example cases Summary







Bigger isn't Always Better: Review of Important Imaging Measurements for the On-Call Radiology Resident

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The "on call" rotation, usually consisting of emergency department and inpatient service coverage by the radiology resident can be an extremely stressful time. Knowledge of certain measurements encountered during common emergent studies can help alleviate this stress and help the resident provide accurate and timely patient care. After reviewing this exhibit, the learner should: Be aware of measurements encountered in the imaging findings of several emergent conditions Understand how to apply these measurements to arrive at accurate diagnoses

TABLE OF CONTENTS/OUTLINE

Introduction Commonly encountered imaging measurements and their diagnostic implications Musculoskeletal (e.g. femoral notch, acromioclavicular joint, Boehler's angle) Cardiovascular (e.g. aorta, cardiac, pulmonary artery, IVC) Gastrointestinal (e.g. pylorus, appendix, bowel lumen) Genitourinary (e.g. ovary, obstetrical) Neurologic (e.g. pre-dental space and other spine measurements, aneurysms) Imaging examples of normal and abnormal findings Peals and Pitfalls Conclusion







ER104-ED-X

MRI Appearance of Clinical Mimics of Appendicitis in Pediatric Patients

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Abdominal pain with clinical concern for appendicitis is a common presentation in the pediatric emergency room. Diagnosis relies heavily on imaging, with first line imaging typically being ultrasound. However, increasingly limited abdominal MRI are being utilized when ultrasound is inconclusive or for problem-solving. While appendicitis is common, there are other clinical mimics of appendicitis that can be encountered on MRI. Since the radiological findings help triage medical and surgical management, familiarity with these mimics is critical. We will present a series of common and uncommon mimics of appendicitis on magnetic resonance imaging (MRI). While the exhibit will focus on the MRI findings, representative and corroborative findings from ultrasound and computed tomography (CT) will be included.

TABLE OF CONTENTS/OUTLINE

A cased based review of mimics of appendicitis on MRI: Bowel and Mesenteric/Omental Etiologies: terminal ileitis, ascending colitis, Meckel's Diverticulitis, ileocolic intussusception, & omental infarction Gynelogical Etiologies: ovarian torsion, isolated fallopian tubal torsion, & tubo-ovarian abscess Genitourinary Etiologies: obstructing ureteral stone & pyelonephritis Musculoskeletal Etiologies: psoas myositis





ER105-ED-X

Breast Emergency: How Do I Manage It?

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

To review breast entities which may be cause of consultation in the Emergency Department, including clinical presentation, imaging and pathologic findings. To illustrate common and uncommon imaging findings both found in imaging techniques commonly employed in the ED (plain radiographs, CT, US) and dedicated breast imaging (mammograms, MR) with pathologic correlation. To emphasize pitfalls and differential diagnosis, and clues for management .

TABLE OF CONTENTS/OUTLINE

Different pathological entities of the breast may present in the ED. The radiologist should be aware of differential diagnosis, imaging and management of the most common lesions. We present. 1. Breast anatomy 2. Lesions according to presentation. Inflammatory/infectious conditions (mastitis: infectious, granulomatous, eosinophilic); Trauma: blunt and penetrating (hematoma, bleeding, breast implant rupture); Palpable lumps (cysts, benign masses, cancer); Foreign bodies (sewing needle, injected substances). 3. Specific lesions in different groups. Male breast (Ginecomastia); Newborn (Breast masses, transient thelarche), adolescents (ginecomastia, thelarche, fibroadenoma), pregnancy (benign tumors, cancer), puerperium (lactational adenoma, galactocele, puerperal mastitis).





ER106-ED-X

Ins and Outs of Plain Radiographs of the Abdomen: Looking for Abdominal Air Where It Should Not Be

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

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TEACHING POINTS

1. To present a series of challenging abdominal plain radiographs, with gas in a non-usual position, providing correlation with other imaging methods (CT, US, MR). 2. To review and illustrate different entities presenting with air in abnormal location. 3. To emphasize pitfalls, diagnostic difficulties and differential diagnosis.

TABLE OF CONTENTS/OUTLINE

We provide a case-based presentation in a quiz format, consisting of plain abdominal radiographs that will help us to review different entities presenting with abnormal abdominal gas. We add a description of findings, complementary studies (US,MR, CT) and illustrative pathologic images when available as well as normal tricky images. In the discussion keys to differential diagnosis will be highlighted. We present gas within: 1. Pneumoperitoneum, retropneumoperitoneum 2. Gastrointestinal tract. - Bowel wall: Pneumatosis intestinalis, coli , gastric pneumatosis - Gallbladder wall: emphysematous cholecystitis - Liver.Abscess,Aerobilia,Portal vein gas. - Pancreatic abscess, emphysematous pancreatitis, 3. Urinary tract. -Emphysematous pyelonephritis -Emphysematous pyelitis -Renal abscess -Emphysematous cystitis - Fournier gangrena 4.Abdominal wall : postoperative gas, necrotizing fascitis 5.Pitfalls. Tubes, colostomy, tampons, postoperative gas





ER107-ED-X

Emergency Imaging Assessment of Intracranial Complications of Acute ENT Infections

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. To review the intracranial complications acute of otorhinolaryngological infections, that may be seen in the emergency setting. 2. Keep in mind that patients can have variable presentations according to the site and extent of the infection. 3. Describe the CT and MR imaging findings of common intracranial complications of otorhinolaryngological infections.

TABLE OF CONTENTS/OUTLINE

1. Description of ENT Infections: a. Oral Cavity b. Oropharynx c. Retropharynx d. Orbits and Sinuses e. EAR infections 2. Review of Intracranial complications of acute ENT infections. a. Extradural/subdural empyema b. Intracranial abscess c. Subperiosteal abscess d. Vascular complications: acute stroke, cerebral sinus venous thrombosis, Mycotic pseudoaneurysms, vasculitis 3. Radiographic findings of intracranial complications of otorhinolaryngological infections in emergency radiology. a. Meningitis findings: leptomeningeal enhancement b. Ischemic injury c. Hydrocephalus d. Subdural/epidural empyema e. Cerebritis and cerebral abscess f. Ventriculitis g. Dural sinus thrombosis







About to Blow Up!: Cased-based Review of Impending Signs of Aortic Rupture, Treatment, and Endoleak Complications

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

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TEACHING POINTS

• Aortic rupture carries a critical sense of urgency given that the integrity of the vascular system is crucial to maintaining the vital blood supply to the various organ systems. • Consequently, specific clinical scenarios demand immediate action to determine whether the aorta is intact or damaged and if it can maintain adequate perfusion. • The radiologist must know how to recognize the broad spectrum of signs that fit the criteria to be considered a vascular emergency, and prompt and accurate diagnosis is indispensable to allow the treating physician to determine the best therapeutic approach.• It is essential that we as the radiologist need to be aware of the postoperative complications appearance of this entity to make sure if re-intervention it needs it or not.

TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENT.-Introduction.-Impending signs of aortic rupture. -Aortic Rupture. -Pre-surgical complications-Treatment -Endoleak complications -Tips and mimics (it 's not a rupture)-Conclusion.





ER109-ED-X

Image Overload: How to Approach an Emergency Brain MRI

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

In the emergency setting, brain MRI may be obtained following a negative or inconclusive head CT, or to further characterize findings seen on CT. When approaching the interpretation of a brain MRI, following a step-wise algorithm allows the radiologist to accurately and efficiently diagnose pathology and to avoid satisfaction of search. Key brain MRI sequences include: DWI/ADC, GRE/SWI, FLAIR, T2W, T1W without contrast, and T1W with contrast (if performed) Specific diagnoses often require information gleaned from more than one sequence.

TABLE OF CONTENTS/OUTLINE

MRI brain sequences and signal characteristics Sequence-based approach emphasizing normal signal characteristics and pathologic changes: 1) DWI/ADC 2) GRE/SWI 3) FLAIR 4) T2W 5) T1W without contrast 6) T1W with contrast (if performed) Review of specific case examples from the emergency setting including stroke, infectious processes, metabolic processes, hydrocephalus, mass lesions, etc.





ER110-ED-X

The Family Jewels: Pearls for Imaging Patients with Acute Scrotal Pain

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

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TEACHING POINTS

1. Acute scrotal pain can be precipitated by infectious, traumatic, vascular, and inflammatory etiologies, all of which are best evaluated at ultrasound. 2. Knowledge of characteristic imaging findings at ultrasound and the patient's clinical history can facilitate an accurate diagnosis and guide appropriate management. 3. Close imaging follow-up is needed after treatment for many etiologies of acute scrotal pain to exclude an underlying malignancy.

TABLE OF CONTENTS/OUTLINE

I. Introduction a. Key anatomy b. Technical tips II. Infectious etiologies a. Epididymitis and epididymo-orchitis b. Intratesticular abscess c. Pyocele d. Fournier's gangrene III. Traumatic etiologies a. Testicular rupture b. Testicular contusion/intratesticular hematoma c. Hematocele IV. Vascular etiologies a. Testicular torsion b. Paratesticular appendage torsion c. Segmental testicular infarction d. Varicocele V. Inflammatory etiologies a. Epididymitis nodosa (sperm granuloma) b. Granulomatous orchitis c. Testicular sarcoidosis VI. Pitfalls a. Incidental intratesticular mass i. Seminoma and other primary neoplasms ii. Lymphoma iii. Epidermoid cyst b. Incidental extratesticular mass i. Adenomatoid tumor VII. Conclusion







ER111-ED-X

The Perilous Pancreas: A Multimodality Review of Pancreatic Trauma

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Magna Cum Laude Identified for RadioGraphics

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TEACHING POINTS

Discuss potential perils in pancreatic assessment in the setting of blunt abdominal trauma Illustrate imaging findings in traumatic pancreatic injuries, emphasizing a multi-modality approach and the importance of determining pancreatic duct integrity Explain management options in relationship to imaging findings/injury grading systems

TABLE OF CONTENTS/OUTLINE

Anatomic considerations and pathophysiology Clinical findings Imaging Evaluation: Modalities: CT, MRI/MRCP, ERCP Imaging findings: Direct Secondary Complications Grading/classification Management options





ER112-ED-X

MDCT Atlas of AAST Solid Organ Injury Scaling 2019 Update

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. To demonstrate the significant change of 2018 revised AAST organ injury scaling of the spleen, liver and kidney. 2. To describe MDCT findings of organ injury scaling based on 2018 updated AAST OIS and management

TABLE OF CONTENTS/OUTLINE

1. Introduction 1. Significant changes in the 2018 revised AAST organ injury scaling 1) The new OIS includes three sets of criteria to assign grade: imaging, operative and pathologic. 2) The incorporation of CT diagnosed vascular injury, defined as either as a pseudoaneurysm or arteriovenous fistula, into the new OIS 2. 2018 updated organ injury scaling 1) Spleen 2) Liver 3) Kidney 2. MDCT findings of AAST organ injury scales based on 2018 revision 1. MDCT findings of vascular injury 1) Uncontained vascular injury Acute contrast extravasation, dissection and/or thrombosis 2) Contained vascular injury Pseudoaneurysm, arteriovenous shunt 2. Spleen 1) MDCT findings of AAST OIS 2) Management 3. Liver 1) MDCT findings of AAST OIS 2) Management 4. Kidney 1) MDCT findings of AAST OIS 2) Management 4.





ER113-ED-X

The On-Call Radiology Residents Guide to Managing the Reading Room: Distractions, Downtimes, and Discussions

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

At the end of this exhibit residents should be able to: Recall strategies to minimize the impact of distractions. Execute a plan for when electronic systems go down. Describe skills for effective communication with referring clinicians.

TABLE OF CONTENTS/OUTLINE

Distractions: • Phone calls: Who takes calls? How to prioritize calls? When to call the attending? • Protocoling: What to individually protocol? How to change a protocol? When and what contrast to use? Is it a true contrast allergy? Pre-medication? • Environment: Who is in the reading room? Can you listen to music? When and where do you eat or drink? Downtimes: • PACS: How do you interpret images? Which images are a priority? How do you know what has been read? • RIS: How do you issue a report? What form of report is issued? How are studies tracked after a downtime? • Electronic Health Records: How do clinicians enter orders? Where do clinicians get the results? How do you get clinical information? Discussions: • Curb-side consults: ED patients, inpatients, outside hospital imaging. • Documenting what was said. • Dealing with resident-attending discrepancies. • On-call procedures: LPs and fluoroscopy. When is it appropriate? After a review of best practices, the learner will be assessed with a case-based quiz requiring practical decision-making skills.





"Point of Care" in Abdominal Trauma: What Not to Miss

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Establish a systematic method of abdominal CT assessment in the trauma context Recognize critical CT findings that would require immediate surgical management Establish the exact location of the injury whether it is intraperitoneal, retroperitoneal or extraperitonea

TABLE OF CONTENTS/OUTLINE

- INTRODUCTION - Epidemiology of abdominal trauma - MECHANISMS OF INJURY - Blunt or penetrating abdominal trauma - What to focus on based on cause (motor vehicle collisions, falls from height, assaults, and sports accidents) or mechanism (external compression, crushing injuries and deceleration) - CT PROTOCOL AND INDICATIONS - Which patients should undergo CT - The importance of multiphase CT analysis - IMAGING INTERPRETATION - Systematic approach for an active search for critical CT findings which would require immediate/prompt surgical management - Establish the source of the injury - Organ-specific injury grading - Limitations and pitfalls - What to report - INTERACTIVE CASE-BASED DIDACTICS - Sample cases to illustrate and solidify the concepts







ER115-ED-X

Damage Control Surgery: Commonly Missed Injuries, Pitfalls, and Mimics within the Abdomen on Diagnostic CT

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Review the indications and process for Damage Control (DC) surgery Understand ways to modify protocol/technique of CT in the setting of DC surgery Illustrate common injuries that are missed during surgery. Illustrate common missed post-operative findings. Highlight common pitfalls and mimics on CT in the DC patient.

TABLE OF CONTENTS/OUTLINE

Indications and description of DC surgery. Common CT protocols for DC surgery. Common injuries found on CT imaging missed on surgery. Common injuries missed on CT imaging. Differentiating between normal post-operative findings and real traumatic injuries on CT. Sample case presentations.





ER116-ED-X

Pancreatic Injury in Blunt Abdominal Trauma

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. To review the principal mechanisms of injury and special features of traumatic lesions of the pancreas. 2. To describe CT findings in pancreatic injury and classification according to AAST grading system. 3. To explain the utility and importance of MR pancreatography for assessing the integrity of the pancreatic duct

TABLE OF CONTENTS/OUTLINE

- Mechanisms of injury of traumatic pancreatic injury - Diagnosis and coexisting lesions - Review of imaging findings: CT and MR - Sample cases of different grades - Management and follow-up of pancreatic injuries







ER117-ED-X

Multi-Modality Imaging of Pancreatic Trauma

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Pancreatic injury is associated with significant morbidity and mortality, and rarely an isolated finding in the setting of trauma. Grading of pancreatic of injury and treatment are based on the location of the injury and involvement of the main pancreatic duct. Management of pancreatic trauma requires a multidisciplinary approach.

TABLE OF CONTENTS/OUTLINE

1. Overview of pancreatic anatomy. 2. Epidemiology and pathophysiology of pancreatic trauma. 3. Clinical presentation and diagnosis. 4. Illustration of pancreatic injury grading using a multimodality imaging (CT, MRI and ERCP) approach. 5. Address common pitfalls in pancreatic imaging and identify techniques, including DE CT and secretin MRCP to overcome these problems. 6. Outline an algorithm for the non-operative, minimally invasive and operative management algorithms in the management of pancreatic injuries. 7. Highlight the spectrum of complications of pancreatic trauma.







Don't Skip a Beat! Critical Imaging Findings in Adults with Congenital Heart Disease Presenting to the Emergency Department

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

Participants

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TEACHING POINTS

Identify commonly encountered congenital heart diseases in adults and the associated palliative surgeries. Review imaging findings of critical pathologies in adults with congenital heart disease. Discuss methods by which imaging protocols in the emergency department can be modified to evaluate adult patients with congenital heart disease and address a specific clinical question.

TABLE OF CONTENTS/OUTLINE

Describe the imaging features of common congenital heart diseases in adults presenting to the emergency department (Tetralogy of Fallot, Single ventricle morphologies, Transposition of the great arteries, Atrial/ventricular septal defects). Review the palliative and corrective operations for common congenital heart diseases and their normal appearance on CT (Blalock-Taussig, Damus-Kaye-Stansel, Norwood-Sano, Fontan, Rastelli, Atrial switch, Mustard, and Jatene). Highlight critical findings in adults with congenital heart disease presenting to the emergency department, and address the methods by which imaging protocols in the emergency department should be modified to identify these pathologies (Pulmonary embolism, Shunt thrombosis, Atrial or ventricular thrombus, Pulmonary arteriovenous malformation, Atrial baffle leak, Embolized cardiac repair devices, Enlarged collateral vessels resulting in hemoptysis).





ER119-ED-X

When Residents are On-Call: A Pictorial Review of Common and Unusual Findings of Intracranial Bleeding and Ischemic Infarcts in the ER

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

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TEACHING POINTS

Whether in the setting of head trauma, spontaneous development of headache, or alteration of mental status, the ability to diagnose intracranial hemorrhage (ICH) is of primary importance for all practitioners. "Rule out bleed." Is almost invariably request for physicians on the ER, is therefore essential and seems like a natural starting point for residents to know the many faces of intracranial bleeding. Residents must have an understanding of hemorrhage and herniation syndromes and are central to the discussion.

TABLE OF CONTENTS/OUTLINE

-Introduction.-Anatomic considerations and landmarks.-Physiopathology of the different etiologies.-Cytotoxic and neurogenic edema.-Herniation syndromes.-Usual cases of intracranial bleeding.-Unusual cases of intracranial bleeding.-Helpful signs and pitfalls.-Conclusions.





ER120-ED-X

Tomography of Acute Orbital Pathology: Only One Point of View

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. To know the main current indications of tomography in acute orbital pathology. 2. Know the orbital anatomy. 3. Determine the characteristics of CT imaging in acute orbital pathology. 4. To know the protocol of study of CT of the orbit. 5. Illustrate with CT images of acute orbital pathology with images of our institution.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Orbital anatomy 3. Indications of CT in acute orbital pathology. 4. NON-TRAUMATIC ORBITARY PATHOLOGY. I. Infectious: 1.1. Preseptal / periorbital cellulitis. 1.2. Postseptal / orbital cellulitis (retroculate). 1.3. Complications: Orbital and Subperiosteal Abscess, bacterial meningitis. II. Inflammation 1.1 Dacryoadenitis / Dacryocystitis. 1.2 Orbital inflammatory pseudotumor. 1.3 Optic neuritis 5. TRAUMATIC ORBITARY PATHOLOGY I. Vascular: Carotid-cavernous fistula. II. Hemorrhagic retinal detachment / Hemorrhagic choroidal detachment / hemovitreo. III. Orbital Fractures and Foreign Bodies. IV. Lens Dislocation. V. Open Globe Injury. 6. Conclusion. 7. References.





ER121-ED-X

The Walking Brain: What the Radiologist Needs to Know About Cerebral Herniation

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

1. Review the intracranial anatomy and herniation points. 3. Know the different clinical presentations of brain hernias. 4. Describe the imaging findings of brain hernias. 5. To illustrate with images of our institution the causes and presentations of acquired brain hernias.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Normal brain anatomy. 3. Concept of brain hernia. 4. Pathophysiology of brain hernias. 5. Classification a. Subfalcial hernia b. Central Transtentorial hernia. i. Upward ii. Falling c. Lateral Transtentorial Hernia. i. Uncal / hippocampal iii. Parahipocampal d. Transsphenoidal hernia (transalar) e. Hernia Tonsilar f. Transcalvarian hernia 6. Conclusion. 7. References.







ER122-ED-X

Pictorial Review of Cardiac Tamponade: What Radiologists Need to Know

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: 1. To know the mechanism and causes of cardiac tamponade. 2. To know imaging findings of cardiac tamponade caused by various diseases. 3. To know the clinical significances of imaging findings of cardiac tamponade. 4. To know the therapeutic strategies of cardiac tamponade.

TABLE OF CONTENTS/OUTLINE

1. Explanation of the mechanism and causes of cardiac tamponade. 2. Explanation of imaging findings and clinical significances of cardiac tamponade. 3. Illustrative cases - Presentation of imaging findings of cardiac tamponade caused by various diseases. - Presentation of imaging findings of serial changes of cardiac tamponade. 4. Discussion 5. Directions and summary







ER123-ED-X

Brain CT Perfusion Studies: Turning False Ischaemic Penumbra into Light

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

To be aware of the potentially misleading patterns on CT perfusion. To learn to identify the principal causes of false ischemic penumbras.

TABLE OF CONTENTS/OUTLINE

Theoretical basis of brain CT perfusion imaging Pathophisiology of acute ischaemic stroke and its correlation with CT perfusion Review of imaging findings (noncontrast CT, perfusion CT and angio CT) and sample cases of the main etiologies of false ischaemic penumbra Tips and tricks to differentiate betwueen real penumbra and its mimics.







ER124-ED-X

Trauma in Pregnancy: One CT Scan Can Save Multiple Lives

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Trauma in pregnancy is a common complication and can have significant effects on the morbidity and mortality of a mother and fetus. Radiation exposure on the fetus has different effects depending on the gestational age with the greatest risk of overall survival earlier in the pregnancy and the greatest risks of major congenital malformation with radiation exposure during the middle of the first trimester. A major cause of fetal and maternal morbidity and mortality in trauma cases is placental abruption; special attention should be given when examining the placental and uterine integrity during a post-traumatic evaluation in a pregnant patient. Although CT is not ideal for evaluating the fetal anatomy, it is the modality of choice during a trauma evaluation with good visualization of osseous fractures, gastrointestinal tract perforations, hemorrhages, herniations, and soft tissue swelling.

TABLE OF CONTENTS/OUTLINE

1. Review the risks inherent in evaluating a post-traumatic pregnant patient with CT 2. Outline the effective dose of radiation to the fetus in a typical radiographic assessment of the post-traumatic pregnant patient and the associated stochastic and deterministic effects on the fetus 3. Depict several clinical cases of obstetric and non-obstetric trauma in pregnancy and the associated CT findings and management





ER125-ED-X

The Changing World of Contraband Smuggling

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

Participants

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TEACHING POINTS

1. Recent developments of liquid forms of cocaine, less radio-opaque packaging and smaller volumes of highly concentrated synthetic opiates have made plain radiographs increasingly insensitive for detection of contraband drugs concealed in the body. 2. CT has a high sensitivity for detection of such contraband, especially with the use of 3D and dual energy techniques. 3 Dual energy CT monochromatic / index measurement techniques may allow non-invasive identification of ingested drug type and drug concentration. 4. Imaging studies can detect internally concealed drugs, weapons, cellphones and money in prison inmates.

TABLE OF CONTENTS/OUTLINE

1. Decreasing sensitivity of radiography as a detection tool for contraband drugs. 2. Rapidly evolving development of newer packaging of illegal drugs. 3. Development and use of concentrated cocaine in liquid form. 4. Increased value of CT as a detection tool including drug identification and purity (use of low-dose, extended window settings, 3D VR/SSD techniques, dual energy monochromatic & index measurement techniques). 5.Detection sensitivity of imaging for synthetic opioids. 6. Contraband detection in prisons.





ER126-ED-X

On-call Primer of Aortic Emergencies

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

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TEACHING POINTS

Aortic emergencies are life threatening scenarios which require rapid recognition by the interpreting radiologist as well as expedited communication of these findings with the patient's care team. The purpose of this pictorial review is to illustrate the spectrum of urgent and emergent aortic conditions on cross sectional imaging, particularly CT, in order to increase radiologist confidence and accuracy in making these diagnoses.

TABLE OF CONTENTS/OUTLINE

Utilizing an interactive pictorial case based approach and quiz format drawn from our case experience, we will review the imaging findings in clinical context for: Traumatic aortic injury, Acute aortic syndromes, Impending and ruptured aortic aneurysm, Mycotic aneurysm, Vasculitis, Aortic fistulas







How to Detect Pulmonary Embolism, Especially Small Emboli More Quickly with Dual-Energy Spectral CT

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

1) Illustrate limitations of detecting pulmonary embolisms (PE) in conventional CT. 2) Illustrate advantages of virtual monochromatic images with extended energy range and iodine-based material decomposition images in dual-energy Spectral CT. 3) Demonstrate strategies to maximize the detection of PE.

TABLE OF CONTENTS/OUTLINE

1) Limitations of conventional CT ·Single parameter (CT number) affected by beam hardening ·Limited tube voltages (photon energy) (80-140kVp) ·Time-consuming to detect all PE 2) Advantages of Spectral CT imaging ·Both monochromatic images from 40-140keV and iodine-based material decomposition images ·Low energy images allows for maximizing the contrast-to-noise ratio for emboli; High energy images eliminate high density artifacts (around superior vena cava, heart and subclavian vein) ·Spectral CT iodine-based material images show perfusion defect caused by embolus 3) Strategies to maximize the detection of PE ·Select optimal monochromatic energy levels for better image contrast and reducing beam hardening. ·Use perfusion defect zones to guide the search for small or partial emboli ·Use iterative recontructions to further reduce image noise for PE detection





ER129-ED-X

Utility of Single-Phase Contrast-Enhanced CT in the Evaluation of Abdominopelvic Trauma

All Day Room: ER Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses

Awards Certificate of Merit Identified for RadioGraphics

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TEACHING POINTS

The purpose of this exhibit is: 1. To review the utility of single phase contrast enhanced CT and evaluation of mesenteric and bowel trauma with out using enteric contrast. 2. To review the imaging features of various solid-organ and hollow viscus penetrating trauma on a single phase CT. 3. To discuss the role of single phase contrast enhanced CT in guiding further imaging such as utilizing CT cystogram in cases of suspected bladder trauma.

TABLE OF CONTENTS/OUTLINE

Differntitating simple fluid from hemoperitoneum and its significance in penetrating abdominal trauma. Review the importance of search pattern and specifically the trajectory based approach. Review the salient imaging findings in the penetrating bowel and mesenteric trauma on single phase CT. Review the imaging findings of hollow viscus trauma such as bladder and rectum and when to acquire additional imaging such as CT cystogram and rectal contrast. Review the imaging findings of solid viscera and vascular injuries on single phase CT. Summary







Checklist Approach as a Guide to the Interpretation of Chest CT Examinations Showing Diffuse Abnormalities in Acute Disease

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

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TEACHING POINTS

Differential diagnosis of patients presenting with acute diseases manifesting as diffuse lung disease at chest CT is a challenge. CT findings alone are usually insufficient to get a diagnosis. After viewing this exhibit you should: 1. Consider clinical, laboratory and radiologic factors that help to get a proper diagnosis. 2. Find a checklist of clinical and radiological data that, if systematically applied, can guide the radiologist to narrow the differential diagnosis.

TABLE OF CONTENTS/OUTLINE

Introduction Global overview of diagnostic approach to diffuse abnormalities at chest CT in acute diseases Clinical chart checklist (symptoms, clinical conditions, blood tests, drugs, trigger factor) Specific system checklist (neurologic, pulmonary, cardiac, gastrointestinal, urologic, connective tissue, hematologic) Check for previous examinations Check for typical radiologic pattern (cardiogenic pulmonary edema, non-cardiogenic pulmonary edema, predominant isolated ground glass, pure alveolar and airway filling, acute/subacute patterns of interstitial lung diseases, mixed patterns) Discussion of specific conditions (cardiogenic and noncardiogenic edema, lung infections, diffuse pulmonary hemorrhage, hypersensitivity pneumonitis, acute interstitial pneumonia, acute exacerbation of interstitial lung disease, lung toxicity,...)







ER131-ED-X

Headache: What to Look for on Emergency Neuroimaging in the Headache Patient

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

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TEACHING POINTS

To understand the goal of headache imaging of determining whether there is an underlying cause To decide what imaging should be performed to exclude secondary causes of headache To identify imaging findings of various causes of headache

TABLE OF CONTENTS/OUTLINE

Neuroimaging cases and mimics will be presented for the following conditions which may cause headache: Vascular • Reversible cerebral vasoconstriction syndrome (RCVS) • Dural sinus thrombosis • Cavernous sinus thrombosis • Temporal arteritis • Unruptured aneurysm Toxic or infectious • Carbon monoxide • Herpes • Meningitis • Cerebral abscess Hemorrhage/infarct • Intraparenchymal hemorrhage • Pituitary apoplexy • Subarachnoid hemorrhage Intracranial pressure derangement • Colloid cyst • Intracranial hypotension • Pseudotumor Other • Tumor • Hemiplegic migraine • Posterior reversible encephalopathy syndrome (PRES) • Sinusitis





ER132-ED-X

Ischemic Strokes in Uncommon Distribution: A Case-based Review with Emphasis on Symptomatology and CT Perfusion to Improve Detection

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

1- Review vascular anatomy of the brain including normal variants and congenital developemental abnormalities. 2- Review basic brain functional anatomy and expected symptomatology in case of ischemic infarct affecting certain territories 3- Review basic principles of CT brain perfusion 3- Present cases of strokes in uncommon distribution (other than MCA territory) and highlight correlation with symptomatology

TABLE OF CONTENTS/OUTLINE

1- Vascular anatomy head and neck 2- Congenital variants (including variants of the circle of Willis and persistent carotido-basilar anastomoses) 3- review of basic CT brain perfusion principles (CBF-CBV-MTT-TTD) 4- Case presentation Recurrent artery of Heubner infarct Percheron artery infarct Anterior choroidal artery infarct Shower emboli Corpus callosum infarct associated with fetal PCA infarct Infarcts associated with intracranial herniation syndromes Venous infarcts etc.




ER133-ED-X

Role of Magnetic Resonance Imaging (MRI) in Assessment of Vascular Thoracoabdominal Emergencies

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: To demonstrate the imaging aspects of the vascular thoracoabdominal emergencies, such as aortic dissection, aneurysms, arterial disruption and occlusive diseases, venous thrombosis, pulmonary hypertension and others using high field magnetic resonance imaging (MRI). To discuss the sensibility and specificity of the MRI in the diagnosis of vascular thoracoabdominal emergencies.

TABLE OF CONTENTS/OUTLINE

Background Comparative between MRI and angiography Review of imaging findings Thoracoabdominal vascular anatomy in MRI Cases of thoracic vascular emergencies Cases of abdominal vascular emergencies Conclusion







Traversing New Terrain: Expected Emergency Radiology Findings in the Transgender Patient Post Gender Confirming Surgery

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

The purpose of this exhibit is to:1. Understand updated and appropriate terminology for the transgender patient population.2. Learn about available and frequently updated resources as well as appropriate imaging to perform in the emergent setting.3. Review general concepts regarding current pelvic surgeries in the transgender population (Gender Confirming Surgery).4. Learn what valuable imaging information to provide clinicians involved in the patient's care (plastic surgeons, urologists, primary care doctors and emergency physicians).

TABLE OF CONTENTS/OUTLINE

Appropriate Terminology for the Transgender PatientClinical Relevance of the hormonal treatment/surgical history of a transgender patient in the setting of Emergency RadiologyOnline Sources for the Patient's Referring Clinician and for the RadiologistCurrent Changes in Nationwide EMRs to Reflect Important Data in the Transgender Patient- The Joint Commission and American Bar Association updates Gender Confirming Surgery- Relevant Surgical Anatomy- Current Surgical Approaches- Expected Imaging Postoperative Findings and Surgical Complications in the ER setting- Sample CasesFuture Directions and Summary





ER135-ED-X

What to Do When Urine Trouble... Imaging Appearances and the Role of Interventional Radiology in Urological Trauma

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

To illustrate the variety of ways in which urological trauma can present, through a series of cases. To review the spectrum of imaging appearances in renal trauma including: renal contusion, laceration, renovascular injury (including active arterial extravasation, pseudoaneurysm, arteriovenous fistula) and injury to the collecting system resulting in urinoma. To recognize features on CT imaging that should alert the reader to the possibility of bladder injury, including intra- and extra-peritoneal bladder rupture. To understand the use of CT urogram, CT cystogram, and fluroscopic studies in the investigation of these patients. To identify situations when interventional radiology could be involved in the management of patients presenting with a traumatic urological injury.

TABLE OF CONTENTS/OUTLINE

Outline of CT protocolling in suspected urinary tract trauma including when to consider delayed urographic imaging or CT cystogram. Overview of the major traumatic renal injuries including contusion, laceration, renovascular injury and collecting system injury. Overview of major traumatic bladder and urethral injuries including intra- and extra-peritoneal bladder rupture and urethral transection. Selection of case studies illustrating key themes and learning points.







ER136-ED-X

Doctor, I Have Chest Pain! Is it an Acute Aortic Thoracic Syndrome?

All Day Room: ER Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses

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TEACHING POINTS

The purpose of this exhibit is:1. To review the spectrum of acute thoracic aortic syndromes from the pathophysiology to the CT appearances, focusing on the aortic dissection, intramural hematoma and penetrating atherosclerotic ulcer.2. To outline the imaging protocol. 3. To recognize potential diagnostic pitfalls and to provide key interpretation features and a diagnostic checklist for each of them.

TABLE OF CONTENTS/OUTLINE

A. BackgroundB. Imaging protocol technique for suspected acute thoracic aortic syndromeC. CT features and pictorial review of the main acute thoracic aortic syndromes:a. Aortic dissection b. Intramural hematoma c. Penetrating atherosclerotic ulcer d. Other presentations: neoplastic infiltration of the aorta, aortic rupture, cardiac ruptureWith the following information applying for each: clinical issues, classification, imaging features, protocol advice and differential diagnosisD. Potential pitfallsE. Reporting tips and summary





ER137-ED-X

Torsion: Twists and Turns and Lessons Learned

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

1. Anatomy and pathophysiology of torsion: why do organs twist? Is it congenital or acquired phenomenon?2. Ischemia and infarction: why is there ischemia in some cases, but not others? What are the imaging findings that indicate end-organ ischemia?3. Imaging techniques: rationale behind imaging in torsion. What is the best test and why? Are there ancillary findings that can make the diagnosis?4. X-marks the spot: in all forms of torsion, the blood vessels will be abnormal. Knowing what signs to look for, and how to follow the vessels is the key to diagnosis.5. Mimics of sinister pathology: Tips and tricks to avoid a mis-diagnosis. Missed torsion can mimic other pathology, such as adnexal tumours or tubo-ovarian abscess. Torsion of benign pathology can look worrisome on imaging.6. Familiar and less familiar torsion: In addition to the commonly encountered torsion which can present acutely such as colon, testes, ovary or epiploic appendage; other less common organs can tort. These will be highlighted in a case-based discussion:o Gallbladdero Benign hepatic tumourso Splenuleo Lungo Unusual adnexal masses

TABLE OF CONTENTS/OUTLINE

• Case based review of common, and un-commonly encountered visceral and gastrointestinal torsion with appearances on multimodality imaging and focus on their acute presentation.• Summary and top tips.





ER138-ED-X

Comprehensive Review of Traumatic Diaphragmatic Injuries (TDI): Radiological-Surgical Perspective

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

1. To illustrate the rate of missed TDI, potential complications and the need for early detection.2. To describe the mechanism of injury, the most common side, size and shape of TDI in blunt and penetrating traumas and the most common associated injuries.3. To review the radiographic, CT, Ultrasound and MRI signs of TDI.4. To review common TDI- mimics in CT in order to reduce false positive diagnosis.5. The need for Artificial Intelligence (AI) program to delineate and artificially-fatten the diaphragm to highlight possible tears, similar to commercially-available rib fracture detection software.

TABLE OF CONTENTS/OUTLINE

1. Epidemiology.2. Why missed?3. Embryology.4. Mechanisms of Injury.5. Side, size and shape of tears.6. Associated Injuries.7. Radiological signs:a. X Ray.b. Ultrasound.c. CT: direct and indirect signs - Rupture mimics (normal variants).d. MRI8. Surgical management.9. Hot zone for AI software development.10. 7 Cases of blunt, penetrating and iatrogenic TDI (two of them with Cinematic rendering images).





ER139-ED-X

Dual-Energy CT for Diverticular Disease of Intestinal Tract

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

Colonic diverticulosis is a common condition which affects nearly 10% of adults over 50 years old. Although small bowel diverticula are less common, affected individuals are in risk of bleeding, obstruction, inflammation and perforation. Dual energy CT (DECT) offers additional advantages over single energy CT. This exhibit describes DECT image acquisition and post-processing techniques relevant to diverticular disease of the bowel, illustrates DECT findings, describes advantages of DECT over single energy CT and discusses limitations of DECT for evaluation of diverticular disease.

TABLE OF CONTENTS/OUTLINE

1- Overview of diverticular disease of the intestinal tract 2- DECT with post-processing techniques for the evaluation of diverticular disease 3- Potential advantages of DECT over single energy CT for the evaluation of diverticular disease 4- Imaging features of diverticular disease with DECT 5.1 Diverticular disease of small bowel 5.1.1 Duodenal, jejunal, ileal diverticulitis 5.1.2 Meckel's diverticulitis 5.1.2 Complicated diverticulitis 5.2 Colonic diverticular disease 5.2.1 Bleeding 5.2.2 Uncomplicated and complicated diverticulitis (perforation, abscess, fistula formation, pylephlebitis) 5- Limitations of DECT







Spontaneous Coronary Artery Dissection (SCAD): Emergency Radiology Perspective

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

1. SCAD is a rare cause of acute coronary syndrome, with a reported incidence of 0.7% to 1.1% in published angiography series. Typically occurs in white, relatively young people (mean age of 42.6±10 years) without risk factors for coronary artery disease, predominantly women.2. Unlike aortic dissections, SCAD is not believed to be secondary to hyper-tension or atherosclerosis. Spontaneous rupture of the vasa vasorum secondary to vascular shear stress, and abnormal connective tissue are postulated etiologies.3. SCAD results from development of a hematoma in the outer third of the vessel media, forcing the intimal-medial layer towards the true lumen, with resultant stenosis.4. Case based discussion with emphasis on role of Emergency-based Cardiac CTA.

TABLE OF CONTENTS/OUTLINE

1. Introductiona. SCAD epidemiology.2. Etiologya. Review of current debate in literature regarding SCAD etiology with supporting evidence for each argument.3. Awareness for radiologistsa. High risk population identificationsb. Radiologic signs on Cardiac CTA.c. Urgency of the findings4. SCAD-mimics: awareness is crucial to avoid false positive diagnosis.5. Next steps in management: invasive coronary angiography.6. Cases: 4 cases from our institution with CCTA, Coronary Angiography and OCT correlation.





ER141-ED-X

Is that Emphysema? Case-based Review of Emphysematous Infections of the Abdomen and Pelvis

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

1. Describe the various types of emphysematous infections involving the abdomen and pelvis. 2. Review the characteristic radiologic findings of emphysematous infections involving the gastrointestinal tract, gallbladder, kidneys, and bladder. 3. Discuss the clinical presentation, etiology, risk factors, and treatment of each type of emphysematous infection.

TABLE OF CONTENTS/OUTLINE

Emphysematous infections of the abdomen and pelvis are rare and life-threatening conditions that require emergent medical treatment. Typical radiologic findings include air within the wall of the affected organ due to the presence of gas-forming pathogens. It is important to evaluate the patient for predisposing risk factors when considering the possibility of an emphysematous infection. Early recognition of emphysematous infections is essential because if left untreated, they can lead to fulminant sepsis and death. This educational exhibit provides a case based review of a variety of emphysematous infections involving the abdomen and pelvis.







ER142-ED-X

Don't Forget the Duodenum: Imaging Spectrum of Duodenal Emergencies

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Identified for RadioGraphics

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TEACHING POINTS

1. To describe the anatomy of the duodenum and its particular relationship with adjacent anatomical structures. 2. To briefly describe the role of imaging in duodenal emergencies, and the added value of dual energy CT in the emergency setting. 3. To review the spectrum of emergent duodenal pathologies in a systematic approach.

TABLE OF CONTENTS/OUTLINE

1. Anatomy of duodenum • Anatomy of four parts of duodenum • Relationships with adjacent structures 2. Role of imaging • Multidetector CT: first imaging modality in the ED setting with added value of Dual-Energy CT. • Other modalities as second line or to confirm diagnosis: Upper GI, MRI and PET/CT. 3. To review emergent duodenal pathologies based on etiology • Peptic ulcer disease and its complications • Vascular etiologies • Post-surgical complications • Traumatic injuries • Infectious/ Inflammatory disease • Malignancy: primary and metastatic lesions causing emergent pathology • Miscellaneous







ER143-ED-X

Ventral Hernia Repair: What the Surgeon Wants to Know

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

1. Anatomy of the anterior abdominal wall 2. Types of ventral abdominal wall hernias and associated complications 3. Indications to repair and types of surgical options 4. CT appearance of different types of surgical repairs 5. Complications related to ventral abdominal hernia repair

TABLE OF CONTENTS/OUTLINE

1. Anatomy of anterior abdominal wall including potential sites for defects that give rise to hernia - Linea alba, Umbilicus, Spigelian fascia 2. Types of ventral abdominal wall hernias- Epigastric hernia, Umbilical hernia, Paraumbilical hernia, Spigelian hernia, Incisional hernia, Parastomal hernia 3. Types of surgeries- Mesh repair- On-lay technique, Inlay technique, Underlay technique, Retro-rectus repair, Preperitoneal approach 4. Post-surgical complications from open surgeries- Surgical site infection, Seromas, Mesh infection, Hematomas, Intraperitoneal abscess, Recurrence of hernia, Bowel obstruction 5. Laparoscopic procedure complications- Herniation from trocar site, Bowel obstruction





ER144-ED-X

Spectral CT in Head and Neck Emergency: How Can We Better Utilize?

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

Imaging plays an important role for head and neck emergencies for both traumatic and non-traumatic conditions, although ER or ENT colleagues can directly visualize and have a great access to the superficial lesions. Dual-energy CT (DECT) has been used for more than 10 years and recently dual-layer detector CT (DLCT) has been introduced with the advantage of acquiring spectral data sets and enabling spectral data analysis. <u>Purpose</u>: Illustration of basic techniques of dual-energy CT and characteristics of DLCT. Review of clinical applications, current evidence and potential usefulness of spectral CT in evaluation for head and neck abnormalities in the emergency setting. Review representative cases of head and neck emergencies with spectral CT. Discussion of future directions of spectral CT in head and neck emergencies.

TABLE OF CONTENTS/OUTLINE

Understanding spectra CT: DECT and DLCT Review of cases including infection/inflammation, neoplasms and trauma focusing on 1) improving conspicuity of enhancing lesions with low-keV imaging, 2) Quantitative analysis using iodine and effective-Z mapping, 3) Detection of bone marrow edema on calcium suppression images, and 4) Effective metal artifact reduction Discussion of current practice and future direction of spectral CT imaging in head and neck emergencies







ER145-ED-X

Rules to Scan By: Criteria for Guiding Imaging Workup in Trauma

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

There is an exhaustive amount of literature regarding scanning guidelines and recommendations for trauma patients. Patient care can be improved, necessary imaging can be carried out more efficiently, and unnecessary studies can be avoided with a consolidation of recommendations for trauma. This exhibit seeks to examine and consolidate imaging guidelines for several types of trauma for adults and pediatric populations with this goal in mind.

TABLE OF CONTENTS/OUTLINE

Review of commonly used guidelines for trauma imaging in adults including Canadian CT Head rule, Canadian C-Spine, NEXUS C-Spine, Modified Denver criteria for BCVI, NEXUS Chest CT Review of commonly used guidelines for trauma imaging in pediatrics including PECARN, CHALICE, CATCH and NEXUS II Head CT Decision Instrument Review of ACR appropriateness criteria, ACEP Clinical Policies, and ACS Best Practices Guidelines for trauma imaging Review of the Ottawa ankle and knee rules Examination of evidence regarding need for repeat imaging in clinical scenarios such as patients with positive imaging findings and patients receiving anticoagulation Consolidated summary figure of several different imaging guidelines for trauma to guide imaging practices







ER146-ED-X

Multimodal Imaging Evaluation of Percutaneous Vascular Injuries: A Case-based Review for Radiology Residents

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. To identify the common iatrogenic vascular complications for percutaneous arterial and venous interventions. 2. To describe the different risk factors for this complications: site of access, type of procedure, sheath size, patient risk factors and operator experience. 3. To explain the ultrasound and CT exploration protocols used for the evaluation of this injuries. 4. To review the imaging findings of each complication. To understand the relevance of the correct characterization of the different vascular injuries to ensure the appropriate and timely treatment

TABLE OF CONTENTS/OUTLINE

- Introduction and epidemiology of the percutaneous vascular injuries. - Risk factors. - Exploration protocols: - Ultrasound. - CT. - Classification of the percutaneous vascular injuries through a pictorial review: - Arterial complications: - Arterial access. - Hematoma and retroperitoneal hemorrhage. - Pseudoaneurysm. - Arteriovenous fistula. - Venous complications: - Venous access. - Thrombosis. - Central venous catheter misplacement. - Summary





ER147-ED-X

Case-based Review of Strokes Mimics for the Radiologist

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

• Recognize important radiologic manifestations of stroke mimics • Discuss the differential diagnosis of uncommon strokes mimics using a multimodality approach including CT perfusion and MRI

TABLE OF CONTENTS/OUTLINE

1. Brief overview of Vascular Anatomy and Cerebral Perfusion Territories 2. Case based review of stroke mimickers including presentation of Neoplastic lesions (Glioblastoma, gliomatosis cerebri, lymphoma, metastatic disease) Toxic Leukoencephalopathy (recreational drugs cocaine, THC and heroine (Chasing the dragon), and medication overdose (methotrexate) Basal ganglia toxcitity (CO poisoning, methanol ingestion) Cerebral Amyloid Angiopathy Related Inflammation Mitochondrial encephalopathy with lactic acidosis and stroke-like episodes (MELAS) Hyperanmonemic encephalopathy Hypertensive encephalopathy (PRES) Reversible cerebral vasoconstriction syndrome Osmotic demyelination syndrome Herpes encephalitis etc.







Imaging of Pancreatic Injuries: A Never Ending Story

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

Pancreatic injuries are not uncommon in the trauma radiology practice. It is important to look for the subtle direct and indirect signs of pancreatic injury to avoid untoward complications like pancreatitis, abscess, pseudoaneurysm/ active contrast extravasation which requires multidisciplinary team approach. Pancreatic injuries can be isolated / associated with other solid organ injuries like liver & spleen. To highlight the salient imaging features of various AAST grades of pancreatic injuries, its complications (vascular & non vascular) and its treatment by diverse interventional radiological procedures in the management

TABLE OF CONTENTS/OUTLINE

Table of Contents/ Outline: Mechanism of pancreatic trauma: Imaging features of pancreatic injuries : Direct & Indirect signs of pancreatic injuries : AAST grading of pancreatic injuries: MDCT & MRI Findings: Complications of pancreatic injuries: Vascular complications & its management: Nonvascular complications & its management : Associated organ injuries: Management algorithm: This exhibit will also highlight the clinical course and management algorithm of the pancreatic injuries and its complications listed above.





ER149-ED-X

Top 20 Urinary Bladder Emergencies You Shouldn't Neglect

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

To review the basic anatomy of the urinary bladder To make a top 20 list with the most uncommon as well as the most common emergent conditions of urinary bladder. To provide a plain list of imaging key findings to face these challenging urinary bladder emergent conditions

TABLE OF CONTENTS/OUTLINE

This pictorical essay will review the key elements of urinary bladder emergencies with a focus on the specific radiological findings, with diagnostic, prognostic and therapeutic implications Basic anatomy Imaging techniques (US, cystography, CT) Pathology Congenital urachal anomalies complications Cystitis (Emphysematous cystitis, Chemotherapy-related, Hemorrhagic cystitis, radiation-induced cystitis, Cystitis secondary to Graft versus Host disease) Bladder Calculi Bladder Hernia and Diverticulum Vesical fistulas (entero-vesical, vesicocutaneous, vesicovaginal) Bladder ischemia Bladder hemorrhage Complicated emergent tumoral conditions Traumatic conditions (contusion , intraperitoneal rupture, interstitial rupture, extraperitoneal rupture) Conclusion







What is Expected When They are Expecting - Imaging and Management of Trauma Pregnant Patient in the Emergency Room Settings and on the Floor: Expectations and Steps to Succeed

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

o Discuss most optimal and safe and/or necessary imaging modalities and specific protocols for evaluation of pregnant patients in acute and chronic trauma setting o Familiarize the radiologists with most common injuries in the abdomen and pelvis in pregnant patient in the trauma setting o Review a range of radiological appearances related to traumatic injuries and their mimics in the abdominal, pelvic and gravida uterus/fetus o Present a flow chart with related imaging from the time patient arrives in the ER to final disposition

TABLE OF CONTENTS/OUTLINE

• Imaging modalities and protocols o Ultrasound general and obstetric o Computed Tomography in trauma o Emergent MRI • Most common abdominopelvic trauma injuries, brief description of management, and related imaging in a pregnant patient o Visceral: liver, kidney, spleen o Vascular: mesenteric root, arterial, venous o Gastrointestinal: bowel wall hematoma, perforation o Genitourinal: bladder rupture, ureteral injury, urethra o Musculoskeletal: spinal and pelvic injuries, muscle and ligamentous injury o Obstetrical (Gravid Uterus): fetal demise, placental abruption, subchorionic hemorrhage, miscarriage, ruptured uterus, trauma to fetus in utero • Mimics in obstetric emergencies: o Uterine myometrial contraction o Uterine leiomyoma o Ectopic Pregnancy





ER151-ED-X

Spontaneous Brain Hemorrhage: A Primer for the Resident on Call

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

The purposes of this exhibit are: 1. To review the imaging findings associated with different presentations of spontaneous brain hemorrhage; 2. To discuss the differential diagnosis according to the imaging features and location of the hemorrhage in the brain, and correlate them with the findings on angiographic studies; 3. To highlight the imaging protocols and modalities that can point a specific etiology for the hemorrhage

TABLE OF CONTENTS/OUTLINE

Epidemiology and clinical presentation of brain hemorrhage Definition of primary and secondary spontaneous brain hemorrhage Clues pointing to a secondary cause of spontaneous brain hemorrhage Etiology according to location and associated features Sample cases and differential diagnosis: - hypertension - amyloid angiopathy - brain aneurysm - vascular malformation - neoplasms - dural venous sinus / cortical vein thrombosis - vasculitis - reversible cerebral vasoconstriction syndrome - coagulopathy - ischemic stroke with hemorrhagic transformation - cocaine vasculopathy Summary





ER152-ED-X

Exsanguinating Entrails: What the Radiologist Needs to Know About Acute Gastrointestinal Bleeding

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Certificate of Merit

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TEACHING POINTS

1. Acute GI bleeding can be precipitated by various pathologies, many of which are of high acuity. 2. Optimization of imaging protocols allows for ease and accuracy of diagnosis. 3. Knowledge of characteristic imaging findings of common pathologies can facilitate timely diagnosis and guide appropriate management.

TABLE OF CONTENTS/OUTLINE

I. Introduction a. Key anatomy b. Protocol optimization II. Upper GI bleeding a. Inflammatory i. Gastric/duodenal ulcers ii. Gastritis/duodenitis b. Neoplasm i. GIST c. Vascular i. Dieulafoy lesion ii. Portal gastropathy d. Iatrogenic i. Aorto-enteric fistula ii. Hemobilia III. Lower GI bleeding a. Anatomic i. Diverticula ii. Meckel's b. Inflammatory i. Infectious ii. Noninfectious c. Vascular i. Angiodysplasia ii. Ischemia d. Neoplasm IV. Conclusion







Fat Stranding as a Clue to Help in Emergency Cases

All Day Room: ER Community, Learning Center Digital Education Exhibit

Participants

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TEACHING POINTS

Prepare the radiologist to search and value fat stranding in several cases in emergency setting. Propose a didactical classification. Exhibit a pool of diverse emergency room diseases, where changes in normal fat appearance has helped in diagnostic decision.

TABLE OF CONTENTS/OUTLINE

A brief definition about the theme. Occasions in which abnormal findings can simulate a non-emergency pathology. Classification table. Wide range of usual and rare emergency cases and their clinical applications: - Inflammatory/Infectious: (appendicitis, cholecystitis, pancreatitis, diverticulitis, pyelonephritis, pre/post-septal cellulitis, inflammatory bowel disease, retroperitoneal fibrosis). - Traumatic: (aortic rupture with pseudo-aneurysm, mesenteric hematoma, omental infarct, pancreatitis, gut trauma). - Vascular: (abdominal aortic aneurysm rupture, pylephlebitis, carotydinia. mesenteric thrombosis, vasculitis). - Perforation: (duodenal ulcer perforation, esophageal perforation, colon perforation, small gut perforation). - Neoplastic: (gastric tumor, colorectal carcinoma, carcinomatosis, cervical câncer). - Miscellaneous: (panniculitis, epipericardial fat necrosis, ventral hernia strangulation). Two challenge-cases to reinforce the concepts shown: (Meckel diverticulitis, appendagitis of appendix).







ER154-ED-X

How Good Are You at Tubes and Lines?

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

-The aim is to know about the lines and tubes into the body, Thier normal position and complications . -To provide knoweldge about to identify the complications in ICU set up radiographs

TABLE OF CONTENTS/OUTLINE

Radiographs mainly chest radiographs are difficult interpret, Especially when in an ICU and emergency set up. Knowledge about different tubes and lines are necessary in regard to their normal position and complications due to abnormal position and displacement. Few tubes and lines are discussed in quiz based approach 1.Endotracheal tube 2.CVP line 3.PICC line 4.Swan ganz catheter 5.Intercostal drainage tube 6.Nasogastric tube. 7.Intraaortic balloon 8.Prosthetic valve 9.PDA/ASD closure device 10.ICD device (defibrillator) We discuss the above Lines and tubes , To identify them in a simple radiograph and report when it is abnormal in a quiz based approach.





ER155-ED-X

Ectopic Gas: Worrisome Bubbles!

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Identified for RadioGraphics

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TEACHING POINTS

- Recognize alarm signs for identification of situations on which ectopic gas detection implies emergency medical conditions.-Understand causes and processes underlying ectopic gas from a practical approach.

TABLE OF CONTENTS/OUTLINE

Ectopic gas is defined as presence of gas in abnormal locations. It constitutes a common radiological finding whose clinical significance varies from "benign" to "life-threatening" situations. In order to assure the best management for each case, its site of origin and whether it implies a severe clinical condition has to be determined. The review focuses on ectopic gas from a wide range of origins, including:- Iatrogenic ectopic gas- Infectious-inflammatory ectopic gas- Neoplastic ectopic gas- Spontaneous ectopic gas- Vascular ectopic gas- Post-traumatic ectopic gas- Neumatosis intestinalisUnderlying causes and processes of ectopic gas should be understood and certain alarm signs recognized in order to identify those cases on which this finding implies an emergency medical condition. In this presentation, all these findings will be discussed through a pictorial review.





ER156-ED-X

System-Wise Clinically Oriented Review of Emergency CT Scans in a Tertiary Oncology Centre

All Day Room: ER Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1.Understanding the indications of emergency CT scans in tertiary oncology setup. 2.A review of findings which made relevant changes in patient management. 3.Identification of key findings based on site of malignancy, complains of patient, associated biochemical and haematological factors increases specificity of diagnosis of radiologist and broadens the differentials for diagnosis.

TABLE OF CONTENTS/OUTLINE

Defination and classification of oncological emergencies. Discussion of neurological emergencies in cancer patients. Discussion of respiratory emergencies in cancer patients. Discussion of gastrointestinal and gynaecological emergencies in cancer patients Discussion of cardiovascular and urological emergencies in cancer patients





ER175-ED-X

MDCT of Skull Base Fractures: Classification Systems, Complications, and Management

All Day Room: ER Community, Learning Center Digital Education Exhibit

Awards Identified for RadioGraphics

Participants

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TEACHING POINTS

1. Describe trauma-relevant anatomy of the skull base. 2. List injury patterns and classification systems of temporal bone, transsphenoid, orbital apex, and basioccipital fractures, and common complications 3. Explain the complementary role of CT and clinical findings in determining the most appropriate treatment pathway for a given injury.

TABLE OF CONTENTS/OUTLINE

1. skull base anatomy: sutures, struts, buttresses, canals, fossae, and foramina Temporal bone -mastoid, tympanic, petrous, squamous, styloid -EAC, tympanic cavity, ossicles, otic capsule, facial nerve -jugular fossa, carotid canal, eustachian tube Sphenoid bone: body, wings, pterygoid plates Clivus/basiocciput 2. Temporal bone fractures -Longitudinal & transverse; otic capsule sparing/violating; petrous/non-petrous -clinical implications: conductive hearing loss, SNHL, vertigo, CSF leaks, meningitis, CN injury 3. Trans-sphenoid and orbital apex fractures -anterior transverse (AT), posterior transverse (PT), lateral frontal diagonal (LFD), mastoid diagonal (MD) -optic canal and superior orbital fissure -clinical implications: CSF leak; syndromes: TON; SOF, orbital apex and cavernous sinus; carotid-cavernous fistula 4. Clivus fractures: -transverse and longitudinal -clinical implications: retroclival hematoma & basilar artery injury.





ED004-SU

Emergency Radiology Sunday Case of the Day

Sunday, Dec. 1 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants

Gayatr¹ Joshi, MD, Charleston, SC (*Presenter*) Nothing to Disclose Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc Margarita V. Revzin, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Paige E. Sharp, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Robin B. Levenson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Judith A. Gadde, DO, Newark, DE (*Abstract Co-Author*) Nothing to Disclose Heishun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Aaron D. Sodickson, MD,PhD, Boston, MA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, General Electric Company Nikhar Kinger, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Elisa N. Flower, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Karen S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Araron MD, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Suzanne Czerniak, MD, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Elisa N. Flower, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Karen S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Andrew Wong, MD,PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) Recognize key imaging findings on multimodality imaging of emergency/trauma patients. 2) Identify pathologic conditions based on the clinical information and imaging findings provided. 3) Understand relevant pathophysiology and recommend appropriate next step in management when appropriate.







SSA06

Science Session with Keynote: Emergency Radiology (Practice Management)

Sunday, Dec. 1 10:45AM - 12:15PM Room: N227B



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Scott D. Steenburg, MD, Zionsville, IN (*Moderator*) Institutional research collaboration, IBM Corporation Karen S. Lee, MD, Boston, MA (*Moderator*) Nothing to Disclose Howard P. Forman, MD, New Haven, CT (*Moderator*) Nothing to Disclose

Sub-Events

SSA06-01 Emergency Radiology Keynote Speaker: Optimizing Efficiency and Quality

Sunday, Dec. 1 10:45AM - 11:05AM Room: N227B

Participants

Scott D. Steenburg, MD, Zionsville, IN (Presenter) Institutional research collaboration, IBM Corporation

SSA06-03 Imaging Workflow Acceleration at a Level 1 Trauma Centre after 24/7 In-house Radiologist Staff Coverage Implementation

Sunday, Dec. 1 11:05AM - 11:15AM Room: N227B

Participants

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PURPOSE

This study aims to evaluate the effect of 24/7 staff radiologist shifts at a Level 1 Trauma Centre on study turnaround time and final report release times as measured by relevant time frames and categorized by CTAS score, radiology shift and day of the week.

METHOD AND MATERIALS

A retrospective chart analysis was conducted on all patients over 18 years old with scans performed at the emergency department (ED). A total of 68,846 exams from pre-24/7 period were taken (Oct 1, 2012 to Sept 30, 2013) and a total of 71,255 from post-24/7 period (Oct 1, 2013 to Sept 30, 2014). The Canadian Triage and Acuity Score (CTAS) was recorded for each patient, categorizing them from most to least acute: CTAS 1 (Resuscitation), 2 (Emergent), 3 (Urgent), 4 (Less Urgent) and 5 (Non-Urgent). The time between imaging request and end of imaging (Time A) and between end of imaging and final report (Time B) were calculated. The Student's t-test and Mann-Whitney test were used to determine statistical significance between pre- and post-24/7 staff radiologist time lengths, where p<0.05 was considered statistically significant.

RESULTS

Time A significantly decreased between pre and post-24/7 by 87 min on average for patients with CTAS 3, 71 min for patients with CTAS 4 and 29 min for patients with CTAS 2. Time B was significantly shortened by 332 min on average for patients with CTAS 2, 316 min for patients with CTAS 1 and 3 and 259 min for patients with CTAS 4. The largest decrease in Time B was observed for patients with CTAS 2, with reductions over the shifts that were newly covered by 24/7 Radiology staff, by an average of 626.6 mins during overnight shifts and weekends.

CONCLUSION

The implementation of around-the-clock attending radiologist coverage at our Level 1 Trauma Centre significantly decreased time between image request and imaging completion for patients with CTAS 2 to 4, and between imaging completion and final report release for patients with CTAS 1 to 4. Patients with CTAS 2 benefitted from the largest decrease in time for this time frame.

CLINICAL RELEVANCE/APPLICATION

The presence of 24/7 staff radiologists can significantly reduce imaging time and report finalization times for CTAS 2 and 3 patients, respectively, which in turn may contribute to faster disposition of ED patients and therefore facilitate faster care for incoming critically ill patients.

SSA06-04 Improving ED Efficiency and Patient Safety: Impact of Overnight In-house Radiology Staff Coverage on Imaging-related ED Recalls

Sunday, Dec. 1 11:15AM - 11:25AM Room: N227B

Participants

Deyvison Talmo Baia Medeiros, BEng,MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Eric Durrant, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Ismail T. Ali, MD,FRCPC, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Jason Robins, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Noah G. Ditkofsky, MD, Toronto, ON (*Abstract Co-Author*) Grant, NVIDIA Corporation Michael E. O'Keeffe, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Ferco H. Berger, MD, Toronto, ON (*Presenter*) Speaker, Siemens AG

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PURPOSE

In-house overnight staff radiologist coverage significantly reduces the overall turnaround time (TAT) for imaging studies. Although TAT is a useful metric for performance, the impact of overnight staff coverage on the quality of acute patient care is still questioned, largely due to published low discrepancy rates between radiology residents and staff. One of the more significant managemant changes related to discrepancies is the call back of patients after discharge from ED, caused by ED physicians acting on preliminary resident reports. This study analyzes how the number of ED patients being called back due to discrepant prelim and final imaging reports changed after implementing an overnight staff coverage model at a major Level 1 trauma center with over 675 acute care beds.

METHOD AND MATERIALS

Using ED visit information of two years prior (2016 and 2017) and one year after (2018) rollout of overnight radiology staff coverage, all patients were identified who had overnight imaging performed during their ED visit and who returned to the ED within 48 hours. Visit notes were assessed by two independent scores who determined if the patient's return was due to an imaging report related recall or not. Descrepant scorers' opinions were assessed by a senior third scorer performing chart review. Logistic regression was used to determine if the new coverage model had a significant impact on the number of ED recalls related to imaging report discrepancies.

RESULTS

ED patient visits with overnight imaging were 9,412 in 2016; 9,736 in 2017; and 10,254 in 2018. Number of imaging related recalls were 51, 57 and 7 (in 2016, 2017, and 2018 respectively). Coverage model was a statistically significant predictor of recalls (b = 2.11, z = 5.42, p < 0.001), before the new overnight staff coverage patients were 8.30 95%CI[4.16, 19.68] times more likely to get a recall related to discrepancy in prelim and final read. Despite an increase of ED visits with overnight imaging of almost 9% in 3 years, imaging related absolute number of recalls dropped by 90%.

CONCLUSION

Despite increasing ED visits, overnight attending coverage has significantly reduced ED recalls related to imaging, improving ED patient safety and ED efficiency.

CLINICAL RELEVANCE/APPLICATION

Overnight final imaging interpretation by in-house staff radiology coverage significantly reduces callback rate in ED patients requiring acute care, improving ED efficiency and patient safety.

SSA06-05 Imaging Information Overload: Quantifying the Burden of Interpretive and Non-Interpretive Tasks for CT Angiography for Aortic Pathologies in the ED

Sunday, Dec. 1 11:25AM - 11:35AM Room: N227B

Participants

Ali Pourvaziri, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose David Tso, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Renata R. Almeida, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Bernardo C. Bizzo, MD,MSc, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Vinit Baliyan, MBBS, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Bashar Kako, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Sebastian Brito-Orama, BS, Guaynabo, PR (*Abstract Co-Author*) Nothing to Disclose Anand M. Prabhakar, MD, Newton, MA (*Abstract Co-Author*) Nothing to Disclose Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Advances in CT imaging has allowed for improved resolution and the ability to create high quality reformations. The unintended consequences is an increase in the volume of images that theradiologist must interpret. With improved imaging, more incidental findings are found, leading to recommendations for follow-up imaging. CT angiography of the chest (CTA) is the study of choice to evaluate aortic pathologies, but over-utilization in the emergency department (ED) can increase the cognitive burden on the radiologist. The purpose is to quantify the complexity of CTA chest exams performed in the ED over a 10 year period.

METHOD AND MATERIALS

This is a retrospective analysis of adults patients (>= 18 years) presenting to the ED at a single Level 1 tertiary care hospital for

the evaluation of acute aortic pathology with CTA Chest from Jan 1, 2005 to Dec 31, 2015. The number of images and reformats per study were obtained from PACS. Aortic findings, including aortic dissection, aneurysm, and post-operative aortic repair, were determined from the radiology report. Imaging recommendations and verbal communication were evaluated. Descriptive statistics and partial correlation analysis were performed with correlation coefficients (CC) calculated.

RESULTS

A total of 4368 studies were performed over 10 years. The mean age was 64 years, with 56.8% male patients. Studies per year increased 163% over the study period. The number of images and reformats per scan increased from 487 to 2918 images and 6.4 to 13.7 reformats (CC = 0.93 and 0.96, respectively, both p<0.0001). The proportions of exams requiring verbal communication increased from 9.3% to 24.7% (CC=0.77, p=0.008) and recommendations from 1.8% to 28.9% (CC=0.66, p=0.03). Overall proportion of cases with aortic findings was 27.3%. However, the proportion of exams with aortic findings did not significantly change over the study period (CC=0.12, p=0.73).

CONCLUSION

This study demonstrates the increasing complexity of CTA exams as seen by the increase in the number of images and reformats per study. Non-interpretive tasks also increased accordingly. Although the number of CTA exams increased over time, the proportion of studies with aortic pathology remained constant.

CLINICAL RELEVANCE/APPLICATION

More compliant adherence to appropriateness criteria and careful thought in determining necessary reformats in CTA protocols should be considered in order to prevent radiologist burn out.

SSA06-06 Value of a 24-hour Teleradiology Service for Cruise Ships in Detecting Previously Missed Pathologies

Sunday, Dec. 1 11:35AM - 11:45AM Room: N227B

Participants

Frank Oliver G. Henes, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Peter Bannas, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Per Stappenbeck, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Adrian Heitele, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Enver G. Tahir, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The introduction of a round the clock teleradiology service for a cruise ship as a novel concept in maritime telemedicine. Using a VPN tunnel we implemented a workflow with a routine high standard interpretation of x-rays that were imaged on board and read by experienced radiologists in a tertiary hospital.

METHOD AND MATERIALS

This study was conducted between February 2017 and September 2018 and four cruise ships were involved in total. The ships were equipped with a mobile digital x-ray unit using digital storage imaging plates (SIEMENS Polymobil). The digital x-ray images were transmitted in a standardized fashion from the cruise ships to the hospital via satellite internet. Using VPN secured data transfer of images was managed together with patient data and integrated to the PACS (GE Healthcare, Centricity Universal Viewer). In the tertiary hospital images were analyzed by the radiologist on-call and reports were immediately sent back via VPN.

RESULTS

Overall 410 x-rays of 355 patients were acquired on board and successfully transmitted via satellite from the cruise ships to the tertiary hospital. The vast majority were skeletal x-rays (n=349) with fracture after a trauma being the most frequent query (n=259). The remaining cases were chest x-rays (n=52) with pneumonia (n=36) being the most frequent query and abdominal x-rays (n=9). In 246 cases no pathologies were seen. Common pathologies were as follows: fracture or dislocation (n=77), osteoligamental injury (n=11), arthrosis (n=16) and others (n=49). In 86% of cases the initial report by the physician on board matched the report in the tertiary hospital. However, in 14% of the cases the radiologist in the tertiary hospital detected pathologies, which were previously missed by the physician on board.

CONCLUSION

Using a VPN tunnel we were able to demonstrate a robust and well-functioning workflow allowing a routine high standard interpretation of x-rays that were imaged on board by experienced radiologists in a tertiary hospital. The radiologists in the tertiary hospital detected pathologies in 14% of the cases, which were previously overlooked and potentially would not have been treated.

CLINICAL RELEVANCE/APPLICATION

A 24-hour teleradiology service for cruise ships has the potential to improve immediate patient care in emergencies on board of cruise ships by making use of the expertise of a radiologist.

SSA06-07 Urgency Emergency Radiology: Imaging at Urgent Care Centers

Sunday, Dec. 1 11:45AM - 11:55AM Room: N227B

Participants Ali Pourvaziri, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose David Tso, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Vinit Baliyan, MBBS, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Bashar Kako, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Sebastian Brito-Orama, BS, Guaynabo, PR (*Abstract Co-Author*) Nothing to Disclose Ajay K. Singh, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company; Research support, Siemens AG; Consultant, Takeda Pharmaceutical Company Limited; Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Urgent care centers are facilities that provide ambulatory care outside of the emergency department. The incorporation of radiography capabilities within these practices make imaging accessible and can serve as screening tests for various conditions. The purpose of this study is to examine the image utilization patterns and to quantify positive cases. In addition, the frequency of radiologist recommendations and documented verbal communication will be examined.

METHOD AND MATERIALS

This retrospective study evaluated radiographs performed for both pediatric and adult patients visiting one of 10 urgent care centers within a large metropolitan city from January 1, 2019 to March 31, 2019. All imaging was interpreted by emergency radiologists at an academic Level 1 trauma center. The number of exams were evaluated by body systems. The number of positive findings, radiologist recommendations, and documented verbal communication were quantified.

RESULTS

A total of 3289 patients were identified over the 3 month period. The average age was 38.4 years (range between 1 to 103) with 61% of patients female. Chest radiographs were the most commonly ordered study accounting for 37.4% of all exams with a positive findings rate of 16.3%. Lower extremity exams comprised of 30.0% of exams with a positivity rate of 27.6%. Upper extremity radiographs accounted for 23.6% of exams with a positivity rate of 33.0%. Imaging of the spine and ribs accounted for 7.2% of exams with 16.4% cases being positive. Abdominal and facial bone radiographs were not commonly ordered, accounting for 0.8% and 1% of all exams respectively, with 7.4% and 27.3% of cases having positive findings. Accounting for all studies, the positivity rate was 23.7%, in which 5.4% had radiologists making recommendations for further imaging or follow-up. Only 1.4% of exams required verbal communication of findings.

CONCLUSION

This study demonstrates the utilization of onsite radiography at a network of urgent care centers within a large metropolitan city, with studies interpreted by emergency radiologists at an academic teaching hospital. Chest and extremity radiographs were commonly ordered exams. Almost a quarter of studies had positive findings, although the rate of recommendations and verbal communication was low.

CLINICAL RELEVANCE/APPLICATION

This study provides insight into the workflow of incorporating ambulatory care imaging within the context of an ED radiology practice.

SSA06-08 Does Intravenous Contrast Utilization Affect CT Scan Operation in Emergency Department? A Large Urban Tertiary Academic Center Experience

Sunday, Dec. 1 11:55AM - 12:05PM Room: N227B

Participants Tugce Agirlar Trabzor

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PURPOSE

Rapid turnaround times in computed tomography (CT) department is essential for efficient management of high patient volumes in a busy urban emergency department. There have been a number of published studies showing prolonged emergency department (ED) stays secondary to use of oral contrast media in CT. However, there is a paucity of quantitative data on the effect of intravenous contrast media on CT workflow in ED. We analyzed the potential effect of intravenous contrast administration in CT studies on the ED workflow.

METHOD AND MATERIALS

In this retrospective study, database of CT acquisitions from April 2018 to April 2019 were retrospectively reviewed at a tertiarylevel academic hospital. The non-contrast and contrast enhanced CT studies ordered by emergency department were extracted and compared. CT studies ordered for evaluation of stroke, high-energy trauma and aortic emergencies were excluded. Time intervals between order time and start of the scans were compared. For statistical analysis Mann- Whitney- U test was used. Significance was set at 0.05.

RESULTS

18951 CT scans were evaluated (13872 non-contrast CT vs 5079 contrast enhanced CT). The overall average time intervals for non-contrast CT and contrast enhanced CT were 48 minutes 38 seconds and 1 hour 17 minutes 10 seconds, respectively (p<0.001). Similar pattern was observed regardless of the type of CT study performed.

CONCLUSION

The use of intravenous iodinated contrast media can cause about a half-hour delay in emergency department workflow at a large

academic institution.

CLINICAL RELEVANCE/APPLICATION

At large institutions, the use of iodinated intravenous contrast media may prolong order to image acquisition time significantly. Physicians and radiologists must take the time interval difference into consideration when planning for improved operational efficiency and CT turnaround time reductions.

SSA06-09 Increasing Timely Access to Emergency CTs via Discrete Event Simulation

Sunday, Dec. 1 12:05PM - 12:15PM Room: N227B

Participants

Deyvison Talmo Baia Medeiros, BEng,MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Eric Durrant, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Michael Carter, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Ferco H. Berger, MD, Toronto, ON (*Presenter*) Speaker, Siemens AG

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PURPOSE

This study aims to investigate ways of reducing turnaround times (TAT) for urgent computed tomography (CT) studies completed at the emergency department (ED) of a major urban Academic Level 1 Trauma Center.

METHOD AND MATERIALS

To model the complex dynamics of the workflow for urgent ED patient CTs, a discrete event simulation model (DES) was developed using the software Simul8 version 24.0. The model was built using a year worth of historical data, and the base model results were validated against current performance metrics. The model was then used to explore the effects of several scenarios on emergency CT TAT, including: 1) decreasing the need for protocols assigned by radiologists, 2) increasing the number of CT technologists as well as reallocating some of their existing shifts, 3) reducing appointment booking delays, and 4) increasing overall demand for emergency CTs.

RESULTS

Scenario results were as follows: 1) reducing the number of protocols will have mild impacts on TAT (e.g. reducing the number of protocols by 30% will reduce TAT by 6.3%). 2) Reallocating one of the technologists shifts from day-time to night-time can reduce TAT by as much as 12.8%, and adding new shifts so that two CT technologists are available at all times can produce a TAT reduction of 18%. 3) Reducing booking delays by 50% will reduce TAT by 15.2%, and investing in an automated booking system for emergency cases would reduce it by 25.9%. Finally, 4) increasing demand by 5% next year and 10% the following year, will produce an increase in TAT by 3% and 11%, respectively.

CONCLUSION

This study highlights the benefits of predictive modeling the uncertainties and the dynamic behavior of complex systems such as the imaging workflow for ED patients. DES is a powerful tool that can be used to test different scenarios before committing any resources to implement process changes. The use of DES has provided insightful information of what process changes will have the most impact on TAT, and so it allows hospital leadership to focus on implementing the changes that will provide the best return.

CLINICAL RELEVANCE/APPLICATION

Modeling ED imaging workflow helps to improve operational efficiency because it provides the quantitative evidence necessary to guide decisions that aim to maximize resource investments.





SSA17

Neuroradiology (Stroke 1)

Sunday, Dec. 1 <u>10:45AM - 12:15PM Room: S501ABC</u>



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

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Sub-Events

SSA17-01 A Deep Learning Algorithm for Detecting Challenging Cases of Acute Ischemic Stroke on Non-Contrast Brain CT

Sunday, Dec. 1 10:45AM - 10:55AM Room: S501ABC

Participants

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PURPOSE

Improving the diagnostic accuracy for acute ischemic stroke (AIS) has the potential to reduce erroneous administration of tissue plasminogen activator (tPA) to patients presenting with stroke-like symptoms. Non-contrast CT is obtained in the acute setting to rule out intracranial hemorrhage but has poor sensitivity and specificity for AIS. Thus, the most ambiguous cases are referred to Diffusion Weighted MRI (DW-MRI) after administration of tPA for diagnostic confirmation. The aim of this study is to produce stroke annotations on non-contrast CT images based on corresponding DW-MRIs in these challenging cases, and then automatically detect and segment AIS directly from non-contrast brain CT images.

METHOD AND MATERIALS

8879 CT slices from 199 patients CT scans were collected and split into training (75%), validation (15%), and test (10%) sets. Out of 199 patients, 99 patients were confirmed to have stroke based on DW-MRIs (positive samples), and 100 patients had no evidence of AIS based on clinical follow up (negative samples). Board-certified radiologists annotated the CT for AIS on positive samples by comparing to corresponding DW-MRIs. The training dataset was then passed through a Mask R-CNN model with a ResNet-50 backbone with L2 Regularization. The loss function was optimized by stochastic gradient descent with momentum. The model was initialized with weights pretrained on the Common Objects in Context dataset. The validation set was used to tune hyperparameters.

RESULTS

The model was assessed on the ability to identify a CT slice as containing a stroke and the ability to segment the regions of corresponding diffusion on MRI on the held-out test set. The model has a whole image classification specificity of 0.6849, sensitivity of 0.4792, F1 score of 0.1394, and accuracy of 0.6736. Additionally, the model demonstrated a promising ability to automatically segment AIS, achieving a mean average precision on true positive predictions of 0.3478 at an intersection-over-union of 10%.

CONCLUSION

Our Mask R-CNN model provides a promising means of detecting acute ischemic stroke on non-contrast CT.

CLINICAL RELEVANCE/APPLICATION

The algorithm can be used to improve the diagnostic accuracy for AIS on non-contrast CT in emergency settings to improve patient selection for intravenous thrombolysis and mechanical thrombectomy.

SSA17-02 Infarct Lesion Prediction Using Baseline MRI in Acute Ischemic Stroke Patients: A Comparison Study between Deep Learning Model and Clinical Thresholding Methods

Participants

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PURPOSE

We aim to determine whether a deep learning model trained on acute stroke patients can predict the 3-7 day infarcted region from baseline DWI/PWI MRI and to compare its prediction with state-of-the-art clinical thresholding methods.

METHOD AND MATERIALS

Patients with baseline DWI/PWI and 3-7 day T2-FLAIR imaging were selected from two large acute ischemic stroke trials. Six image channels from baseline imaging were used as model inputs (DWI, ADC, and from PWI: Tmax, CBF, CBV, and MTT). Ground truth was manually segmented on 3-7 day T2-FLAIR. The network structure was an attention-gated deep convolutional U-net with a composite loss function. The model outputs a map where each voxel represents the probability of being part of the lesion. Patients were grouped into unknown, minimal, partial, major reperfusion status. Area-under-the-curve (AUC), Dice score coefficient (DSC), and predicted lesion volume difference were analyzed. In minimal and major reperfusion, the model was compared to a thresholding method (RAPID) using Tmax>6 sec and ADC<620 x 10-6 mm2/s by a paired sample Wilcoxon test, respectively.

RESULTS

182 patients were included (age 65 ± 16 yrs, baseline NIHSS 15 [IQR 10-19]). For all patients, the model had a median AUC of 0.91 (IQR 0.87, 0.95); at 0.5 probability threshold, median DSC was 0.53 (IQR 0.31-0.68) and lesion volume differences were 9.1 ml (IQR -14.2-28.6) and 23.7 ml (IQR 11.4-50.1) (absolute difference). In minimal reperfusion patients, median AUC was 0.90 (IQR 0.85, 0.94) vs 0.78 (IQR 0.72, 0.82) for the Tmax model (p<0.001); in major reperfusion patients, median AUC was 0.93 (IQR 0.89, 0.96) vs 0.68 (IQR 0.62, 0.76) for the ADC model (p<0.001). In partial or unknown reperfusion patients, AUC was similar: 0.90 [IQR 0.86, 0.96] and 0.92 [IQR 0.86, 0.96], respectively.

CONCLUSION

A deep learning model trained without reperfusion status performs better at infarct lesion segmentation compared to commonlyused threshold-based methods in minimal and major reperfusion patients, while also achieving high performance in partial or unknown reperfusion patients.

CLINICAL RELEVANCE/APPLICATION

A deep learning model without reperfusion information trained on acute images can achieve good performance at predicting imaging outcome at 3-7 days.

SSA17-03 Quantitative Evaluation of Multiphase Versus Single Phase Computed Tomography Angiography for the Detection of Distal Ischemic Stroke

Sunday, Dec. 1 11:05AM - 11:15AM Room: S501ABC

Participants

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PURPOSE

The aim of this investigation was to quantitatively evaluate the effects of the addition of peak and delayed venous phase imaging to arterial phase CTA for the detection of distal ischemic strokes. Changes in sensitivity, specificity, time required to render a final decision, and subjective level of diagnostic confidence were quantified.

METHOD AND MATERIALS

Four attending radiologists contributed as readers to this IRB-approved, HIPAA-compliant study. For each reader, two sessions were conducted; in each session, the reader retrospectively interpreted the CTA studies of 104 patients (52 positive, 52 negative) who underwent imaging for suspicion of acute ischemic stroke, resulting in a total of 832 interpretations. During the first session for each reader, only arterial phase images were available; during the second session, peak and delayed venous phase images were additionally available. The patients' images were randomized and de-identified, and the two reading sessions for each radiologist

were separated by at least one month in order to minimize inter-session confounding. Data collected included presence or absence of arterial occlusion, time to render a final decision, and subjective level of diagnostic confidence.

RESULTS

The addition of venous phase images resulted in a significant 7.5% absolute increase in sensitivity (86.5% vs. 94.0%, p = .004) and an insignificant increase in specificity (98.2% vs. 99.0%, p = .387). No significant increase was observed in relative positive predictive value (97.2% vs. 98.1%, p = .511) but a small significant increase in relative negative predictive value was seen (87% vs. 91%, p = .001). A small but significant reduction in reading time was observed (66.7 seconds vs. 59.6 seconds, p = .001). A significant increase in diagnostic confidence was observed (2.26 vs. 2.58, p < .001). Inter-radiologist agreement (Kappa value) increased from 0.76 to 0.84.

CONCLUSION

The addition of peak and delayed venous phases to arterial phase CTA imaging for the detection of distal ischemic stroke significantly increases diagnostic sensitivity, reading speed, and reader confidence without incurring a corresponding reduction in specificity.

CLINICAL RELEVANCE/APPLICATION

By increasing sensitivity and reading speed at no cost to specificity, conducting multiphase imaging as a routine stroke protocol has the potential to improve diagnostic accuracy and patient outcomes.

SSA17-04 Deep Learning-Based Contrast Enhanced Time-Resolved Cone-Beam CT Angiography with IV Injection

Sunday, Dec. 1 11:15AM - 11:25AM Room: S501ABC

Participants

Juan Montoya, Madison, WI (*Presenter*) Nothing to Disclose Beverly A. Kienitz, MD, DDS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose Azam S. Ahmed, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose David Niemann, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose Yinsheng Li, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose John W. Garrett, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose Ke Li, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose Sebastian Schafer, PHD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose Charles M. Strother, MD, Madison, WI (*Abstract Co-Author*) Research Consultant, Siemens AG Research support, Siemens AG License agreement, Siemens AG Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company

PURPOSE

The purpose of this work was to develop a deep learning technique to generate time-resolved cone-beam CT angiography (TR-CBCTA) from cone-beam CT perfusion data sets.

METHOD AND MATERIALS

With IRB approval and written consent, 43 patients with acute ischemic stroke and a high NIH stroke scale scores (>5) were recruited in one-stop-shop C-arm cone beam CT stroke imaging clinical trial study. The recruited subjects received both diagnostic CT and C-arm cone-beam CT perfusion imaging. The C-arm cone beam CT perfusion data acquisitions consist of nine 5-seconds bidirectional rotational scans with 100 cc contrast medium injected intravenously followed by 50 cc saline flush. To generate TR-CBCTA, the acquired high quality diagnostic CT images were used to train our previously published deep learning angiography (DLA) neural network to extract vascular features from axial CT images. This trained deep neural network was transferred to learn TR-CBCTA from the acquired cone-beam CT perfusion data sets. To capture the spatiotemporal characteristics of TR-CBCTA, the trained DLA model was fine-tuned using images from the acquired cone-beam CT perfusion data sets. The trained model was then used to generate TR-CBCTA of other data sets from different patients. The generated TR-CBCTA images were subject to qualitative assessment of image quality of large arteries (i.e internal carotid artery - ICA, middle cerebral artery - MCA, anterior cerebral artery - ACA and the distal branches of the MCA and ACA) as well as the anatomy of the cerebral venous system. The presence/absence of residual bone and mis-registration artifacts was also evaluated.

RESULTS

All major arteries as well as venous drainage showed good to excellent image quality in time-resolved DLA images. No significant residual signal from osseous structures was observed.

CONCLUSION

A deep learning based method was developed to generate TR-CBCTA from cone-beam CT perfusion data sets with reduced misregistration and residual bone artifacts induced by inter-sweep patient motion and known to be the major technical limitation.

CLINICAL RELEVANCE/APPLICATION

Time-resolved cone-beam CT angiography from cone-beam CT perfusion data sets may enable reliable use of c-arm based timeresolved CTA to directly visualize vascular occlusions and assess collaterals to ischemic stroke patients.

SSA17-05 Quantitative CT Perfusion: Do the CT Scanner Model and Variation in Vascular Flow Rate Affect Quantitative Measures of Parametric Maps?

Sunday, Dec. 1 11:25AM - 11:35AM Room: S501ABC

Participants

Neelu Jain-Lakhani, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose Eric L. Gingold, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose Kiran S. Talekar, MBBS, MD, Philadelphia, PA (*Abstract Co-Author*) Spouse, Employee, GlaxoSmithKline plc Adam E. Flanders, MD, Narberth, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Using a CT perfusion phantom, we sought to determine whether quantitative measurements on CT perfusion maps differed between CT manufacturers and scanner models and to determine if differences in simulated blood flow rates affect these quantitative measurements.

METHOD AND MATERIALS

A unique CT perfusion phantom comprised of 4 movable rods was used in this study. The phantom contains 2 rods designed to simulate arterial and venous flow rates and 2 rods replicating identical normal perfused brain tissue. The simulated arterial and venous contrast rods are designed to move at 5 distinct speeds, allowing acquisition of datasets at 5 different simulated blood flow rates. Scanning was performed using standard clinical protocols on 3 different CT scanner models at each of the speeds. The CT phantom was scanned 5 times for one of the phantom speeds to confirm reproducibility. Datasets from each scan were post processed using commercial perfusion software to create time attenuation curves and parametric perfusion maps for cerebral blood volume (CBV), cerebral blood flow (CBF) and mean transit times (MTT). Region of interest (ROI) measurements in the simulated brain tissue rods were obtained for 3 centrally located scan slices.

RESULTS

Quantitative ROI measurements revealed that CBF values increased, MTT decreased, and CBV did not change with increased phantom speed, as expected, for all three CT scanner models. The absolute values of CBV and CBF were different across CT scan manufacturers, although closer in range between two models of a single CT manufacturer, for a given phantom speed. For example, at a simulated flow rate of 1.5 mm/sec measured at a central phantom slice position, CBF(ml/100g/min) was 17.7 for Scanner 1 (mfgr 1), 14.0 for Scanner 2 (mfgr 1), and 36.0 for Scanner 3 (mfgr 2); CBV(ml/100g) was 4.9 for Scanner 1, 4.2 for Scanner 2, and 7.8 for Scanner 3; MTT(sec) was 16.7 for Scanner 1, 18.0 for Scanner 2, and 16.2 for Scanner 3.

CONCLUSION

Scanner manufacturers and models yield substantially different quantitative ROI values; therefore, one must be cautious when using absolute values for interpreting CT perfusion images, particularly when attempting to devise threshold values for CBF and CBV.

CLINICAL RELEVANCE/APPLICATION

Since quantitative values are not consistent across CT scanners, one must be cautious when using them for interpreting CT perfusion, particularly if attempting to devise threshold values for CBF and CBV.

SSA17-06 Imaging Triage of Acute Stroke Patients for Endovascular Clot Retrieval (ECR): Audit of the Effects of Broadened Eligibility Criteria and Process Improvements on Utilisation of CT Perfusion at a Health Network Stroke Centre

Sunday, Dec. 1 11:35AM - 11:45AM Room: S501ABC

Participants

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PURPOSE

The DAWN and DEFUSE-3 trials published in 2017 showed improved outcomes for later-presenting acute stroke (AS) patients with large vessel occlusion treated with endovascular clot retrieval (ECR). At our institution we experienced a markedly increased volume of CT perfusion (CTP) studies for patients with potential AS during 2018. We aimed to determine if there were associations between: 1. liberalized temporal eligibility criteria and increased CTP utilization and 2. CTP utilization and number of patients having ECR who were discharged home.

METHOD AND MATERIALS

Audit of 3 hospital network. Inclusion: Consecutive. Suspected AS >18 years who had CTP. Study Period 1. 1 January-30 June 2017; Period 2. 1 January-30 June 2018. Data collection: Age, gender, hospital of presentation, triage category, NIHSS (National Institute of Health Stroke Score), symptoms / signs, time SLSW-triage, # patients reaching angiography for intended ECR (IECR), ECR performance, disposition (home / other). Number needed to scan (NNS) for 1 IECR =Total # CTP / total # IECR. Total ED presentations were calculated. Analysis: Comparison of periods 1. and 2. Student t, Wilcoxon Rank Sum and chi-square tests with significance set at p <0.05.

RESULTS

A 38.6 % increase in CTP (515 in 2017, 714 in 2018) occurred with 42/515 (8.2%) and 76/714 (10.6%) proceeding to intended ECR (80.9% increase) . NNS declined from 12.3 to 9.4. 39/515 (7.6%) and 62/714 (8.7%) of patients had ECR (60.0% increase). >85% of patients in both periods were triage category 2 (CAT2) ; increase in all CAT2 ED presentations 2017-8 was 1.6%. 90/118 patients with IECR had complete data for analysis. Median time SLSW at triage differed between the two groups (median [244 mins (IQR: 95-600) in 2018 vs. 74.5 mins in 2017 (IQR: 53-205); p <0.0001]. 23 and 28 patients who had ECR were discharged home in 2017 and 2018, respectively.

CONCLUSION

CTP volume grew between 2017 and 2018 well in excess of ED presentations. Median time SLSW was different between the two study periods. Reduction in NNS may reflect patient selection for CTP and/or changed decision-making after CTP. In 2018 versus 2017, 199 more CTPs were performed for an additional 5 ECR patients to be discharged home.

CLINICAL RELEVANCE/APPLICATION

Broadened temporal criteria for endovascular clot retrieval (ECR) in acute stroke (AS) are associated with substantial increase in CT perfusion utilization per ECR patient discharged home.

SSA17-07 Amide Proton Transfer Magnetic Resonance Imaging of Cerebral Infarction: Correlation with Clinico-Radiological Findings

Sunday, Dec. 1 11:45AM - 11:55AM Room: S501ABC

Participants

Daichi Momosaka, MD, Higashi-ku, Japan (*Presenter*) Nothing to Disclose Osamu Togao, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose Akio Hiwatashi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose Kazufumi Kikuchi, MD,PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Amide proton transfer (APT) imaging is a kind of chemical exchange saturation transfer imaging technique based on proton exchange between amides (-NH) and bulk water. As proton exchange rate depends on tissue pH, APT imaging could detect pH reduction in cerebral infarctions. The purpose of this study was to clarify correlations between APT-weighted signal (APTws) and clinico-radiological findings in patients with infarctions.

METHOD AND MATERIALS

In this retrospective study, 29 patients (13 males and 16 females; age range 9-91 y.o.; median 65 y.o.) were examined with a 3T MR system. The infarction etiology was cardioembolic in 11 cases, atherosclerotic in 5 cases and others in 13 cases. The range of time after ictus was 1.8 to 720 h. (median 52.3 h.). The range of lesion size was 19 to 132 mm (median 50 mm). The parameters of APT imaging were as follows: saturation pulse strength = 1.5μ T, saturation time = 2.0 sec, 25 offset frequencies (±6 ppm). MTR asymmetry at 3.5ppm was defined as APTws. Regions-of-interest (ROIs) were manually drawn around the infarction and contralateral normal-appearing white matter (CNWM) on diffusion-weighted images, then these were copied onto the APT images. We measured cumulative histogram parameters, including 10th, 25th, 50th, 75th, 90th percentiles of APTws in infarction and CNWMs. Histogram parameters were compared between infarction and CNWM using Wilcoxon signed-rank test. Those were also compared between cardioembolic infarction and the other subtypes of infarctions using Mann-Whitney U test. Correlation between 10th percentile of APTws (APT10th) and time after ictus, lesion size and 10th percentile of ADC (ADC10th) were evaluated using Spearman's rank correlation coefficient.

RESULTS

APT10th of infarction was significantly lower than that of CNWM (-1.69 ± 1.80 vs. -1.12 ± 1.73 %, p = 0.0381). APT10th of cardioembolic infarction were significantly lower than those of the other infarction subtypes (-2.77 ± 2.42 vs. -1.02 ± 0.82 %, p = 0.0144). APT10th positively correlated with ADC10th (r = 0.49, p = 0.0065) and inversely correlated with lesion size (r = -0.43, p = 0.0216). There was no significant correlation between APTws and time after ictus.

CONCLUSION

APTws was reduced in cardioembolic infarctions, large infarctions and infarctions with low ADC values.

CLINICAL RELEVANCE/APPLICATION

APT imaging could be used to evaluate tissue acidosis in cerebral infarctions.

SSA17-08 High B Values for Diffusion-Weighted Imaging at 3 Tesla Improves the Sensitivity for Acute Ischemic Stroke Detection

Sunday, Dec. 1 11:55AM - 12:05PM Room: S501ABC

Participants

Jerome Bailleux, Paris, France (*Abstract Co-Author*) Nothing to Disclose Adnan Altayeb, MD, Paris, France (*Presenter*) Nothing to Disclose Kevin Zuber, Paris, France (*Abstract Co-Author*) Nothing to Disclose Yvonne M. Purcell, MBBCh, Paris, France (*Abstract Co-Author*) Nothing to Disclose Adrien Collin, Paris, France (*Abstract Co-Author*) Nothing to Disclose Augustin Lecler, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose Julien Savatovsky, MD, Saint Mande, France (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

MRI may be performed in the setting of acute neurological deficits, in order to diagnose ischemic stroke, rule out alternative diagnoses and select patients for further traitement. The diagnosis is based on the demonstration of diffusion weighted high-signal intensity with decreased apparent diffusion coefficient (ADC) value. The optimum b factor to use at 3T has never been defined in the literature, varying between 1000 and 2000; hence, this study compares 2 b factors : b1000, b2000 s/mm2 in evaluating recent cerebral ischemic lesions at 3T MRI.

METHOD AND MATERIALS

227 patients with a recent ongoing or transient neurological deficit (< 24h) were inclued over 3 months. We performed b1000 and
b2000 MR diffusion sequences 3T MRI in an emergency setting. These acquisitions were quantitatively and independently analysed by 2 readers, specifying the presence of an ischemic lesion and their diagnostic confidence. Inter-reader agreement, sensitivity, specificity, and positive and negative predictive values were calculated.

RESULTS

Recent ischemic lesions were detected in 78/227 patients (34.4%). The sensitivity for b2000 was significantly higher than for b1000 at 3T (98.7% vs 93.7%, p=0.05), whereas the specificty was equivalent (99.3% vs 97.3%, p=0.18). There was no statistical difference for diagnostic confidence.

CONCLUSION

MR diffusion sequence with a b factor of 2000 s/mm2 has a better sensitivity for the detection of recent ischemic lesions, compared to 1000 s/mm2 at 3T.

CLINICAL RELEVANCE/APPLICATION

DWI with a b factor of 2000 s/mm2 has a significantly higher sensitivity in diagnosing recent ischemic stroke compared to a b factor of 1000 s/mm2 and is recommended in the emergency setting.

SSA17-09 High Performance of Deep-Learning (DL) based Segmentation Model of Acute Ischemia Stroke Lesions Evaluated with ASPECTs Score on Head CT

Sunday, Dec. 1 12:05PM - 12:15PM Room: S501ABC

Participants

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PURPOSE

In this study, we aim to develop a deep-learning (DL) based model to automatically segment signs of ischemia acute stoke lesions on head CT scans. By implementing the topographic scoring system (Alberta Stoke Program Early Score, ASPECTs), we evaluated the performance of the proposed model in the detection of patients with acute ischemic stroke.

METHOD AND MATERIALS

For this retrospective study, over 36, 000 CT images were collected from 1,500 patients with and without ischemia stroke between 2012 and 2017. All patients had CT and MRI scan taken less than twenty-four hours apart for stroke diagnosis. The presence of Ischemia stroke lesions as well as the corresponding ASPECTS score per region were labeled on CT scans by board-certified radiologists as ground truth on the review of MRI images and clinical reports. Using CT scans as input, a DL-based model was developed by using Dense UNet as the backbone, integrating Deeplab architectures. ASPECTs score was automatically calculated individually over all ASPECTS regions for the segmentation of ischemia stroke lesions.

RESULTS

In total, scans of 346 patients including 240 patients with acute ischemia stroke and 106 patients without acute ischemia stroke lesions were used in the evaluation of the model performance. Sensitivity, specificity and accuracy rate in an ASPECTS regions-based analysis were 39.80%, 98.02% and 96.37%, respectively.

CONCLUSION

The proposed automated model demonstrated a high performance in the prediction of ischemia stoke lesions in head CT scans as well as in regions like cerebellum and brainstem.

CLINICAL RELEVANCE/APPLICATION

Our proposed model could serve as a useful tool for early diagnosis of ischemia stoke lesions and has the potential to influence clinical decisions to treat patients with thrombolysis and thrombectomy.



105TH Scientific Assembly and Annual Meeting December 1-6 | McCormick Place, Chicago



ERS-SUA

Emergency Radiology Sunday Poster Discussions

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



AMA PRA Category 1 Credit ™: .50

Participants

Ludo F. Beenen, MD, Amsterdam, Netherlands (Moderator) Nothing to Disclose

Sub-Events

ER200-SD- DECT Evaluation of Acute Appendicitis Using Iodine Maps

Station #1

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

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

ER242-SD- Cervical Spine CT's Ordering in the Trauma Setting Based on NEXUS and Canadian C-Spine Rules: An Institutional Experience

Station #2

Participants Marie Tominna, MD, Troy, MI (*Presenter*) Nothing to Disclose Kurt E. Tech, MD, Grosse Pointe, MI (*Abstract Co-Author*) Nothing to Disclose Katie Tausch, MD, Royal Oak, MI (*Abstract Co-Author*) Nothing to Disclose David Kakish, MD, Auburn Hills, MI (*Abstract Co-Author*) Nothing to Disclose Kanika Thapar, MD, Royal Oak, MI (*Abstract Co-Author*) Nothing to Disclose Kathleen A. Barry, MD, Birmingham, MI (*Abstract Co-Author*) Nothing to Disclose Patrick Pettengill, MD, Royal Oak, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

ER243-SD- Diffusion Tensor Imaging (DTI) Indices in Spinal Cord Injury Patients SUA3

Station #3

Participants Sarita Magu, MD, Rohtak, India (*Presenter*) Nothing to Disclose Ravi Karisaiyappanavar, MBBS, MD, Rohtak, India (*Abstract Co-Author*) Nothing to Disclose Seema Rohilla, MBBS, MD, Rohtak, India (*Abstract Co-Author*) Nothing to Disclose Roop Singh, MBBS, MS, Rohtak, India (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

Prognostication of spinal cord injury

ER244-SD- Do TBI Patients with ICH Have a Signature Symptom Profile?

Station #4

Participants Kyle Costenbader, BSC, Washington, DC (*Presenter*) Nothing to Disclose Fahimul Huda, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose Muhammed Shand, McLean, VA (*Abstract Co-Author*) Nothing to Disclose Marilyn M. Kraus, Washington , DC (*Abstract Co-Author*) Nothing to Disclose Derek Brown, MS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose M. Reza Taheri, MD, PhD, Falls Church, VA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

ER230-SD- Eliminating Radiologist Pre-Approval of CT Protocols: Impact on Emergency Department Turnaround SUA5 Times

Station #5

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

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No

PURPOSE

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

METHOD AND MATERIALS

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

RESULTS

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

CONCLUSION

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

CLINICAL RELEVANCE/APPLICATION

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

ER158-ED- The Whole Spine Yards: A Review of Pediatric Spine Trauma SUA6

Station #6

Magna Cum Laude

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

TEACHING POINTS

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

TABLE OF CONTENTS/OUTLINE

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

ER157-ED- Pancreatic Injury: Comprehensive Imaging Review and Management Update

Station #7

Awards Certificate of Merit Identified for RadioGraphics

Participants

Tarek N. Hanna, MD, Atlanta, GA (*Presenter*) Nothing to Disclose Jihoon Lim, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Gayatri Joshi, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose Carrie N. Hoff, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Siddhartha Kosaraju, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Joseph A. Graves, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Keith D. Herr, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

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

TABLE OF CONTENTS/OUTLINE

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







ERS-SUB

Emergency Radiology Sunday Poster Discussions

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

ER

AMA PRA Category 1 Credit ™: .50

Participants

Ferco H. Berger, MD, Toronto, ON (Moderator) Speaker, Siemens AG

Sub-Events

Participants

ER202-SD- Differentiation of Drowning in Seawater and Freshwater with Pleural Effusion: A Phantom Study Using Dual-Layer Spectral CT

Station #2

Norihiro Shinkawa, MD, Miyazaki, Japan (*Presenter*) Nothing to Disclose Toshinori Hirai, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Research Grant, Bayer AG Nobuhiro Yukawa, MD, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose Ai Sonoda, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose Eiji Kakizaki, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Forensic medicine identifies drowning and whether it occurred in salt- or fresh water. The sodium chloride (NaCl) concentration in pleural fluid differentiates between fresh water- and salt water drowning (FWD, SWD). As dual-layer spectral CT (DLSCT) acquires low- and high-energy data simultaneously, dual-energy analysis is possible. We used a phantom to determine whether DLSCT is useful for evaluating the NaCl concentration in fluid.

METHOD AND MATERIALS

Based on the reported NaCl concentration in pleural effusion, we estimated the most appropriate cut-off value to be 110 mEq/l. An NaCl concentration < 110 mEq/l was defined as FWD; a concentration > 110 mEq/l as SWD. Plastic tubes filled with 50-ml solutions containing NaCl concentrations ranging from 101 - 120 mEq/l and increased in one-mEq/l steps were scanned using DLSCT. The attenuation value on 120-kVp scans and on virtual monoenergic images (VMIs) acquired at 70-, 60-, 50-, and 40-keV was calculated using the region-of-interest method. The area under the receiver operating characteristics curve (AUC) was used to compare the ability of the imaging modalities to differentiate between fresh- and salt water. Differences in their AUCs were assessed by pair-wise comparisons. A *p*-value < 0.05 was considered to indicate a significant difference.

RESULTS

For fresh water, the mean attenuation value was 9.9 ± 0.18 HU at 120-kVp, 9.6 ± 0.11 HU at 70-keV, 9.8 ± 0.14 HU at 60-keV, 10.4 ± 0.27 at 50-keV, and 10.9 ± 0.40 HU at 40-keV. For salt water these values were 10.0 ± 0.20 , 9.5 ± 0.20 , 9.7 ± 0.10 , 10.5 ± 0.20 , and 11.4 ± 0.20 , respectively. The AUC was 0.690 at 120-kVp; for VMIs at 70-, 60-, 50-, and 40-keV it was 0.675, 0.540, 0.595, and 0.935, respectively. It was significantly higher at 40-keV than at 120-kVp (p=0.034), 60-keV (p=0.012), and 50-keV (p=0.0009). There was no significant difference in the AUC between VMIs acquired at 40- and 70-keV.

CONCLUSION

Dual-energy imaging using DLSCT, especially 40-keV VMI, is useful for evaluating the NaCl concentration in fluid. Dual-energy analysis of pleural fluid may help to distinguish between FWD and SWD.

CLINICAL RELEVANCE/APPLICATION

Dual-energy analysis of pleural fluid using DLSCT may be useful for forensic medicine as it helps to distinguish FWD from SWD.

ER203-SD- Ruling Out Pneumothorax Via Ultrasound Using B-Flow Imaging SUB3

Station #3

Participants Martin Fasshauer, MD, Goettingen, Germany (*Presenter*) Nothing to Disclose Lorenz Biggemann, Goettingen, Germany (*Abstract Co-Author*) Nothing to Disclose Joachim Lotz, MD, Gottingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

After trauma a first and quick evaluation with ultrasound (extended focused assessment with sonography in trauma; eFAST) is often the first imaging procedure for internal injuries such as bleeding, pericardial effusion or pneumothorax. While a contrast enhanced whole body CT scan remains the gold standard for assessment of trauma related injuries, some patients require urgent care due to hemodynamic instability. The most important disadvantage of eFAST however is the low sensitivity and consequentially high number of underdiagnosed injuries. One of the reasons for aforementioned low sensitivity is inexperience of the examiner. With focus on pneumothorax, pleural adhesions as well as decreased mobility of the lung further impair evaluation of ultrasound findings. We therefore investigated the use of ultrasound B-Flow imaging (GE Healthcare) to assess pleural movement in order to rule out pneumothorax.

METHOD AND MATERIALS

20 healthy male volunteers were examined to prove non-inferiority of M-Mode and B-Mode compared to B-Flow. We used a 6-8 MHz linear-array transducer (ML6-15, Logiq S8 XDclear, GE Healthcare, Chicago, IL, USA) with standard recommended views for eFAST. Written consent was obtained from each volunteer.

RESULTS

B-Flow imaging was visually superior to M-Mode as well as B-Mode in healthy male volunteers for detection of pleural movement. Especially in few obese volunteers where pleural movement was subjectively markedly decreased in M-Mode, confidence of existent pleural movement was preserved in B-Flow imaging.

CONCLUSION

Assessment for sonographic pleural movement to rule out pneumothorax is often difficult in inexperienced examiners, especially while performing eFAST. While further investigation including trauma patients will be needed, B-Flow imaging might serve as a superior tool for detection of pleural movement.

CLINICAL RELEVANCE/APPLICATION

Ultrasound B-Flow imaging is non-inferior to M-Mode in detection of pleural movement.

ER231-SD- Performance Analysis of Deep Learning Algorithm for Emergency Chest CT Reading SUB4

Station #4

Participants Yu Ziting, Yinchuan, China (*Presenter*) Nothing to Disclose Jun Gu Sr, Beijing, China (*Abstract Co-Author*) Nothing to Disclose Lili Yang, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose Fang Wang, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose Ruoshui Ha, BA, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose Yun Shen, PhD, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company Researcher, General Electric Company Xuejun Ping, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

To assess the performance of deep learning algorithm through reading time and diagnostic accuracy for emergency chest CT images.

METHOD AND MATERIALS

A total of 30 patients underwent emergency chest CT were retrospectively collected and randomly divided into two groups and each group consisted of 15 people. In the first week, one resident independently read the images of group A and recorded the total reading time and the number of nodules in the lungs, position, the number of fractures and position. Group B images were firstly read by AI and then the second reading was conducted by the resident on the basis of AI reading. Reading time and results were recorded. After one week, image reading mode in group A and group B were interchanged. Group B images were read by the resident. Group A images were read by AI first, then the second reading was conducted on the basis of AI with reading time and results recorded. The consensus results of two senior imaging diagnostic radiologist combined with AI diagnosis were used as the gold standard conditions of nodules and fractures in patients. Detection time and efficiency of the resident only and the resident with AI assisted to diagnose nodules and fractures were compared

RESULTS

A total of 72 pulmonary nodules and 172 fractures were determined as gold standard. The reading time of the resident assisted by AI ($55\pm35s$) was faster than that of the resident alone ($154\pm46s$) (P<0.01). Resident alone detected 35 nodules and 72 fractures while the resident detected 96 nodules and 139 fractures with AI assisted. For the resident reading alone, the sensitivity of the nodule detected by the resident was 27.78% and the sensitivity of the fracture detected was 41.86%. For the resident reading with AI assisted, the sensitivity of nodule detection was 80.55% and the sensitivity of fracture detection was 80.81%. There were statistically significant differences between the two groups (P<0.05).

CONCLUSION

AI can significantly reduce the reading time of emergency chest CT by residents, improve the sensitivity of residents in identifying pulmonary nodules and fractures.

CLINICAL RELEVANCE/APPLICATION

The emergency chest CT report always requires high accuracy and has stringent timeline. AI can not only significantly improve the diagnostic speed of residents but also effectively improve the detection efficiency of nodules and fractures.

ER160-ED- CT in Diagnosis of Post-Colonoscopy Complications: What the Radiologist Must Know SUB5

Station #5

Awards Cum Laude

Participants Abbisbek P. Keraliya

Abhishek R. Keraliya, MD, Boston, MA (*Presenter*) Nothing to Disclose Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc

TEACHING POINTS

1. Fiberoptic colonoscopy has become a routine investigation in the diagnosis and treatment of many colonic diseases and is the

standard method for routine screening of colorectal cancer in healthy individuals. As the use of colonoscopy has increased in recent years, awareness and early diagnosis of the associated complications has become increasingly important to prevent morbidity and mortality. 2. Common complications of colonoscopy include bowel perforation, postprocedural hemorrhage, splenic injury, and postpolypectomy syndrome. Unusual complications of colonoscopy include appendicitis, diverticulitis, mesenteric tears, pneumothorax, septicemia, and colonic volvulus. 3. CT is the imaging modality of choice to assess for the possible complications of colonoscopy in patients presenting to emergency department with postprocedural abdominal pain. CT is more sensitive and specific compared to abdominal radiographs in detecting and localizing various post-colonoscopy complications.

TABLE OF CONTENTS/OUTLINE

Case-based illustration of the utility of CT to detect complications of colonoscopy including bowel perforation, postprocedural hemorrhage, splenic injury, and postpolypectomy syndrome.

ER159-ED- Key Findings that Influence the Management of Head and Neck Infectious Emergencies: What the SUB6 Radiologist Must Tell the ER

Station #6

Awards Certificate of Merit

Participants

Jeet Patel, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose Anushi Patel, MD, Longwood, FL (*Abstract Co-Author*) Nothing to Disclose Swati Sharma, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Peter J. Fiester, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Patrick Natter, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Dalys E. Haymes, MD, Atlantic Beach, FL (*Abstract Co-Author*) Nothing to Disclose Dinesh Rao, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose John Kim, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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TEACHING POINTS

1. Head and neck infections that radiologists see in the emergency department include those of the orbits, sinuses, temporal bone, oral cavity and the pharynx. 2. The radiologist's interpretation of imaging studies for these infections guides clinical management by informing emergency physicians of the extent and severity of an infection. 3. There are key imaging findnigs and diagnoses that the radiologist must report that can prompt an emergency physician to admit a patient for inpatient management or consult a surgical subspecialist. The absence of these findings are also pertinent negatives that enable clinicians to proceed with treatment in the ED or to discharge a patient with outpatient follow-up.

TABLE OF CONTENTS/OUTLINE

1. Orbital: a) Postseptal cellulitis b) Postseptal cellulitis + orbital compartment syndrome c) Subperiosteal abscess d) Dacryocystitis 2. Temporal bone: a) Coalescent mastoiditis b) Bezold abscess c) Mastoiditis + intracranial abscess and venous sinus thrombosis d) Malignant otitis externa 3. Sinuses: a) Acute invasive sinusitis 4. Odontogenic: a) Masticator space odontogenic abscess b) Floor of the mouth/submandibular odontogenic abscess / Ludwig's Angina c) Cavernous sinus thrombosis 5. Pharyngeal/Retropharyngeal: a) Peritonsillar abscess + parapharyngeal extension b) Peritonsillar absces + retropharyngeal extension





RC108

Imaging of Musculoskeletal Emergencies (Interactive Session)

Sunday, Dec. <u>1 2:00PM - 3:30PM Room: S406A</u>



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Manickam Kumaravel, MD, FRCR, Houston, TX (Moderator) Nothing to Disclose

Special Information

This interactive session will use RSNA Diagnosis Live^m. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC108A Hip

Participants Manickam Kumaravel, MD, FRCR, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

manickam.kumaravel@uth.tmc.edu

LEARNING OBJECTIVES

1) Understand in depth the normal anatomy of hip. 2) Appreciate subtle and catastrophic patterns of the hip and peri-hip causes of pain. 3) Effectively utilize CT and MRI in problem solving patients with hip and peri-hip causes of pain. 4) Comprehend the clinical implications of hip pain presentations.

ABSTRACT

The learner will be exposed to a wide gamut of patients presenting to the emergency room with hip and peri-hip causes of pain. Injuries will be elucidated with plain radiography, CT and MRI.

RC108B Wrist

Participants Claire K. Sandstrom, MD, Seattle, WA (*Presenter*) Spouse, Advisory Board, Boston Scientific Corporation;

For information about this presentation, contact:

cks13@uw.edu

LEARNING OBJECTIVES

1) Review osseous and soft tissue emergencies of the wrist that may be encountered in the Emergency Department. 2) Describe appropriate imaging work-up of wrist emergencies.

RC108C Ankle and Foot

Participants Adnan M. Sheikh, MD, Ottawa, ON (*Presenter*) Speaker, Siemens AG

For information about this presentation, contact:

asheikh@toh.ca

LEARNING OBJECTIVES

1) Review the imaging modalities to assess ankle and foot pathologies. 2) Understand the imaging features of common and uncommon ankle and foot injuries. 3) Develop strategies to reduce the possibility of a missed lesion on screening.

RC108D Shoulder

Participants

Jonathan A. Flug, MD, MBA, Phoenix, AZ (Presenter) Nothing to Disclose

For information about this presentation, contact:

flug.jonathan@mayo.edu

LEARNING OBJECTIVES

1) Detect imaging abnormalities commonly seen in the shoulder in the emergency setting. 2) Identify commonly encountered

shoulder pathology in the emergency setting. 3) Recommend appropriate follow up for various findings in the shoulder in the emergency setting.

ABSTRACT

The shoulder is a commonly injured body part presenting in the emergency setting. For many injuries, x-ray imaging is the first line in diagnosis and these studies may reflect a significant proportion of the workflow of a radiologist in a general or subspecialty practice. However, these injuries are often missed or have a delay in diagnosis. The purpose of this course is to review normal anatomy in the shoulder as well as commonly encountered pathology to improve diagnosis and provide strategies when x-ray imaging cannot sufficiently establish a diagnosis.





ED004-MO

Emergency Radiology Monday Case of the Day

Monday, Dec. 2 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants

Gayatr^I Joshi, MD, Charleston, SC (*Presenter*) Nothing to Disclose Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc Margarita V. Revzin, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Paige E. Sharp, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Robin B. Levenson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Judith A. Gadde, DO, Newark, DE (*Abstract Co-Author*) Nothing to Disclose Heishun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Aaron D. Sodickson, MD,PhD, Boston, MA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, General Electric Company Nikhar Kinger, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Suzanne Czerniak, MD, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Karen S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Andrew Wong, MD,PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) Recognize key imaging findings on multimodality imaging of emergency/trauma patients. 2) Identify pathologic conditions based on the clinical information and imaging findings provided. 3) Understand relevant pathophysiology and recommend appropriate next step in management when appropriate.





SPDL20

Radiology Stranger Things: A Journey into the Upside Down (Case-based Competition)

Monday, Dec. 2 7:15AM - 8:15AM Room: E451B



AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 0

Participants

Eric B. England, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose Carl C. Flink, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

Special Information

This interactive session will use RSNA Diagnosis Live[™]. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

LEARNING OBJECTIVES

1) Review "strange" presentations of common and uncommon Musculoskeletal and Emergency Radiology pathology. 2) Discuss imaging findings associated with a variety of Musculoskeletal Radiology cases. 3) Differentiate Emergent from non-Emergent imaging findings associated with a variety of conditions. 4) Use mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 5) Receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance.







RC208

Emergency Cardiothoracic CT Angiography

Monday, Dec. 2 8:30AM - 10:00AM Room: E450B



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Douglas S. Katz, MD, Mineola, NY (Moderator) Nothing to Disclose

Sub-Events

RC208A Imaging of Venous Thromboembolism in Obesity: Pitfalls and Pearls

Participants Douglas S. Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

douglasscottkatzmd@gmail.com

LEARNING OBJECTIVES

1) To provide some 'pearls' for accurate interpretation of CT pulmonary angiography performed for suspected pulmonary embolism. 2) To review some potential 'pitfalls' in the interpretation of CT pulmonary angiography for suspected pulmonary embolism, using examples from clinical practice, and to discuss strategies for avoiding falling into these potential pitfalls. 3) To briefly review the relevant imaging literature.

RC208B CT Angiography of Acute Aortic Syndrome

Participants

Constantine A. Raptis, MD, Saint Louis, MO (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the imaging findings of patients presenting with the acute aortic syndrome. 2) Identify imaging findings in patients with the acute aortic syndrome that can affect prognosis or management. 3) Discuss mimics and confounding imaging findings in cases of suspected acute aortic syndrome.

RC208C Emergency Coronary CT Angiography

Participants Jeffrey M. Levsky, MD, PhD, Bronx, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jlevsky@montefiore.org

LEARNING OBJECTIVES

1) Identify the landmark studies that form the evidence base for ED coronary CTA. 2) Contrast the levels of evidence supporting CTA use in different settings. 3) Differentiate between proven and speculative benefits and drawbacks of CTA. 4) Assess the appropriateness of development of ED coronary CTA programs.





SSC04

Science Session with Keynote: Emergency Radiology (Imaging Algorithms and Technique)

Monday, Dec. 2 10:30AM - 12:00PM Room: S102CD

AI CT ER

AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Aaron D. Sodickson, MD, PhD, Boston, MA (*Moderator*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, Speaker, General Electric Company

Krystal Archer-Arroyo, MD, Decatur, GA (Moderator) Nothing to Disclose

Savvas Nicolaou, MD, Vancouver, BC (Moderator) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

Sub-Events

ssc04-01 Emergency Radiology Keynote Speaker: Acute Care - Why Care for Algorithms and Technique?

Monday, Dec. 2 10:30AM - 10:50AM Room: S102CD

Participants

Krystal Archer-Arroyo, MD, Decatur, GA (Presenter) Nothing to Disclose

SSC04-03 Reducing the Incidence of Venous Air Embolism in Contrast-Enhanced CT Angiography Using Preflushing of the Power Injector

Monday, Dec. 2 10:50AM - 11:00AM Room: S102CD

Participants

Jianxin Guo, Xian, China (*Presenter*) Nothing to Disclose Jia Xiaoqian, Xian, China (*Abstract Co-Author*) Nothing to Disclose Jianying Li, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company Jingtao Sun, Xian, China (*Abstract Co-Author*) Nothing to Disclose Yue Yao, Xian, China (*Abstract Co-Author*) Nothing to Disclose Yun Shen, PhD, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company Researcher, General Electric Company Qian Tian, Xian, China (*Abstract Co-Author*) Nothing to Disclose Shumeng Zhu, Xian, China (*Abstract Co-Author*) Nothing to Disclose Jian Yang, Xian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the incidence of venous air embolism (VAE) incidence with or without implementation of preflushing before connecting a power injector to a patient's catheter, aiming to reducing the VAE in contrast-enhanced CT angiography (CTA)

METHOD AND MATERIALS

The control group underwent the conventional injection procedure. In the preflushing group, the injector tubes were flushed at high speed (10 ml/s) with saline before being connected to the patients' indwelling catheters. The locations, number and sizes of VAE were analyzed. The difference in the incidence of VAE between the 2 groups was compared.

RESULTS

A total of 4900 adults (control/preflushing, 2190/2710) were included. A total of 228 (4.65%) patients were found to have 318 VAEs (285 bubbles and 33 gas-liquid plane VAEs). The incidence of VAE in the preflushing group (3.21%) was lower than that in the control group (6.44%); a similar trend was observed for multiple VAEs (P<0.05). VAEs occurred in the following locations from high to low frequency: right atrium>pulmonary artery trunk>superior vena cava>right ventricle>left brachial vein>right brachial vein. There was no significant difference in the location, shape or diameters (P=0.19) of VAEs between the two groups.

CONCLUSION

The proposed preflushing procedure is simple yet effective in reducing the incidence of VAE by 50.16% in patients with CTA thus improving safety during power injection.

CLINICAL RELEVANCE/APPLICATION

The first reported effective measure of preflushing power injector tubing at a high flow rate with saline can significantly reduce the incidence of VAE.

SSC04-04 Combination of Rapid Scanning with Wide-Detector and Adaptive Statistical Iterative Reconstruction-V Algorithm in Low Dose Chest CT for Unconscious Patients

Monday, Dec. 2 11:00AM - 11:10AM Room: S102CD

Participants

Yongjun Jia, MMed, Xianyang, China (*Presenter*) Nothing to Disclose Meng Jing, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose Yongfei Y. Hao Jr, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose Xiaohan Li, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose Dong Zhu, Xian Yang, China (*Abstract Co-Author*) Nothing to Disclose Xiaoai Qiao, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose Jianying Li, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company

PURPOSE

To explore the value of combining rapid scanning with wide-detector and new adaptive statistical iterative reconstruction (ASIR-V) in low dose chest CT for unconscious patients.

METHOD AND MATERIALS

Prospectively randomized 46 unconscious patients for chest CT into 2 spiral-scan groups: Group A (n=23) with 80mm collimation and 0.28s gantry rotation speed; Group B (n=23) with 40mm collimation and 0.5s speed to simulate conventional scan protocol. Both groups used the 120kV and AutomA technique (10-500mA) and 50% pre-ASIR-V to obtain a noise index of 14HU.The 0.625mm images were reconstructed with 50%ASIR-V and different kernels. Standard deviations of the antero-subcutaneous fat and back muscle of different scan modes and reconstructions were measured and compared with LSD-t test. The maximum diaphragmatic displacements were measured on sagittal images of the lung-kernel reconstruction and compared. Two radiologists performed 4level subjective assessments of image quality and motion artifact. The Wilcoxon test and Kappa test was used for image goodness and score consistency, respectively.

RESULTS

The mean scan time in Group A was 1.17s, 70% faster than the conventional protocol (3.91s) resulting in better overall image quality and no measurable diaphragmatic displacement in Group A, compared with the 4.70 ± 5.29 mm in Group B (p<0.05). There was no difference in radiation dose (1.33 vs. 1.48mSv) and image noise between the two scan groups.

CONCLUSION

The combination of fast scanning with 80mm collimation, 0.28s rotation speed and ASIR-V significantly reduces motion artifacts and image noise in low-dose chest CT for unconscious or uncooperative patients.

CLINICAL RELEVANCE/APPLICATION

The use of 80mm wide-detector and fast rotation speed combined with ASIR-V can significantly reduce motion artifacts and maintain image quality at low radiation dose, and is more suitable for the chest CT examination for unconscious or uncooperative patients.

SSC04-05 Comparison of Baseline, Bone-Subtracted, and Edge-Enhanced Chest Radiographs for Detection of Pneumothorax

Monday, Dec. 2 11:10AM - 11:20AM Room: S102CD

Participants

Fatemeh Homayounieh, MD, Boston, MA (Presenter) Nothing to Disclose

Matthew D. Gilman, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

Chayanin Nitiwarangkul, MD, Bangkok, Thailand (Abstract Co-Author) Nothing to Disclose

Ramandeep Singh, MBBS, Boston, MA (Abstract Co-Author) Nothing to Disclose

Ruhani Doda Khera, MD, Cambridge, MA (Abstract Co-Author) Nothing to Disclose

Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Speaker, Siemens AG; Research Grant, Lunit Inc; Researcher, Merck & Co, Inc; Researcher, Pfizer Inc; Researcher, Bristol-Myers Squibb Company; Researcher, Novartis AG; Researcher, F. Hoffmann-La Roche Ltd; Researcher, Polaris Pharmaceuticals, Inc; Researcher, Cascadia Healthcare, LLC; Researcher, AbbVie Inc; Researcher, Gradalis, Inc; Researcher, Zai Lab

Jo-Anne O. Shepard, MD, Boston, MA (Abstract Co-Author) Editor with royalties, Reed Elsevier

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PURPOSE

To assess detectability of pneumothorax on unprocessed baseline (Up), bone-subtracted (B-), and edge-enhanced (E+) frontal chest radiographs (CXR).

METHOD AND MATERIALS

Our retrospective IRB approved study included 202 patients (mean age 53 ± 24 years; 132 men, 70 women) who underwent frontal CXR and had trace (<5mm), moderate (>=5mm, <3cm), large (>=3cm), or tension pneumothorax. All patients (except those with tension pneumothorax) had concurrent chest CT performed within 1-7 days of CXR for clinically indicated reasons. Two radiologists reviewed the CXR and chest CT for pneumothorax on Up CXR (ground truth). All Up CXR were processed to generate B- and E+ images (ClearRead X-ray, Riverain Inc). Two separate thoracic radiologists (R1, R2) sequentially assessed the Up, B- and E+ images and separately recorded the presence of pneumothorax (side, size and confidence for detection) for each image type. Area under the curve (AUC) was calculated with ROC analyses to determine the accuracy of pneumothorax detection.

There were 120 right, 95 left, and 13 bilateral pneumothoraces with 53 trace, 87 moderate, 29 large, and 46 tension pneumothoraces. B- images had the lowest accuracy for detection of pneumothorax compared to Up and E+ images (p<0.01). With B-, the sensitivity dropped from 91% to 84% on the right side and 83% to 77% on the left for R1 but remained relatively unchanged for R2 (87% vs 86%). Highest detection rates, and confidence was noted for the E+ images (empiric AUC for R1 and R2 0.95-0.99). No false positive pneumothorax was noted on either B- or E+ images.

CONCLUSION

Enhanced CXRs are superior to bone subtraction and unprocessed radiographs for detection of pneumothorax.

CLINICAL RELEVANCE/APPLICATION

Enhanced CXRs improve detection of pneumothorax over unprocessed images; bone subtracted images must be cautiously reviewed to avoid false negatives.

SSC04-06 FFR-CT in the Evaluation of Acute Chest Pain - Concepts and First Experiences

Monday, Dec. 2 11:20AM - 11:30AM Room: S102CD

Participants

Richard Bayer, Charleston, SC (*Presenter*) Institutional Research support, Bayer AG; Institutional Research support, HeartFlow, Inc; Institutional Research support, Siemens AG

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PURPOSE

Fractional flow reserve derived from coronary CTA (FFR-CT) is becoming rapidly established in the evaluation of patients with chronic stable angina in an elective setting. However, the utility of FFR-CT in the work-up of patients presenting to the Emergency Department (ED) with acute chest pain (ACP) is insufficiently studied. We evaluated the hospital course and treatment decisions along with the 30-day rate of major adverse cardiovascular events (MACE) in ACP patients undergoing cCTA and FFR-CT in the ED.

METHOD AND MATERIALS

Patients between the ages of 18-95 years who presented to our ED with ACP and underwent clinically indicated cCTA and FFR-CT were included, if their cCTA interpretation showed coronary artery stenosis between 30-90% luminal narrowing. cCTA was acquired using 3rd generation dual-source CT and FFR-CT was performed using the commercially available computational fluid dynamics approach (HeartFlow®, Redwood City, CA). Subjects were evaluated for patient management decisions, 30 day MACE, repeat presentation to the ED, and 30 day additional testing for evaluation of chest pain. They were subsequently compared to a control group of patients who also presented to the ED with ACP, but underwent alternative evaluation strategies.

RESULTS

The average turnaround time for completing FFR-CT analyses was 3h 22min. 16/31 patients (52%) with stenosis grade of 30-90% by cCTA had negative FFR-CT (>0.80), of whom 9 (56%) were discharged from the ED and 2 of whom underwent invasive coronary angiography (ICA) during the index ED visit, with 1 being revascularized. In comparison, 10/15 patients with FFR-CT <0.80 underwent ICA. Out of the 16 patients without functionally significant coronary artery disease (CAD) by FFR-CT, 15 (93%) did not undergo revascularization and did not experience MACE during the 30-day follow-up. One patient was referred for ICA in the setting of severe stenosis on cCTA, albeit with negative FFR-CT, where ICA showed severe multivessel disease prompting subsequent revascularization. Conversely, 3 patients with FFR-CT <0.80 experienced MACE during follow-up. Within 30-days 2 patients with FFR-CT <0.80 were readmitted, versus none in the FFR-CT>0.80 group. Overall, a negative FFR-CT analysis translates into a high negative predictive value to exclude 30-day MACE occurrence of 94% in this preliminary cohort.

CONCLUSION

These preliminary data suggest that FFR-CT could be utilized for a more rational risk stratification and disposition of patients who present to the ED with ACP than with cCTA alone, helping to differentiate those who would benefit from admission and further invasive management versus those who could be safely discharged. While prior studies have demonstrated utility in the stable chest pain population, to our knowledge this represents the first reported experience in the ACP, ED setting.

CLINICAL RELEVANCE/APPLICATION

cCTA with subsequent FFR-CT demonstrate potential for accurate and safe evaluation of CAD in patients presenting to the ED with ACP.

SSC04-07 Comparison of ASPECTS by Human Observers and Automated ASPECTS in Prediction of Final Infarct Volume in Anterior Circulation Emergent Large Vessel Occlusion

Monday, Dec. 2 11:30AM - 11:40AM Room: S102CD

Participants

John P. Walsh, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Omar Metwally, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Shobhit Mathur, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Maria Zhu, MSc, Vancouver, BC (*Presenter*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

PURPOSE

To compare human non-contrast CT ASPECTS, human CT angiography ASPECTS and automated ASPECTS as predictors of final infarct volume in emergent large vessel occlusion in anterior circulation

METHOD AND MATERIALS

CT studies at presentation of consecutive patients (n=98) presenting with emergent large vessel occlusion in the anterior circulation (terminal ICA, M1, proximal M2) were reviewed. ASPECTS readings were made by two radiologists on non-contrast CT and CT angiography studies independently in a blinded fashion. The observers were blinded from each other, other imaging studies and clinical and patient data. Automated ASPECTS readings were recorded from a research based software package. The observers later made consensus ASPECTS readings on follow-up CT or MRI performed within 7 days of presentation. Spearman's rank correlation was performed. Kappa statistic was calculated to test inter-observer agreement among the human readers.

RESULTS

Substantial correlation with final ASPECTS was found for human NCCT ASPECTS (r=0.713, p<0.001) and human CTA ASPECTS (r=0.718, p<0.001) readings. The correlation was good for automated ASPECTS (r=0.543, p<0.001). Good interobserver agreement was seen for NCCT ASPECTS (kappa = 0.628) and CTA ASPECTS (kappa = 0.611).

CONCLUSION

Compared to automated ASPECTS, the ASPECTS by human observers correlates better with final infarct volume in anterior circulation emergent large vessel occlusion. NCCT ASPECTS and CTA ASPECTS show good agreement among the human observers.

CLINICAL RELEVANCE/APPLICATION

ASPECTS is a valuable prognostic marker and important tool to make clinical decisions in acute ischemic stoke. Ongoing validation of machine learning based research applications is important.

SSC04-08 Unsupervised Detection of Various Intracranial Diseases on Brain CT Using Generative Adversarial Networks (GANs)

Monday, Dec. 2 11:40AM - 11:50AM Room: S102CD

Participants

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PURPOSE

The main obstacles in applying supervised learning to imaging diagnosis are limited number of abnormal images and effort to annotate training set. In this study, we aim to assess value of simplified AnoGAN (anomaly detection with generative adversarial networks) model in detecting various intracranial disease on brain CT in an unsupervised manner.

METHOD AND MATERIALS

We trained a Progressive Growing of GAN (PGGAN) to generate realistic artificial CT images, using the training set of 1,159 normal brain CT scans (37,324 slices). Test set consisted of total 200 axial slices of brain CT images (100 abnormal images and 100 normal images). Using our simplified AnoGAN model, PGGAN-trained generator yields a corresponding realistic fake image to a given test image by minimizing mean square error between the fake and the test images. The differences between the fake and the test image on attention maps can detect and localize abnormal findings. For evaluation of the detection performance, we classified various intracranial diseases into 4 groups: intracranial hemorrhage, acute infarction including hypoxic brain injury, tumor including primary brain tumor and metastasis, and other diseases. If the attention map partially included the abnormal lesions, it was considered a positive detection.

RESULTS

Total per-slice sensitivity was 89.0% (89/100) and total per-lesional sensitivity was 87.2% (102/117). For each disease group, sensitivity was 91.3% (21/23) for hemorrhage, 85.2% (23/27) for acute infarction, 96.8% (30/31) for tumor and 78.9% (15/19) for other diseases. Evaluation for other performance characteristics was limited due to difficult quantification and calculation of non-pathologic false positive detections.

CONCLUSION

We suggest that unsupervised learning of GANs using healthy dataset can be used to detect various intracranial diseases on unseen data and has high sensitivity to detect anomalies.

CLINICAL RELEVANCE/APPLICATION

We propose that this model can be useful for screening and triaging emergency patients with various intracranial diseases by detecting anomalies on CT.

SSC04-09 Color-Coded Virtual Non-Calcium Dual-Energy CT for the Depiction of Bone Marrow Edema of the Calcaneus in Patients with Acute Tarsal Trauma: A Multireader Diagnostic Accuracy Study

Participants Christian Booz, MD, Frankfurt am Main, Germany (*Presenter*) Speaker, Siemens AG Ibrahim Yel, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose Lukas Lenga, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose Simon S. Martin, MD, Charleston, SC (*Abstract Co-Author*) Institutional Research support, Siemens AG Katrin Eichler, MD, Frankfurt am Main, Germany (*Abstract Co-Author*) Nothing to Disclose Moritz H. Albrecht, MD, Charleston, SC (*Abstract Co-Author*) Speaker, Siemens AG Julian L. Wichmann, MD, Frankfurt, Germany (*Abstract Co-Author*) Speaker, General Electric Company Speaker, Siemens AG Nicole Huizinga, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose Thomas J. Vogl, MD, PhD, Frankfurt , Germany (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the diagnostic accuracy of a dual-energy computed tomography (CT) virtual non-calcium (VNCa) technique for the depiction of traumatic bone marrow edema of the calcaneus.

METHOD AND MATERIALS

Data from 62 patients with acute tarsal trauma who had undergone third-generation dual-source dual-energy CT and 3-T magnetic resonance imaging (MRI) within seven days between January 2017 and July 2018 were retrospectively analyzed. Five radiologists, blinded to clinical and MRI information, independently assessed conventional grayscale dual-energy CT series for the presence of fractures; after at least eight weeks, readers re-evaluated all cases using color-coded VNCa reconstructions for the presence of bone marrow edema for four calcaneal regions. Quantitative analysis of CT numbers on VNCa reconstructions was performed by a sixth radiologist. Two additional experienced radiologists (32 and 20 years of experience in musculoskeletal imaging), blinded to clinical and CT information, assessed MRI series in consensus to define the reference standard. Sensitivity, specificity and the area under the curve (AUC) were the primary indices for diagnostic accuracy.

RESULTS

MRI revealed a total of 62 areas with focal posttraumatic bone marrow edema in 39 patients. Fractures were present in 11 patients. In the qualitative analysis, VNCa showed high overall sensitivity (286/310 [92%]), specificity (899/930 [97%]), positive predictive value (286/317 [90%]), negative predictive value (899/923 [97%]) and accuracy (1185/1240 [96%]) for the depiction of bone marrow edema. Inter-reader agreement was excellent (κ =0.84). CT numbers obtained from VNCa were significantly different in areas with or without edema (p<.001). The overall AUC was 0.98. A cut-off value of -53 Hounsfield units (HU) provided a sensitivity of 82 % (51/62) and specificity of 95% (176/186]) for differentiating bone marrow edema.

CONCLUSION

In both quantitative and qualitative analyses, dual-energy CT VNCa reconstructions show excellent diagnostic accuracy for the depiction of traumatic calcaneal bone marrow edema compared to MRI by enabling direct color-coded visualization.

CLINICAL RELEVANCE/APPLICATION

Bone marrow edema may be visualized using color-coded VNCa reconstructions during dual-energy CT performed for detection of fracture in patients with acute tarsal trauma, potentially replacing MRI in patients with contraindications.







ERS-MOA

Emergency Radiology Monday Poster Discussions

Monday, Dec. 2 12:15PM - 12:45PM Room: ER Community, Learning Center



AMA PRA Category 1 Credit ™: .50

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Participants

Karen S. Lee, MD, Boston, MA (Moderator) Nothing to Disclose

Sub-Events

ER204-SD-MOA1 Pregnant Trauma: Retrospective Analysis of Fetal Outcome in the Trauma of Pregnant Patients Station #1

Participants

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PURPOSE

The purpose of this study was to analyze the fetal outcome in the trauma of pregnant patients. The relationship between fetal outcome and various factors such as the mechanism of maternal injury and fetal ultrasound findings were studied.

METHOD AND MATERIALS

The study was IRB approved and HIPAA compliant. Pregnant patients>=16 years old who sustained blunt or penetrating trauma 5/1/2005-2/28/2017 from two Level 1 trauma centers were included. During this period, a total of 152 pregnant patients met the inclusion criteria. Data collected included the type of trauma, mechanism of injury, maternal injury, fetal ultrasound, and fetal outcome.

RESULTS

130/152 (85.5%) patients sustained blunt trauma and 18/152 (11.8%) patients sustained penetrating trauma. Motor vehicle collision was the most common mechanism of blunt trauma (n=74 or 56.9%). Gunshot wound was the most common mechanism of penetrating trauma (n=10 or 55.6%). There were 12 cases of fetal demise; 11 from maternal blunt trauma (11/130) and 1 from maternal penetrating trauma (1/18). Findings on initial fetal ultrasound included no fetal heart rate (6/12), no acute findings (3/12), not obtained (2/12), and placental abruption (1/12). There were 15 cases of positive fetal ultrasound findings; 12 from maternal blunt trauma (12/130) and 3 from maternal penetrating trauma (3/18). Findings included no fetal heart rate (7/15), bradycardia/distress (2/15), perigestational sac bleed (1/15), uterine rupture (1/15), placental rupture (1/15), irregularly shaped gestational sac (1/15), and limited evaluation (2/15). Of 7 cases of no fetal heart rate, 6 cases were fetal demise while 1 case was an early normal pregnancy. Two cases of bradycardia/distress led to birth at the time of admission while the remaining cases led to normal pregnancy.

CONCLUSION

Eight percent of blunt trauma and six percent of penetrating trauma resulted in fetal demise. The most common finding on the fetal ultrasound associated with fetal demise is no fetal heart rate, followed by no acute findings. No fetal heart rate and placental rupture are two findings associated with fetal demise.

CLINICAL RELEVANCE/APPLICATION

Trauma in pregnant patients is important as it involves both the mother and the fetus. Imaging evaluation with MRI, CT, and fetal US provides important information during the initial evaluation.

ER205-SD- Usefulness of a Clinical Decision Support System (CDSS) for Suitability of Performance of an Aortic CT-Angiography for the Diagnosis of Acute Aortic Syndrome (AAS) MAPAC Imaging Project

Station #2 Participants

Blanca Lumbreras-Fernandez, MD, Madrid, Spain (*Presenter*) Nothing to Disclose Manuel Vicente Redondo, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Nicolas A. Almeida SR, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Fernando Gonzalez-Tello, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Alfonso Muriel Garcia, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Borja Fernandez-Felix, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Ines Pecharroman, PhD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Agustina Vicente Bartulos, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the utility of the algorithm used in our emergency department for the suitability of performance of an aortic CTangiography for the clinical suspicion of AAS. Also, to evaluate the possible association of the included variables with the radiological findings.

METHOD AND MATERIALS

An algorithm-based radiological approach was developed for clinical use of the CDSS. The algorithm considers three variable groups: symptoms, signs and clinical history; and three risk categories were established: low, intermediate, high. We reviewed aortic CT-angiography performed from March 2016-June 2018, which were requested due to suspected AAS using the algorithm developed. Chi-2 test and multinomial logistic regression were used in the statistical analysis performed between variables included in the CDSS algorithm and the findings in the CT.

RESULTS

We found 130 patients met the established criteria. In total, 19 patients (14.6%) had AAS and 34 patients (26.2%) had another acute disease. A total of 10 patients (7.7%) were in the low risk group, 48 (36.9%) in the intermediate group and 72 (55.4%) in the high risk group. None of the patients from the low risk group had AAS. In the intermediate group, 4 patients (8.3%) had AAS, while in the high risk group we found 15 patients (20.8%) with AAS. The probability of having AAS diagnosed in CT in those patients with a history of aortic aneurysm is 3.4 times higher (p=0.021), whereas the probability of having AAS with an auscultation suggestive of aortic valve insufficiency is 5.1 times higher. (p=0.019).

CONCLUSION

The use of an algorithm in the emergency department that includes clinical presentation, patient history and complementary tests, can be useful to optimize the diagnosis of AAS. Further investigations and a larger sample of patients are necessary to establish a clinical prediction rule.

CLINICAL RELEVANCE/APPLICATION

We propose a decision algorithm for performing an aortic CT-angiography in cases of clinical suspicion of AAS in the emergency department.

ER206-SD- Performance Evaluation of a Deep Learning Algorithm in Measuring Midline Shift in Head CT Scans MOA3 Station #3

Participants

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PURPOSE

Midline shift (MLS) has been associated with poor prognosis in patients with spontaneous intracerebral hemorrhage (sICH). Calculating the MLS is a simple way to quantify the early mass effect in patients with sICH.To evaluate the performance of a deep learning algorithm in measurement of midline shift for patients with sICH using head CT images.

METHOD AND MATERIALS

200 patients with cerebral hemorrhage from July 2017 to December 2018 were retrospectively collected in our hospital and 56 patients with acute sICH were finally included in this study. Two radiologists with more than 10 years' working experience used the Philips post-processing workstation software (Extended Brilliance Workstation) to assess MLS at several locations, including the pineal gland septum pellucidum and cerebral falx. MLS (max) was defined as the maximum midline shift among these locations. The average of MLS (max) measured by two radiologists was used as the gold standard. A deep learning-based commercial artificial intelligence (AI) diagnostic system was used to measure the MLS (max). Kappa statistic was used to analyze concordance of MLS(max) between the gold standard and deep learning algorithm. The wilcoxon signed rank test of paired samples was used to analyze the MLS(max) between the gold standard and deep learning algorithm.

RESULTS

In 56 patients with sICH, 38 (67.86%) patients had midline shift. MLS(max) was (4.81 ± 0.70) mm for gold standard and (2.17 ± 0.47) mm for deep learning algorithm with statistically significant difference (P<0.001). Kappa statistic between gold standard and deep learning algorithm was low (K=0.032), representing poor agreement for MLS (max).

CONCLUSION

AI based deep learning algorithm is still insufficiently accurate in measuring MLS (max) for patients with sICH in their CT images, resulting in poor agreement with gold standard.

CLINICAL RELEVANCE/APPLICATION

The clinical value of AI measured extent of midline shift in patients with spontaneous intracerebral hemorrhage is limited due to its insufficiency in measurement accuracy.

ER241-SD- 256-Rows Dual-Energy CT Virtual Decalcification Technique for Detection of Bone Marrow Edema at Visual and Quantitative Analyses

Station #4

Participants Kun Zhang, MD, Changsha, China (*Presenter*) Nothing to Disclose Luyou Yan, Changsha, China (*Abstract Co-Author*) Nothing to Disclose Junhan Pan, BS, Changsha, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic performance of dual energy computed tomography (CT) virtual decalcification (VNCa) technique for detection of bone marrow edema (BME) in patients with vertebral compression fractures.

METHOD AND MATERIALS

This institutional review board-approved study included 29 consecutive patients with 73 vertebral fractures who underwent both a dual energy CT examination (Revolution CT scanner, GE Healthcare) and a 3-T magnetic resonance (MR) examination of the spine between October 2018 and January 2019. MR images served as the reference standard. Two independent and blinded readers visually evaluated all vertebral bodies for the presence of abnormal bone marrow attenuation on color-coded overlay virtual VNCa DECT images by using a binary classification system (0=chronic compression fracture, 1=acute compression fracture); specificity, sensitivity, predictive values, and inter-observer agreements were calculated. Another reader performed a quantitative analysis on VNCa DECT images; cut-off value was calculated using ROC analysis.

RESULTS

MR imaging depicted 43 edematous and 30 nonedematous vertebral compression fractures. In the visual analysis, VNCa DECT images had an overall sensitivity of 88.4%, specificity of 100.0%, positive predictive value of 100%, and negative predictive value of 90.3%. The interobserver agreement was excellent ($\kappa = 0.82$). CT content obtained from VNCa DECT images were significantly different between vertebrae with and without bone marrow edema on MR (p < 0.001). Receiver operating characteristic curve (ROC) analysis revealed an area under the curve (AUC) of 0.886. A cutoff value of 1036.9 mg/m3 provided sensitivity of 86%, specificity of 82.1% for the differentiation of edematous vertebral bodies. The AUC of visual image analysis is larger than quantitative VNHAP image evaluation (0.942 > 0.886).

CONCLUSION

Visual and quantitative analyses of dual energy CT virtual decalcification (VNCa) technique had excellent diagnostic performance for identifying acute and chronic compression fractures. And the diagnostic efficiency of the visual image analysis is higher than that of quantitative image evaluation.

CLINICAL RELEVANCE/APPLICATION

Dual energy CT virtual decalcification (VNCa) technique can serve as a useful tool for accurate diagnosis of acute and chronic vertebral compression fractures, which has potential clinical and health-economic benefits.

ER227-SD- Pitfalls of Automated ASPECTS: Initial Experience in A Tertiary Care Centre

Station #5

Participants Shobhit Mathur, MD, Vancouver, BC (*Presenter*) Nothing to Disclose Omar Metwally, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Maria Zhu, MSc, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

PURPOSE

To compare the performance of automated ASPECTS provided by two software applications in acute stroke

METHOD AND MATERIALS

The non-contrast CT head studies of 91 consecutive patients referred with clinical suspicion of acute stroke were reviewed retrospectively by two observers and ASPECTS readings were made, first in an independent blinded fashion and later in consensus. A blinded consensus reading was also made on follow-up CT or MRI study (available for 67 patients) performed within 7 days. The observers then noted the readings from the software, also noting the possible cause of differences from the consensus readings.

RESULTS

The consensus human readings on the initial studies showed substantial correlation with automated results on the same studies from software package 1 (r=0.613, p<0.001) and software package 2 (r=0.663, p<0.001). The consensus human readings on follow up studies showed moderate to poor correlation with automated results on initial studies from software package 1 (r=0.353, p<0.001) and software package 2 (r=0.428, p<0.001). Segmentation errors, presence of extra-axial collections, anatomic asymmetry and chronic infarcts were common causes of misreadings by the softwares.

CONCLUSION

In our initial experience, although automated ASPECTS from both the softwares showed good correlation with human readings in acute stroke, they were moderate-poor predictors of final infarct volume.

CLINICAL RELEVANCE/APPLICATION

ASPECTS is a valuable tool in evaluation of acute stoke studies. The suggestions highlighted here would help ongoing improvement in the emerging machine learning based software applications in acute stroke imaging.

ER165-ED- Retroperitoneal Injuries on MDCT from Blunt and Penetrating Trauma Revisited: Pearls and Pitfalls MOA6

Participants Jessica G. Kumar, Miami Beach, FL (*Presenter*) Nothing to Disclose Fabio M. Paes, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose Anthony M. Durso, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose David Dreizin, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG Douglas S. Katz, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose Christopher G. Puchferran, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose Daniel Suarez, MD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose Felipe Munera, MD, Key Biscayne, FL (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Review the retroperitoneal anatomy and organs Revisit retroperitoneal injuries on MDCT sustained from blunt and penetrating trauma Discuss diagnostic pearls and common pitfalls in diagnosing retroperitoneal injuries on MDCT

TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Incidence of retroperitoneal injuries b. Patient demographics c. Commonest mechanisms of injury 2. Retroperitoneal anatomy a. Boundaries i. Anterior: posterior parietal peritoneum ii. Posterior: transversalis fascia iii. Craniocaudal: diaphragm to pelvic brim b. Compartments i. Anterior pararenal 1. Boundaries: 2. Contents: ii. Perirenal 1. Boundaries: 2. Contents: iii. Posterior pararenal 1. Boundaries: 2. Contents: 3. Retroperitoneal injuries a. Anterior pararenal i. Gastrointestinal injuries: 1. Distal esophagus 2. Second and third portions of the duodenum 3. Ascending and descending colon ii. Pancreatic injuries iii. Vascular injuries: 1. Aorta 2. IVC b. Perirenal i. Adrenal injuries ii. Renal injuries c. Posterior pararenal i. Muscular injuries ii. Other 4. Diagnostic pearls 5. Common pitfalls

ER162-ED- The Top 10 Radiological Diagnosis for the Pediatric Emergency Room: A Practical and Pictorial Review MOA7 from Head to Toe

Station #7

Participants Alvaro Paniagua, MD, Madrid, Spain (*Presenter*) Nothing to Disclose Jose L. Crespo San Jose, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Miguel Paniagua, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Adriana Fernandez Gonzalo, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Carlos Calles Blanco, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Maria Jesus Adan Martin, Toledo, Spain (*Abstract Co-Author*) Nothing to Disclose Isabel G. Gordillo, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

A review of the most frequent and characteristic pathologies in the emergency department for pediatric population that required a radiological diagnosis.

TABLE OF CONTENTS/OUTLINE

Based on our experience, we show a practical exhibition of the ten most frequent and most important diseases that every radiologist who attends pediatric emergencies should know: 1.Neonatal Hypoxic Ischemic Encephalopathy (HIE), 2.Cranioencephalic trauma, 3.Fractures, with a special focus on hidden fractures and child abuse, 4.Viral infection of the lower respiratory tract, 5.Bacterial pneumonia and complications related to pneumonia, 6.Pneumothorax, 7.Appendicitis, 8.Intussusception, 9.Hypertrophic pyloric stenosis (HPS), 10.Testicular and ovarian torsion. Samples, pitfalls, the best radiological tricks and tools for an initial analysis and the top differential diagnosis are shown for each one, as well as some recommended bibliography for a more in depth analysis.







ERS-MOB

Emergency Radiology Monday Poster Discussions

Monday, Dec. 2 12:45PM - 1:15PM Room: ER Community, Learning Center

ER

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants

Howard P. Forman, MD, New Haven, CT (Moderator) Nothing to Disclose

Sub-Events

ER207-SD- Correlation between the Severity of Traumatic Aortic Injury and Clinical Outcomes at a Level 1 MOB1 Trauma Center

Station #1 Participants

Ahmed M. Sobieh, PhD, Worcester, MA (*Presenter*) Nothing to Disclose Byron Y. Chen, MD, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose Jon Dorfman, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose Hao S. Lo, MD, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To determine if severity of traumatic aortic injury correlates with various clinical outcomes including: mortality, concomitant injuries, and length of hospital stay. To determine if severity of traumatic aortic injury can guide in clinical management.

METHOD AND MATERIALS

IRB-approved, HIPPA compliant retrospective study, informed consent requirement was waived. Data extracted from PACS & Trauma registry in a tertiary care university hospital from January 2005 to December 2018. Inclusion: Adult patients presenting with blunt trauma. Patients with CT scan showing acute aortic traumatic injury. Exclusion: None. Demographic data, trauma mechanism, injuries, calculated Injury severity score (ISS), hospital length of stay, operative management, clinical outcome (alive or dead) were obtained from the trauma registry. Two blinded emergency radiologists reviewed the CT images of all patients included in our cohort. We classified aortic injury into 4 types: Grade 1: intimal tear, Grade 2: focal dissection/intramural hematoma, Grade 3: pseudoaneurysm, Grade 4: rupture.

RESULTS

We identified 91 patients in our electronic medical records with various degrees of traumatic aortic injuries identified by CT. 46 blunt trauma patients had images available for review. 37 (80%) were male. The median age was 49 years old (range 18- 89). Median injury severity score (ISS) was 35. 38 patients survived to discharge, only 8 patients died (17%). Associated injuries include intra-abdominal (n=34, 74 %), traumatic brain injury (n =15, 33%), extremity injury (n=37, 80%). spine fractures ((n=25, 54%). Aortic injury grades were as follows 8 (17%) grade 1, 15 (33%) gade 2, 21 (46%) grade 3, and 2 (4%) grade 4. Twenty four (52%) had operative intervention. 12.5%, 40%, 76% and 50% with increasing grade from 1 to 4 respectively. The overall mortality was 17%. Mortality was 25%, 13%, 14% and 50% by grade 1, 2, 3, and 4 respectively.

CONCLUSION

CT assessment of aortic injury severity can guide clinical management and predict outcome. Patients with a lower injury severity score, grades I and II, may not survive but it is their associated injuries which determine their mortality.

CLINICAL RELEVANCE/APPLICATION

CT angiography is highly sensitive in detecting significant actue aortic injuries and is recommended in the initial evaluation of suspected acute aortic injury. Different grades of aortic injury correlate to clinical outcome and length of hospital stay.

ER208-SD- A Comparative Study on the Detection Efficiency for Different Types of Fractures Based on Deep MOB2 Learning (DL) Algorithm

Station #2 Participants

Yanhong Zhao, MMed, MMed, Yinchuan, China (*Presenter*) Nothing to Disclose Xiaowen Zhang, MBBS, MBBS, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose Jie Ding, Ning Xia, China (*Abstract Co-Author*) Nothing to Disclose Jun Gu Sr, Beijing, China (*Abstract Co-Author*) Nothing to Disclose Ruoshui Ha, BA, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose Lili Yang, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose Fang Wang, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose Yu Ziting, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To explore differences in the detection efficiency using deep learning (DL) based artificial intelligence (AI) diagnostic system for complete fracture, incomplete fracture and old rib fracture.

METHOD AND MATERIALS

In this retrospective study, a total of 76 patients with emergency chest trauma underwent chest CT examination were collected. All CT images were reconstructed using the lung algorithm and subsequently imported to a commercial AI diagnostic system (InferRead CT Bone research, Infervision, Beijing) to detect the presence of rib fractures. Rib fractures used as gold standard were labeled by two radiologists with more than 15 years of experience in chest diagnosis combined with results generated by DL-based system. Rib fractures were classified into three groups, including complete, incomplete and old fractures. The detection number of different types of fractures by the system was recorded and the sensitivity of different types of fractures compared using chisquare test.

RESULTS

A total of 329 rib fractures including 118 complete fractures, 103 incomplete fractures and 108 old fractures were established as the gold standard. Based on the results obtained using AI system, we detected a total of 331 rib fractures including 289 true positive (TP) fractures. Among all TP fracture, 113 were marked as complete fractures, along with 84 incomplete fractures and 92 old fractures. Therefore, the sensitivity of AI for rib fracture detection was 87.84%, and the false positive rate was 2.81%. The detection rate for complete fracture, incomplete fracture and old fracture was 95.76%, 81.55% and 85.19%, respectively. There was a statistically significant differences in sensitivity among three types of rib fracture detected by AI (P=0.003). Particularly, the diagnostic rate in the detection of complete fracture was found to be significantly greater than that of incomplete fracture and old fracture.

CONCLUSION

The diagnostic efficiency using AI in the detection of rib fracture was found to be correlated with the fracture type. Particularly, complete fracture was found to be best identified by the AI system compared to incomplete and old fracture.

CLINICAL RELEVANCE/APPLICATION

AI system demonstrated different performances in the detection of different types of fractures, and the effectiveness of complete fracture examination is found to be better than incomplete fractures and old fractures.

ER209-SD-MOB3 Speed Balling: Identify Lab Values Which May Predict a Positive Imaging Finding on a CT to Help Triage Patients in an ED Setting

Station #3

Alexander R. Moeller, BS, Brookline, MA (*Presenter*) Nothing to Disclose Ashwin Jain, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Mustafa Qureshi, MBBS, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Bindu Setty, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Participants

Patients frequently present to the emergency department acutely intoxicated on a combination of heroin and cocaine (speedball) with altered mental status. Consequently, many of these patients receive neuroimaging. The purpose of our study is to identify laboratory characteristics that predict for positive imaging findings, with the goal to help triage such patients who would require neuroimaging following speedball use.

METHOD AND MATERIALS

We obtained study data through a retrospective review of clinical, laboratory, and imaging data in the electronic medical records. Patients presenting with urine toxicology positive for opiates and cocaine who underwent neuroimaging were selected for analysis. Imaging data, including CT head from the associated hospitalization was collected. Clinical and laboratory data were also included for analysis. Crude and adjusted odds ratios were calculated using SAS software.

RESULTS

A total of 105 patients matching the study criteria were identified. The mean age was 42 years old (range: 22 to 63) and 72.4% of patients were male (n=76). On multivariate analysis (MVA) adjusting for age and gender, positive hepatitis C status (OR 3.33 [95% Confidence Interval (CI) 0.34-30.34], p=0.289), abnormal echocardiogram (OR 3.51 [95% CI 0.60-20.49], p=0.164), and head trauma (OR 1.46 [95% CI 0.44-4.85], p=0.539) were positively associated with abnormal neuroimaging. Laboratory findings including elevated white blood cell count (OR 1.02 [95% CI 0.35-3.03], p=0.968) and positive blood culture (OR 0.84 [95% CI 0.19-3.73], p=0.813) were not significantly associated with abnormal neuroimaging.

CONCLUSION

Though our results did not reach statistical significance, there was a trend toward an abnormal findings on neuroimaging in patients with positive hepatitis C status, abnormal echocardiogram, or head trauma. These criteria could help identify patients most appropriate to receive neuroimaging in the setting of speedball use.

CLINICAL RELEVANCE/APPLICATION

Our study could help identify subset of patients likely to have abnormal neuroimaging findings presenting to the ED under the influence of speedball.

ER228-SD- Intraosseous Contrast Administration for Emergency Computed Tomography: A Case-Control Study MOB4

Station #4

Participants Philipp Schindler, MD, Muenster, Germany (*Presenter*) Nothing to Disclose Anne Helfen, MD, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose Moritz Wildgruber, MD, PhD, Iffeldorf, Germany (*Abstract Co-Author*) Nothing to Disclose Walter L. Heindel, MD, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose Christoph Schuelke, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose Max Masthoff, MD, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The aim of the study was to evaluate the feasibility of intraosseous (i.o.) contrast media injection (CMI) for emergency computed tomography (CT) of severe trauma and the associated image quality compared to intravenous (i.v.) CMI.

METHOD AND MATERIALS

The authors retrospectively analyzed objective (contrast-to-noise ratio (CNR)) and subjective (4-point Likert scale) image quality of CTs after i.o. (n=4) versus i.v. (n=20) CMI. All patients underwent a native head CT scan, a cerebral CT angiography (CTA) and CTA of the supra-aortic vasculature as well as a chest and abdominal CT scan in the venous phase; one patient with an i.o. access additionally received a CTA of the lower limbs. Electronic patient records have been reviewed to determine i.o. access related complications.

RESULTS

Both groups were consistent in age, heart rate, scan parameters including the flow rate of the contrast agent, resulting in comparable radiation dose levels. The image noise and CNR had no significant difference between the two groups. Scoring the delineation of the main vessels after i.o. CMI showed very good or good results (80% and 20% of patients) and no significant difference to the i.v. group. There were no CT or i.o. access related complications observed.

CONCLUSION

The i.o. access is a safe and suitable alternative for emergency CMI in CT. Using established protocols good to very good image quality can be achieved, comparable to i.v. CMI. We show for the first time, that i.o. CMI is also feasible for CTA imaging of the head and neck region as well as of pelvic and leg vessels.

CLINICAL RELEVANCE/APPLICATION

The intraosseous access is a safe and suitable alternative for emergency contrast media injection in CT while intraosseous contrast media injection is also feasible for CTA imaging of the head and lower limbs.

ER229-SD- Improved Detection of Acute Small Vessel Occlusions Using CT Perfusion in Acute Stroke MOB5

Station #5

Participants Shobhit Mathur, MD, Vancouver, BC (*Presenter*) Nothing to Disclose John P. Walsh, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Omar Metwally, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Bonnie Niu, BSC, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

PURPOSE

To evaluate the utility of CT perfusion in detection of acute small vessel occlusions.

METHOD AND MATERIALS

In this retrospective study, a total of 50 CT studies performed for acute stroke were included where CT perfusion study was performed. These included 20 consecutive CT studies with intracranial acute small vessel occlusions seen on CTA and 30 consecutive studies with negative CT and CTA at presentation and negative CT and/or MRI performed within 7 days of presentation. Initially, two radiologists reviewed the noncontrast CT and multiphase CTA studies. The observers noted the presence or absence of occlusion and name of the occluded vessel. The reader confidence on a scale from 1 to 5 and time taken for review was recorded. On a separate occasion, CT perfusion data was presented to the readers before the noncontrast CT and multiphase CTA and the same readings were made. On both occasions, the observers were blinded from each other, previous or follow up imaging and clinical data and the data was presented in a random fashion. Thereafter, consensus readings were made on the CTA studies, noncontrast CT and CT perfusion studies at presentation and the follow-up MRI or CT performed within 7 days.

RESULTS

No difference of age or sex was found in the study population positive and negative for small vessel occlusion. No significant difference in the sensitivity of small vessel intracranial occlusions was found between two sets of readings. The level of confidence and speed improved with addition of CT perfusion (p<0.05).

CONCLUSION

CT perfusion maps improve the speed and confidence of interpretation in the setting of acute stroke due to acute intracranial small vessel occlusions.

CLINICAL RELEVANCE/APPLICATION

Small vessel occlusions can be a diagnostic challenge on CT and MPCTA studies performed for acute stroke. Addition of CT

perfusion maps could be beneficial in these cases.

ER164-ED- Let's Be Blunt: Imaging and Management of Genitourinary Tract Trauma MOB6

Station #6 Participants

Katy M. Edmonds, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Richard D. White, MBChB, FRCR, Blairgowrie, United Kingdom (*Presenter*) Nothing to Disclose Katherine S. Moore, MBChB, BSC, Cardiff, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Ghali Salahia, MD, Cardiff, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Rwth E. Owen, MBBCh, FRCR, Cardiff, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Ian A. Zealley, MBChB, Perth, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Andrew Wood, MBBS, FRCR, Cardiff, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Andrew C. Gordon, Cardiff, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Daniel Y. Chung, PhD,FRCR, Cardiff, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Highlight mechanisms by which the genitourinary tract can be affected by trauma (e.g. blunt, penetrating, iatrogenic) 2. Describe relevant imaging strategies 3. Illustrate a spectrum of genitourinary traumatic injuries on multimodality imaging 4. Present a grading system for renal trauma with schematic diagrams and imaging correlation 5. Demonstrate the role of interventional radiology in the management of trauma of the genitourinary tract

TABLE OF CONTENTS/OUTLINE

1. Mechanisms of genitourinary tract trauma a. Commonly affected areas and protective mechanisms 2. Imaging strategies 3. Urinary tract trauma a . Renal i. Grading system b. Ureter c. Bladder d. Urethra 4. Male genital tract trauma 5. Female genital tract trauma 6. Management, including the role of interventional radiology a. Vascular b. Non-vascular

ER163-ED- Surgical Fixation of Rib Fractures: What the Radiologist Should Know MOB7

Station #7

Participants Lenetta Boyce, FRCR, Liverpool, United Kingdom (*Presenter*) Nothing to Disclose David Melling, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Ganesh Retnasingam, FRCR, MRCS, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Having experience of performing over 360 surgical rib fracture stabilisation procedures since 2014 at a single major trauma centre hospital, the purpose of this exhibits is:1. To review the indications and benefits for the surgical fixation of rib fractures2. Describe salient radiological features the surgeon needs to know prior to considering fixation3. Understand how the rib fractures are stabilised and the role of post operative imaging

TABLE OF CONTENTS/OUTLINE

Benefits of surgically stabilising rib fracturesIndications for surgical fixationRelevant preoperative imaging features, what the surgeon needs to know.Review of relevant pre and postoperative imaging including pre an post operative plain radiographs preoperative multiplanar CT preoperative 3D reconstructed images







AI28

AI Theater: Next-Generation Radiology AI: The Journey from an AI Algorithm to a Partner: Presented by Aidoc

Monday, Dec. 2 2:00PM - 2:20PM Room: AI Showcase, North Building, Level 2, Booth 10724

Participants

Elad Walach, MSc, Tel Aviv-Yafo, Israel (Presenter) Nothing to Disclose

Program Information

We are on the verge of a new generation in radiology AI where there is already evidence of AI significantly impacting the day-today radiology workflow. The adoption of AI in radiology should be viewed through the lens of a journey, with each step of AI development contributing to a final goal of a full-scale solution. The AI ecosystem should move from talking about algorithms and models to a world where we talk about value in the clinical outcomes and solutions that actually improve clinical care. Session takeaways: 1.The current state of AI - is it beyond the hype? 2. AI vendor evaluation metrics - what should radiology departments look for 3. From accuracy to outcomes - use cases from real clinical settings





SSE06

Emergency Radiology (Non-Trauma: Brain, Head and Neck, and Spine)

Monday, Dec. 2 3:00PM - 4:00PM Room: E353A



AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants

Suzanne T. Chong, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose Zachary S. Delproposto, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSE06-01 Diagnostic Accuracy and Impact on Clinical Patient Management of an Ultrafast 5 Min/5 Sequences Brain MRI Protocol in Acute Neurological Emergencies

Monday, Dec. 2 3:00PM - 3:10PM Room: E353A

Participants

Philipp M. Kazmierczak, MD, Munchen, Germany (*Presenter*) Nothing to Disclose
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Olga Solyanik, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate sensitivity, specificity, and impact on clinical patient management of an ultrafast (5 min/5 sequences) brain MRI protocol for the detection of intracranial pathologies in acute neurological emergencies.

METHOD AND MATERIALS

449 consecutive emergency patients with acute non-traumatic neurological symptoms were evaluated for this IRB-approved prospective single center trial. 60 patients (30 female, 30 male, median age 61±19 years) with negative head CT were included and underwent emergency brain MRI at 3 Tesla subsequent to CT. MRI included the ultrafast protocol (Ultrafast-MRI; sag T1 GRE, ax T2 TSE, ax T2 TSE Flair, ax T2* EPI-GRE, ax DWI SS-EPI; TA 5 min) and an equivalent standard-length protocol (TA 15 min), which served as reference standard. Two blinded board-certified neuroradiologists independently analyzed the MRI data sets with regard to image quality (1-non-diagnostic, 2-poor/substantial artifacts, 3-satisfactory, 4-good/minor artifacts, 5-excellent/no artifacts) and intracranial pathologies. Sensitivity and specificity for the detection of intracranial lesions were calculated accordingly.

RESULTS

93 additional intracranial lesions (total: n=125; acute ischemia n=21, intracranial haemorrhage n=27, edema n=2, white matter lesion n=38, chronic infarction n=3, others n=2) were detected by Ultrafast-MRI (CT: n=32 lesions; standard-length protocol: n=133 lesions). Image quality was equivalent to the standard-length protocol (T2; Ultrafast-MRI: 3.95±0.221, standard-length protocol 4.02±0.227, p=0.083). Ultrafast-MRI demonstrated high diagnostic accuracy (sensitivity: 0.939 [0.881;0.972]; specificity 1.000 [0.895;1.000]) for the detection of intracranial pathologies and changed clinical patient management in 10 % (6/59).

CONCLUSION

In 5 min, Ultrafast-MRI including 5 standard sequences allows for the time-optimized diagnostic workup in acute neurological emergencies at high sensitivity and specificity compared to a standard-length protocol, with relevant impact on clinical patient management.

CLINICAL RELEVANCE/APPLICATION

Ultrafast-MRI represents a powerful and fast alternative to head CT for the detection and differential diagnosis of intracranial pathologies in acute neurological emergencies.

SSE06-02 Pitfalls of Automated ASPECTS: Initial Experience in a Tertiary Care Center

Monday, Dec. 2 3:10PM - 3:20PM Room: E353A

Participants Shobhit Mathur, MD, Vancouver, BC (*Presenter*) Nothing to Disclose John P. Walsh, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Omar Metwally, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Maria Zhu, MSc, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

PURPOSE

To compare the performance of automated ASPECTS provided by two software applications in acute stroke

METHOD AND MATERIALS

The non-contrast CT head studies of 91 consecutive patients referred with clinical suspicion of acute stroke were reviewed retrospectively by two observers and ASPECTS readings were made, first in an independent blinded fashion and later in consensus. A blinded consensus reading was also made on follow-up CT or MRI study (available for 67 patients) performed within 7 days. The observers then noted the readings from the software, also noting the possible cause of differences from the consensus readings.

RESULTS

The consensus human readings on the initial studies showed substantial correlation with automated results on the same studies from software package 1 (r=0.613, p<0.001) and software package 2 (r=0.663, p<0.001). The consensus human readings on follow up studies showed moderate to poor correlation with automated results on initial studies from software package 1 (r=0.353, p<0.001) and software package 2 (r=0.428, p<0.001). Segmentation errors, presence of extra-axial collections, anatomic asymmetry and chronic infarcts were common causes of misreadings by the softwares.

CONCLUSION

In our initial experience, although automated ASPECTS from both the softwares showed good correlation with human readings in acute stroke, they were moderate-poor predictors of final infarct volume.

CLINICAL RELEVANCE/APPLICATION

ASPECTS is a valuable tool in evaluation of acute stoke studies. The suggestions highlighted here would help ongoing improvement in the emerging machine learning based software applications in acute stroke imaging.

SSE06-03 Clinical Utility of Material Decomposition Algorithm on Unenhanced Dual-Energy Computed Tomography in the Detection of Acute Ischemic Infarcts

Monday, Dec. 2 3:20PM - 3:30PM Room: E353A

Participants

Sadia R. Qamar, MBBS, Vancouver, BC (*Presenter*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Bonnie Niu, BSC, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Gordon T. Andrews, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

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PURPOSE

To determine the value of Dual-energy unenhanced computed tomography compared to standard unenhanced computed tomography in the detection of acute ischemic stroke.

METHOD AND MATERIALS

We retrospectively studied 70 patients presenting to the emergency department (ED) with clinical signs and symptoms of acute ischemic stroke who underwent an initial dual-energy CT head without intravenous (IV) contrast within the therapeutic window of 4.5 hours followed by a standard CT head without IV contrast within the next 24 hours. Three material decomposition algorithm to exploit the differences in the energy spectra of gray matter and white matter in an attempt to better visualize the cytotoxic edema associated with acute ischemic stroke was used. Alberta Stroke Program Early CT (ASPECT) scores were assigned on both of these initial and follow up CT heads. The studies were reviewed independently by two board-certified radiologists, blinded to the clinical information and patient outcome. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated.

RESULTS

Standard, brain edema and 24-hour ASPECT scores were calculated for 70 patients. Of these patients, 43 (61.4%) had acute infarctions. Three material decomposition algorithm with brain edema reconstructions were superior to predict the infarction volume keeping 24-hour follow-up standard noncontrast CT as a reference with ASPECTS score of 7.57 vs 7.6; p-value 0.05. Standard non-contrast CT head had a 80% sensitivity (95% confidence interval (CI), 51.3-95.7%), 73% specificity (95% CI, 42-94%), 80% PPV (95% CI, 51.3-95.7%), and 72.3% NPV (95% CI 51.7-95.66%). The DECT showed a 94.2% sensitivity (95% CI, 71.4-99.81%), 100% specificity (95% CI, 76.3-100%), 100% PPV (95% CI, 77.1-100%), and 92.3% NPV (95% CI 62.44-99.89%). The overall interobserver agreement was good (0.61-0.80).

CONCLUSION

DECT proves to provide a better estimate of the end-infarct volume when compared to the standard non-contrast CT head in acute ischemic stroke.

CLINICAL RELEVANCE/APPLICATION

Early detection of acute ischemic stroke is critical for the patient outcome. Non-contrast CT head is the initial imaging modality to estimate the infarct volume and assess prognosis. DECT with its three material decomposition application improves the visualization of edema in acute ischemic infarct compared to standard non-contrast CT head, thus improving diagnostic accuracy.

SSE06-04 Capability of a New Model-Based Iterative Reconstruction for Brain CT to Diagnose Acute Ischemic Stroke: Multicenter Study

Monday, Dec. 2 3:30PM - 3:40PM Room: E353A

Participants

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PURPOSE

We investigated the clinical capability of a newly developed model-based iterative reconstruction (MBIR) for brain CT to diagnose acute ischemic stroke.

METHOD AND MATERIALS

Of 211 patients admitted with suspected acute ischemic stroke at four participating institutes, 83 who had undergone brain CT within 24 hr post-onset and were diagnosed with acute ischemic stroke by diffusion-weighted MRI or follow up CT were enrolled. CT scanning was on a 320-detector CT instrument [Aquilion Genesis, Canon Medical Systems (CMS)]; 2-mm-thick slices were reconstructed with both hybrid IR [h-IR: AIDR 3D (FCXX), CMS] and newly-developed MBIR (Brain LCD, CMS). Two diagnostic radiologists consensually graded the visualization of ischemic areas (IAs) on all reconstructed images. Grade I = IA not visualized, grade II = IA barely visualized, grade III = IA visualized, and grade IV = IA clearly visualized. The contrast-to-noise ratio (CNR) of the IA vis-à-vis contralateral normal sites was calculated. The visualization grade and the CNR of scans subjected to MBIR and h-IR were compared using the Wilcoxon signed-rank test.

RESULTS

IA visualization grades I, II, III, and IV were assigned to 39-, 8-, 10-, and 26 of the 83 MBIR images, respectively, and to 40-, 16-, 13-, and 14 of the h-IR images. In 61 patients (73.5%) the visualization grade was the same with both reconstructions; in 22 (26.5%) it was higher with MIBR than h-IR. In no cases was h-IR superior to MBIR (p<0.01). The median CNR was 5.0 for MBIR [interquartile range (IQR) 2.6-8.5] and 1.2 (IQR 0.8-2.0) for h-IR (p<0.01).

CONCLUSION

The new MBIR algorithm was superior to h-IR with respect to IA visualization and the identification of low-density areas in patients with acute ischemic stroke.

CLINICAL RELEVANCE/APPLICATION

MBIR improved the diagnostic ability of brain CT to identify low-density areas in patients with acute ischemic stroke.

SSE06-05 One-Stop-Shop Imaging in Acute Ischemic Stroke: Clinical Application of Simultaneous Acquisition of Cardiac CT in a Potential Cardioembolic Stroke

Monday, Dec. 2 3:40PM - 3:50PM Room: E353A

Participants

Sadia R. Qamar, MBBS, Vancouver, BC (*Presenter*) Nothing to Disclose Saira Hamid, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Gordon T. Andrews, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

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PURPOSE

To demonstrate the usefulness of performing simultaneous cardiac CT in patients undergoing CT head/ CTA arch to the vertex for acute ischemic stroke.

METHOD AND MATERIALS

We retrospectively analyzed one-year clinical data for all patients presenting with clinical suspicion of ischemic stroke categorized as hot stroke, per institutional policy. All of these patients underwent non-contrast CT head and multiphasic CT angiography from arch to the vertex as a standard hot stroke imaging protocol. This clinical data was further extracted for simultaneously performed cardiac-gated coronary CTA during their initial presentation. Potential cardioembolic sources were identified and categorized into high and medium risk categories. Frequency and percentages were calculated. Furthermore, all of these positive stroke patients were evaluated for risk assessment based on (Coronary Artery Disease Reporting and Data System) CAD-RADS scoring system.

RESULTS

A total of 5227 patients underwent hot stroke imaging with 1405 positive patients. Out of these, 110 patients (7.82%) patients had their cardiac-gated coronary CTA performed during their initial presentation. Potential cardioembolic sources were identified in 53/1405 (3.77%) patients. High-risk causes included; myocardial infarction 1(1.88%), left atrial thrombus 1 (1.88%), infective vegetation 1 (1.88%), non-infective vegetation (marantic) 1 (1.88%), prosthetic cardiac valves 7 (13.2%). Medium-risk causes included; patent foramen ovale 11 (20.75%), atrial septal defect 1 (1.88%), mitral valve prolapse 1(1.88%), valvular calcifications 14 (26.41%), and enlarged left atrium 4 (7.54%) patients. Three patients had both valvular and mitral annular calcifications. CAD-RADS categories were as follows; 0 in 43 (81.15%), 1 in 3(5.66%), 2 in 4(7.54%), 3 in 2(3.77%) and 4 in 1 (1.88%) patients.

CONCLUSION

We conclude that cardiac CT can reliably identify the potential sources in clinically suspected cardioembolic strokes and simultaneously provide the coronary artery risk assessment.

CLINICAL RELEVANCE/APPLICATION

Identification of the potential embolic sources in suspected cardioembolic strokes is vital for reducing patient's morbidity and mortality due to its early and late complications. Simultaneous acquisition of the cardiac CT with stroke imaging can act as a one-stop shop to detect these cardioembolic sources in selected patients.

SSE06-06 Fatal Intracerebral Hemorrhage Complicated With and Without Methamphetamine Poisoning: Can We Tell the Differences on PMCT?

Monday, Dec. 2 3:50PM - 4:00PM Room: E353A

Participants

Maiko Yoshida, MD, Chiba, Japan (*Presenter*) Nothing to Disclose Yohsuke Makino, MD, Setagaya-ku, Japan (*Abstract Co-Author*) Nothing to Disclose Masatoshi Kojima, RT, Chibashi, Japan (*Abstract Co-Author*) Nothing to Disclose Takuro Horikoshi, MD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose Hiroki Mukai, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose Shinya Hattori, MD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose Hajime Yokota, MD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose Hirotaro Iwase, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The purpose of this study was firstly to assess the incidence of fatal hemorrhage complicated with methamphetamine (MA) poisoning and secondly to assess post-mortem CT (PMCT) feature of fatal intracerebral hemorrhage (ICH) with MA poisoning comparing its findings to those without MA poisoning in order to figure out whether the key findings exist to differentiate those 2 groups.

METHOD AND MATERIALS

Consecutive medico-legal autopsy data from November 2011 through February 2018 (n=3044)were searched, yielding 80 cases with non-traumatic fatal hemorrhage. In all cases, toxicological examination was performed. Among 80 cases, ICHs located on basal ganglia and brain stem were extracted and comparison of findings was performed between 2 groups; ICH with MA poisoning and ICH without MA poisoning. The frequency, age distribution, types of hemorrhage and PMCT findings were compared. Two board-certified radiologists with forensic experiences interpreted PMCT images.

RESULTS

; On MA poisoning group there were 9 ICH cases located on basal ganglia and brain stem (The median age was 51.88years), while there were 14 cases on non-MA poisoning group (The median age was 61.35years). There was statistically significant difference between the ages of those 2 groups (p=0.0094). On PMCT comparison, there were statistically significant differences on mid-line shift distance (mm) (only for basal ganglia) (p=0.0281) and volume of aortic valve calcification (p=0.0182), while there was no statistically significant difference on volume of hematoma, cardiothoracic ratio, circumference of ascending aorta and calcification of aortic wall.

CONCLUSION

Forensic radiologists should be aware the possibility of ICH with MA poisoning if massive hemorrhage on PMCT is detected. Younger age, calcification of aortic valve and remarkable mid-line shift could be the key.

CLINICAL RELEVANCE/APPLICATION

(dealing with Postmortem CT) "Using Postmortem CT with toxicological examination is recommended in the process of death investigation."





ED004-TU

Emergency Radiology Tuesday Case of the Day

Tuesday, Dec. 3 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants

Gayatr^I Joshi, MD, Charleston, SC (*Presenter*) Nothing to Disclose Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc Margarita V. Revzin, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Paige E. Sharp, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Robin B. Levenson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Judith A. Gadde, DO, Newark, DE (*Abstract Co-Author*) Nothing to Disclose Heishun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Aaron D. Sodickson, MD,PhD, Boston, MA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, General Electric Company Nikhar Kinger, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Suzanne Czerniak, MD, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Karen S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Andrew Wong, MD,PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) Recognize key imaging findings on multimodality imaging of emergency/trauma patients. 2) Identify pathologic conditions based on the clinical information and imaging findings provided. 3) Understand relevant pathophysiology and recommend appropriate next step in management when appropriate.





RC308

Emergency Radiology Series: Current Imaging of the Acute Abdomen

Tuesday, Dec. 3 8:30AM - 12:00PM Room: S401CD



AMA PRA Category 1 Credits ™: 3.25 ARRT Category A+ Credits: 4.00

Participants

Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose Vincent M. Mellnick, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

RC308-01 Abdominal Fluoroscopic Emergencies

Tuesday, Dec. 3 8:30AM - 9:00AM Room: S401CD

Participants William M. Thompson, MD, Albuquerque, NM (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Know the ins and outs of performing emergency gastrointestinal examinations. 2) Know the common presentations of emergency esophageal and abdominal disorders. 3) Know how to diagnose the common emergency gastrointestinal disorders demonstrated on fluoroscopic examinations.

RC308-02 Diagnostic Performance and Efficiency of Magnetic Resonance Imaging (MRI) in Suspected Acute Appendicitis

Tuesday, Dec. 3 9:00AM - 9:10AM Room: S401CD

Participants

Nicolas Murray, MD, Vancouver, BC (*Presenter*) Nothing to Disclose David Jung, West Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

For information about this presentation, contact:

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PURPOSE

Evaluate the diagnostic performance and efficiency of MRI in suspected acute appendicitis compared to ultrasound (US) and computed tomography (CT).

METHOD AND MATERIALS

Single institution, IRB-approved, retrospective study of adult patients presenting to emergency department with suspected acute appendicitis from May 2017 to May 2018. Diagnostic characteristics of US, MRI, and CT were analyzed using a contingency table. Diagnostic efficiency was examined by average patient wait time, defined between times of initial imaging and final management decision.

RESULTS

599 patients met the eligibility criteria, with 445 US (54.7%), 137 MRI (16.9%), and 231 CT scans (28.4%) performed. Sensitivity, specificity and diagnostic yield of MRI were respectively 91.7% (95%CI, 73.0%-99.0%), 85.0% (95%CI, 77.0%-91.0%), and 88.3% (95%CI, 81.9%-92.7%), not significantly different than CT with respective values of 94.3% (95%CI, 84.3%-98.8%), 88.8% (95%CI, 83.2%-93.0%) and 93.1% (95%CI, 89.0%-95.7%). Using an intention-to-diagnose approach, diagnostic properties of US were significantly lower than both MRI and CT (p<0.01) with sensitivity of 61.5% (95%CI, 51.5%-70.9%), specificity of 18.2% (95%CI, 14.2%-22.7%), and diagnostic yield of 29.7% (95%CI, 25.6%-34.1%). Mean wait time for patients undergoing MRI as initial investigation (n=21, 3.5%, 100.6 minutes) was not significantly different from patients examined initially by CT (n=133, 22.2%, 104.3 minutes, p=0.78) or US (n=238, 39.7%, 125.6 minutes, p=0.29). All imaging routes where patients experienced multiple modalities had significantly longer wait times than routes involving one modality (p<0.01).

CONCLUSION

Diagnostic performance of MRI is comparable to CT and superior than US. With favourable patient wait times, MRI can be considered as initial investigation modality in suspected acute appendicitis.

CLINICAL RELEVANCE/APPLICATION

The greater role of MRI as first-line investigation modality in suspected acute appendicitis will reduce exposure to ionizing radiation without compromising diagnostic performance or timeliness.

RC308-03 Intraluminal Gas in an Inflamed Non-Perforated Appendix: A Reliable CT Sign of Gangrenous Changes and Imaging Occult Perforation

Tuesday, Dec. 3 9:10AM - 9:20AM Room: S401CD

Participants

Mohammad Haroon, MD, New Delhi, ON (*Presenter*) Nothing to Disclose Yashmin Nisha, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose Blair MacDonald, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose Adnan M. Sheikh, MD, Ottawa, ON (*Abstract Co-Author*) Speaker, Siemens AG Kashif Iqubal, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose Paul Anton Reymond Prakash Sathiadoss, MBBS, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose Sabarish Narayanasamy, MBBS,MD, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose Abhishek Jha, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess the utility of intraluminal air in an inflamed, apparently non-perforated appendix in predicting gangrenous changes or occult perforation. Determine, if obstructive appendicolith has an added value in predicting the same.

METHOD AND MATERIALS

This retrospective study was done on adult patients (n=554) of histopathologically proven appendicitis who underwent enhanced MDCT prior to surgery, presenting at our hospital over a consecutive period of 3 years. Patients with obvious CT signs of perforation were excluded to create a cohort of acute uncomplicated appendicitis. These CT were reviewed by an Emergency Radiology Fellow and 2 Emergency Radiologists for presence or absence of intraluminal gas and obstructive appendicoliths. These findings were compared with surgical/pathological results regarding presence or absence of gangrenous/perforated appendicitis. Statistical analysis was performed with the help of contingency tables and sensitivity, specificity, positive and negative predictive values were determined and correlation was tested with Chi-squared test and p value < 0.05 was considered statistically significant.

RESULTS

Of the total 554 cases of acute uncomplicated appendicitis on imaging, 130 had intraluminal gas (90 gangrenous), 178 had obstructive appendicoliths (74 gangrenous) and 66 were with both gas and appendicoliths (50 gangrenous). Sensitivity, specificity, positive and negative predictive values for intraluminal gas and presence or absence of gangrene were 69%, 90%, 69% and 90% respectively. These values for obstructive appendicolith were 42%, 72%, 42% and 72% respectively. These values for the presence of both intraluminal gas and appendicolith were 39%, 96%, 75% and 84% respectively. These values for the presence of either intraluminal gas or appendicoliths were 86%, 69%, 46% and 94% respectively. All these results were significant with p value < 0.05.

CONCLUSION

Presence of intraluminal gas in otherwise acute uncomplicated appendicitis on imaging is a reliable sign of underlying gangrenous changes or image-occult perforation. Presence of obstructive appendicolith, although less reliable sign as an independent risk factor as compared to intraluminal gas, it notably adds to the predective value.

CLINICAL RELEVANCE/APPLICATION

These CT signs are reliable in predicting the risk of gangrene and perforation and can help surgeons to avoid delays in surgery thereby reducing incidence of complications.

RC308-04 Intrapatient Analysis of CT Diagnosis of Acute Diverticulitis: Is Non-Contrast CT Enough?

Tuesday, Dec. 3 9:20AM - 9:30AM Room: S401CD

Participants

Tugce Agirlar Trabzonlu, MD, Chicago, IL (*Presenter*) Grant, Siemens AG Kevin R. Kalisz, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Kamal Subedi, MBBS, Kathmandu, Nepal (*Abstract Co-Author*) Nothing to Disclose Donald Kim, DO, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Vahid Yaghmai, MD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the performance of computed tomography (CT) without oral and intravenous (iv) contrast material for the diagnosis of acute diverticulitis by comparing dual energy CT (DECT) contrast enhanced and virtual non-contrast (VNC) images.

METHOD AND MATERIALS

In this retrospective analysis, we reviewed CT studies with oral and IV contrast obtained with DECT scanner for abdominal pain. Cohort included 153 patients with 306 sets of CT images with a radiological diagnosis of acute diverticulitis (n=76) and control cases without evidence of diverticulitis (n=77) scanned between October 2018 and March 2019. In the first session, the virtual non-contrast images were randomized and analyzed for the presence of diverticulitis. The findings and presence of complication (perforation, abscess formation or fistula) were also noted. In the second session, true contrast enhanced images were randomized and analyzed. Diagnostic performance of VNC images were compared with contrast enhanced CT studies. Sensitivity, specificity and accuracy were calculated.

RESULTS

Out of 153 patients, 76 (49.7%) had acute diverticulitis and 77 (50.3%) did not have findings of acute diverticulitis on contrast enhanced computed tomography (CECT). 18 of 76 (23.7%) patients with acute diverticulitis had findings of complicated diverticulitis on CECT. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of VNC images were 96.1% (95% CI= 88.9-99.2%), 97.4% (95% CI= 90.9-99.7%), 97.3% (CI= 90.3-99.3%), 96.2% (CI= 89.2- 98.7%) and 96.7% (95% CI= 92.5-98.9%) respectively. The complications of acute diverticulitis was detected in 11 of 18 (61.1%) patients with VNC images.

CONCLUSION

When compared to routine CT imaging with iv and oral contrast, non-contrast images have high diagnostic accuracy for acute colonic diverticulitis. However, for the assessment of the signs of complicated diverticulitis, non-contrast CT had much lower diagnostic performance.

CLINICAL RELEVANCE/APPLICATION

Non-contrast CT can be beneficial for diagnosing uncomplicated diverticulitis. However, the use of contrast remains necessary when complicated diverticulitis is present.

RC308-05 CT in the Setting of Suspected Colonic Diverticulitis: Prevalence and Diagnostic Yield for Diverticular Disease and Alternative Diagnosis in a Large Cohort in 1069 Patients

Tuesday, Dec. 3 9:30AM - 9:40AM Room: S401CD

Participants

Julius M. Weinrich, Hamburg, Germany (*Presenter*) Nothing to Disclose Peter Bannas, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Maxim Avanesov, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Franziska Schlichting, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Leonie Schmitz, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Azien Laqmani, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose Frank Oliver G. Henes, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the prevalence and diagnostic yield of CT in the detection of diverticulitis and alternative diagnoses (AD) in a large cohort of patients with suspected colonic diverticulitis (CD).

METHOD AND MATERIALS

We retrospectively included 1069 patients (560 women) undergoing CT for the evaluation of suspected CD. The final clinical diagnosis derived from the discharge report was used to determine the prevalence of CD and AD and to calculate the diagnostic accuracy of CT. Differences in the prevalence of diagnoses by age (<45;45-69;>=70 y/o) were compared using Cochran-Armitage test with a p-value <0.05 indicating statistical significance.

RESULTS

Prevalence of CD was 52.4% (561/1069) and of AD 40% (427/1069). In the remaining 7.6% (81/1069) no final clinical diagnoses was established. Overall, CT had a sensitivity and specificity of 99.1%/99.8% for diagnosing CD and for AD 92.7%/96.4%, respectively. The prevalence of diverticulitis was significantly lower in patients >=70 y/o (43%; 128/298) when compared with patients <45 y/o (54.1%;100/185) and 45-69 y/o (56.8%;333/586) (p<=0.0004). The most frequent alternative diagnoses were appendicitis (12.6%; 54/427), infectious colitis (10.5%;45/427), infectious enteritis (8.2%;35/427), urolithiasis (6.1%;26/427), and pyelonephritis (4.9%;21/427). Prevalence of specific AD varied significantly according to age (p<0.05). Appendicitis was significantly more frequent in patients <45 y/o (5.4%;10/185), whereas ischemic colitis, hemorrhage and pneumonia were more frequent in patients >=70 y/o. In the latter group colorectal carcinoma was also a frequent AD (10/298).

CONCLUSION

In the clinical setting of suspected diverticulitis the prevalence of acute diverticulitis and alternative diagnoses varies according to age. CT provides high diagnostic accuracy in the diagnosis of both, diverticular disease and alternative conditions.

CLINICAL RELEVANCE/APPLICATION

Clinicians must be aware that in about 40% of patients with suspected diverticulitis alternative diagnoses are the causes for their symptoms, and that there is an age-related prevalence of AD.

RC308-06 Ultrasound of First Trimester Pregnancy

Tuesday, Dec. 3 9:40AM - 10:10AM Room: S401CD

Participants Mariam Moshiri, MD, Bellevue, WA (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Learn essential criteria for diagnosis of a normal viable first trimester pregnancy. 2) Learn essential criteria for differentiating an ectopic pregnancy from intrauterine pregnancy, and various ectopic pregnancies. 3) Learn appropriate use of such terms as 'pregnancy of unknown location', findings suspicious for early pregnancy failure', etc as outline by SRU lexicon and criteria.

ABSTRACT

Imaging evaluation of first trimester pregnancy especially in an emergent setting can pose dilemmas since in early pregnancy a gestational sac may not be clearly visible. Differentiating an IUP from an ectopic pregnancy is crucial as the latter requires clinical intervention. There is some overlap of serum BhCG levels with IUP, ectopic pregnancy, and spontaneous pregnancy loss. in 2012, SRU consensus panel published their agreed upon criteria and lexicon for reporting first trimester ultrasound exams. We will review the clinical application of these criteria and the lexicon, and review appearance of various types of ectopic pregnancies.

RC308-07 Dual-energy CT of the Acute Abdomen: Current Status

Tuesday, Dec. 3 10:20AM - 10:50AM Room: S401CD

Participants

Savvas Nicolaou, MD, Vancouver, BC (*Presenter*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

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LEARNING OBJECTIVES

1) Explain the principles of Dual Energy CT/Spectral imaging. 2) Describe and apply 3-material decomposition. 3) Evaluate application of 3-material decomposition in select cases (organ perfusion in trauma, bowel ischemia, active bleeding, renal stone analysis).

RC308-08 Facilitating Acute Bowel Ischemia Diagnosis: Value of Low-keV Monoenergetic Imaging and Color-Coded Iodine Maps in Dual-Energy CT

Tuesday, Dec. 3 10:50AM - 11:00AM Room: S401CD

Participants

Elina Khasanova, MD, Vancouver, BC (*Presenter*) Nothing to Disclose Sunghan Jung, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Francesco Macri, MD, PhD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Christopher Lunt, MBChB,MRCS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Yuhao Wu, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Gavin M. Sugrue, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

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PURPOSE

To assess the impact of virtual monoenergetic imaging (VMI) and color-coded iodine-overlay images (IOI) on reader confidence and image quality (IQ) in the detection of hypoperfused bowel compared to simulated 120-kVp images (s-120-kVp).

METHOD AND MATERIALS

Institutional review board approval was obtained. Acute bowel ischemia was reported in 80 patients imaged with triphasic CT studies with the portal venous phase acquired with dual energy analysis (90-150 snVp; 3rd generation dual source CT) from 01/02/2016 to 31/12/2018. Of 80 patients, 26 (33%) had bowel ischemia confirmed intra-operatively, 11(14%) deceased within 72 hours, 43 (53%) did not qualify for surgery. S-120-kVp, VMI (40, 50, 60 keV) and IOI (40%, 50%, 60% of iodine overlay color-coded saturation) datasets were created for each patient. Quantitative assessment (HU and CNR) on ischemic bowel, normal bowel, and portal vein was performed only on the surgically proven cases (n=26). Two emergency radiologists independently evaluated subjective image quality (IQ) and diagnostic confidence (DC). Time-to-diagnosis (TTD) was recorded on VMI and IOI datasets with the highest IQ and DC and s-120-kVp dataset. One-way ANOVA and Kruskal-Wallis/Wilcoxon rank sign tests were used for statistical analysis.

RESULTS

There was a significant increase in absolute attenuation difference between normal and ischemic bowel in 40, 50, 60 keV datasets (mean±SD 66±5.3, 62±4.3, 54±5.5 HU) compared to s-120-kVp (38±5.6HU). Both readers deemed 50-keV as the best VMI dataset for subjective IQ including image sharpness and resolution (p=0.0017), DC (p=0.0003). IOI-50% demonstrated subjective IQ (p=0.0021) and DC (p=0.0041). TTD for 50-keV, IOI -50%, and s-120-kvp datasets resulted 37±4 seconds (sec), 39±10 sec, 107±7 sec).

CONCLUSION

Low energy imaging (50-keV) and color-coded IOI (50% saturation) significantly improved bowel wall conspicuity with increased attenuation differences and higher diagnostic confidence between ischemic and non-ischemic bowel compared to simulated 120-kVp. In addition, 50 keV and 50% IOI datasets allowed shorter TTD.

CLINICAL RELEVANCE/APPLICATION

Hypoperfused bowel often goes unrecognized especially for short ischemic segments that blend in with normal bowel loops. Low monoenergetic images and color-coded overlay iodine maps increase bowel wall attenuation differences improving hypoenhanced bowel segments identification.

RC308-09 Dual-Energy CT in Evaluating the Acute Bowel in Emergency: A Real Diagnostic Gain?
Participants Luca Tarotto, Napoli, Italy (*Presenter*) Nothing to Disclose Igino Simonetti, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose Francesco Palumbo, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose Luigi Palumbo, MD, Pozzuoli, Italy (*Abstract Co-Author*) Nothing to Disclose Alfonso Ragozzino, Pozzuoli, Italy (*Abstract Co-Author*) Nothing to Disclose Stefania Romano, MD, Pozzuoli, Italy (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Purpose of the study was to retrospectively analyze the processed imaging findings from the Dual Energy CT examinations of patients with acute abdominal symptoms compared with the native axial and multiplanar reconstructions in evaluating the cause of disease.

METHOD AND MATERIALS

A retrospective analysis on 122 patients who underwent DECT examination in emergency for acute abdominal symptoms were considered. All examinations were performed using a dual energy dual source CT 128 detector rows scanner (Drive, Siemens), after administration of i.v. contrast medium (Iomeron 400, Bracco) with mono or double phase acquisition. Native and processed images (i.e. iodine map, fusion series, virtual non contrast) were analysed in evaluation of: mesenteric vessels opacification of major and secundary branches; bowel wall thickening; bowel wall enhancement; abdominal addictional findings (free peritoneal air and fluid, mesenteric stranding, bowel lumen dilatation). Double readers / blinded final diagnosis analysis were performed; a cross-check of imaging and surgical/endoscopic from both native and processed images were made.

RESULTS

In 94/122 patients a correct diagnosis with correlative native imaging findings have been noted. In 39 patients in which the native images were already effective, post processed imaging findings did not add any new informations, whereas among the 28 patients with inconclusive findings at the native scans regarding the final diagnosis, processed images (iodine map) seemed to show altered findings, most of them in inflammatory and ischemic bowel disease.

CONCLUSION

DECT could be of help in case of controversial and not defined imaging findings , but the relative absolu value of the iodine map in evaluating the bowel wall trophism seemed to be reconsidered.

CLINICAL RELEVANCE/APPLICATION

Clinical relevance of this study is mainly pertinent on the DECT in evaluating the bowel wall enhancement in acute conditions

RC308-10 Abdominopelvic Imaging in the Emergency Department of Patients Treated with Immune Checkpoint Inhibitors: A Single Institute 9-Year Experience

Tuesday, Dec. 3 11:10AM - 11:20AM Room: S401CD

Participants

Ezgi Guler, MD, Cleveland, OH (*Presenter*) Nothing to Disclose Sreeharsha Tirumani, MBBS, MD, Beachwood, OH (*Abstract Co-Author*) Nothing to Disclose Daniel A. Smith, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose Christopher Hoimes, DO, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose Nikhil H. Ramaiya, MD, Shaker Heights, OH (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate abdominopelvic imaging findings of cancer patients treated with immune checkpoint inhibitors (ICIs) who presented to the emergency department (ED).

METHOD AND MATERIALS

A retrospective database search was performed to identify patients treated with ICIs who presented to the ED and underwent abdominopelvic imaging between January 2010 and November 2018. Images were reviewed to assess tumor burden and to detect immune-related adverse events (irAEs). Clinical indications for imaging and management were documented from medical record.

RESULTS

A hundred patients (62 men, median age: 63 years) with 138 abdominopelvic exams including 123 CT scans, 9 X-rays, 5 US, and 1 HIDA exams were identified. The most common cancer types included lung (40%), melanoma (17%), and kidney (12%). The date of ED visit occurred a median of 70 days after starting ICI (IQR 75-25 139-31). Common imaging indications included abdominal pain (72%), constipation (5%), and hematuria (5%). Forty-nine (35%) ED abdominopelvic scans showed worsening tumor burden at a median of 42 days (IQR 75-25 92-22) following initiation of ICIs. Twenty-five (18%) scans detected a cause of acute abdomen in patients treated with ICIs. In 5 (4%) exams, both an etiology of acute abdomen and worsening tumor burden were identified. Ten (10%) out of 100 patients demonstrated an irAE at a median of 74 days (IQR 75-25 284-42) following initial dose of ICI. irAEs detected on imaging included colitis/enteritis (6/10), pneumatosis coli (2/10), acute hepatitis (1/10), and acute acalculous cholecystitis (1/10). Steroid therapy was started in 2 cases following ICI discontinuation. The other most common causes of acute abdomen included gastrointestinal tract emergencies (10/100), and collections/abscesses (5/100).

CONCLUSION

Thirty five percent of abdeminenalisis imaging of nationals on ICI therapy who presented to the ED demonstrated warraning tymes

burden. Abdominopelvic irAEs were detected on imaging in 10% of patients and colitis/enteritis was the most common irAE.

CLINICAL RELEVANCE/APPLICATION

Abdominopelvic imaging at the ED detected the etiology of clinical presentation in 57% of patients treated with ICIs.

RC308-11 Clinical Use and Value of Renal Ultrasound for Suspected Urolithiasis in the Emergency Department

Tuesday, Dec. 3 11:20AM - 11:30AM Room: S401CD

Awards

Trainee Research Prize - Medical Student

Participants

Camilo Campo, Boston, MA (*Presenter*) Nothing to Disclose Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc Aaron D. Sodickson, MD,PhD, Boston, MA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, General Electric Company

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PURPOSE

Computed tomography (CT) has the highest sensitivity and specificity for urolithiasis in patients with acute flank pain. However, studies have suggested that ultrasound (US) should be the initial imaging test in the Emergency Department (ED) for acute flank pain. The purpose of this study is to assess the value of renal US in predicting follow-up imaging for patients with acute flank pain and to calculate the additional time required to obtain a renal US prior to CT.

METHOD AND MATERIALS

This was an IRB-approved, HIPAA-compliant retrospective study of all patients that underwent renal US in the ED from March 2018-March 2019 for acute flank pain. Data points collected were: presence of calculi and/or hydronephrosis on US, whether patients underwent follow-up imaging within 24 hours of US, presence of calculi and/or hydronephrosis on follow-up imaging, acute extrarenal findings, need for intervention, and history of urolithiasis. The time interval between US and follow-up CT was recorded based on the time that the tests were ordered.

RESULTS

271 patients underwent renal US in the ED for acute flank pain. 76 of 271 patients (28%) underwent follow-up imaging within 24 hours of initial US: 72 underwent CT abdomen/pelvis and 4 underwent magnetic resonance urogram (MR). Of the initial 271 US, 138 (51%) were positive for calculi and/or hydronephrosis on US. Of the 76 patients who underwent follow-up CT or MR, 40 (52%) had been positive for calculi and/or hydronephrosis on initial US and 36 (47%) had been negative on US. Of the 76 that underwent follow-up imaging, 10 had acute extra-renal findings, and 17 had subsequent intervention. For patients that underwent follow-up CT, the mean time interval between US and CT was 170 min.

CONCLUSION

Few cases of acute flank pain underwent follow-up imaging. Of these, approximately half had a positive US (54%) and half had a negative US (47%). Therefore, it is likely that clinical judgement plays a large role in predicting the need for follow-up imaging. We also found a larger time interval between US and follow-up CT for patients with positive versus negative US, which may reflect that patients with positive US were given the opportunity to pass the stones before follow-up imaging.

CLINICAL RELEVANCE/APPLICATION

Renal US is often the initial test done in the ED for acute flank pain. We evaluate how renal US predicts follow-up imaging and the additional time required to obtain a renal US prior to CT.

RC308-12 Imaging of Renal Emergencies

Tuesday, Dec. 3 11:30AM - 12:00PM Room: S401CD

Participants John J. Hines JR, MD, Huntington, NY (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Identify acute and emergent conditions of the kidney, with emphasis on renal obstruction, infection and hemorrhage. 2) Discuss cross-sectional imaging findings typically found with acute kidney disease, with an emphasis on CT. 3) Explain how the radiologist can integrate imaging findings with clinical history in order to help guide management of the patient with acute kidney disease.





SSG10

Neuroradiology (Stroke 2)

Tuesday, Dec. 3 10:30AM - 12:00PM Room: N229



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Greg Zaharchuk, MD, PhD, Stanford, CA (*Moderator*) Research Grant, General Electric Company; Research Grant, Bayer AG; Stockholder, Subtle Medical

Michael H. Lev, MD, Boston, MA (*Moderator*) Consultant, General Electric Company; Research Grant, General Electric Company; Research support, Siemens AG; Consultant, Takeda Pharmaceutical Company Limited;

Sub-Events

SSG10-01 Don't Be Cowed: Bovine Arch and Stroke Laterality

Tuesday, Dec. 3 10:30AM - 10:40AM Room: N229

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PURPOSE

Left-hemispheric strokes are more frequent and often have a worse outcome than their right-hemispheric counterparts. The present study aims to evaluate whether laterality of cardiogenic cerebral embolization is affected by anatomical characteristics of the aortic arch. We hypothesized that laterality varies between patients with a bovine versus standard arch branching.

METHOD AND MATERIALS

We retrospectively identified 1598 acute cardioembolic strokes in patients with atrial fibrillation from our institutional stroke database (2009-2017). Selecting the first event in each patient yielded 1459 infarcts. Inclusion criteria were an acute anterior circulation ischemic infarct and availability of both arch and brain imaging (MR or CT). Alternative causes of stroke (e.g. >50% intra/extracranial stenosis ipsilateral to the stroke, lacunar infarct, dissection) and anomalous arch were excluded. Imaging was reviewed for stroke characterization and laterality and arch branching pattern. Bovine arch denotes a common origin of the brachiocephalic trunk and the left common carotid artery. Strokes were classified as bilateral, left or right hemispheric. Univariate analysis was performed using Chi square tests.

RESULTS

The final cohort comprised 615 patients, mean age 77 (SD 11.8) with 376 women (61%). The majority were ethnic minorities (33% white, 30% black, remainder mixed/Hispanic). Standard arch (n=424) stroke distribution was left 43.6% (185), right 45.1% (191) and bilateral 11.3% (48). Bovine arch (n=191) stroke distribution was left 51.3% (98), right 35.6% (68) and bilateral 13.1% (25). Bovine arches were associated with more left sided strokes compared with standard arches (p=0.035). Of note, 43% of patients with bovine arch were black and there was an association between black race and bovine arch (p=0.0001).

CONCLUSION

Bovine aortic arch configuration is associated with left hemispheric laterality of cardioembolic stroke.

CLINICAL RELEVANCE/APPLICATION

Our study enriches the understanding that arch anatomy influences stroke laterality and highlights the need for further research into the causative hemodynamic factors.

SSG10-02 Reporting Quality and MR Technical Heterogeneity of Intracranial Vessel Wall MR Imaging: A Systematic Review of the Literature

Tuesday, Dec. 3 10:40AM - 10:50AM Room: N229

Participants

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PURPOSE

A systematic review of the literature was performed to identify studies using vessel wall MR imaging (VWI) to study intracranial vasculopathies. A qualitative synthesis of each study and an assessment of MR technical heterogeneity and reporting quality was conducted.

METHOD AND MATERIALS

PubMed, MEDLINE and EMBASE databases were searched up to September 2018 using inclusion/exclusion criteria for studies assessing intracranial vasculopathies with VWI. Two independent reviewers screened potential studies and extracted data. Foreign language articles were translated. The 22-point Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline was used to appraise reporting quality of analytic observational studies by calculating a Complete Reporting Score (CRS=yes/[yes+no]) for each study; criteria were scored as 'yes' if reporting was fulfilled. Scores of each manuscript section (introduction, methods, results, discussion) were also assessed. Inter-rater agreement was summarized by a Cohen's kappa (κ). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline was used.

RESULTS

Among 2431 articles, 79 met the inclusion criteria. Work was contributed most frequently from Asia (68%, n=54), received federal funding (62%, n=49), was retrospective (52%, n=42), and designed as analytic observational studies (51%, n=40). Intracranial atherosclerosis (ICAD) was the most commonly studied intracranial vasculopathy (52%, n=41). Considerable MR technical heterogeneity in magnet strength (range: 0.5T to 7T), spatial resolution (in-plane voxel size range: 0.11 to 1.27), and MR protocol was present with postcontrast imaging performed in 62% (n=49) of the exams. Among the 40 analytic observational studies, the overall mean STROBE CRS was 0.64 (range= 0.32-0.82); the introduction section had the strongest mean reporting score (CRSIntro=0.99) compared to the methods section, which emerged as the weakest (CRSMethods=0.53).

CONCLUSION

Assessment of the literature showed considerable MR technical heterogeneity in MR imaging methods. Among the analytic observational studies, the completeness of reporting based on STROBE guidelines, was variable.

CLINICAL RELEVANCE/APPLICATION

Reducing the heterogeneity of MR protocols in VWI studies and more consistent adherence to STROBE guidelines should maximize effective synthesis and clinical translation of findings for intracranial vasculopathies.

SSG10-03 Radiomic Analysis on Symptomatic Intracranial Atherosclerotic Plaque Using High Resolution MRI

Tuesday, Dec. 3 10:50AM - 11:00AM Room: N229

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PURPOSE

This study aims to evaluate a quantitative radiomic approach based on High-resolution magnetic resonance imaging (HR-MRI) to differentiate symptomatic intracranial artery plaque from asymptomatic plaque.

METHOD AND MATERIALS

This study retrospectively analyzed 158 patients with middle cerebral artery (MCA) and basilar artery (BA) stenosis underwent HR-MRI between September 2013 and October 2016. Atherosclerosis plaques from MCA and BA were extracted as the region of interest (ROI) for quantitative evaluation. The stenosis value, plaque area/burden, lumen area, intraplaque hemorrhage (IPH), contrast enhancement ratio and 109 quantitative radiomic features were extracted and compared between symptomatic and asymptomatic patients. Univariate analysis was applied first to find possible variable that was associated with symptoms. Student t-test or twosample Wilcoxon test was used if the variable was/was not normally distributed. P-values <0.05 were considered as statistical significant. Multi-variate logistic analysis and a random forest model were used to evaluate the diagnostic performance.

RESULTS

A total of 158 patients met the inclusion criteria. There were 75 acute, 36 sub-acute symptomatic patients, and 47 asymptomatic patients. Smoking (odds ratio [OR]=2.724; 95%CI,1.200-6.183), IPH (OR=11.340; 95%CI, 1.441-89.221) and enhancement ratio (OR=6.865; 95%CI, 1.052-44.802) were independently associated with symptomatic plaques. The combined smoking, IPH and enhancement ratio had an area under the curve (AUC) of 0.714 for identifying symptomatic plaques. Radiomic features in T2, T1 and CE-T1 images were associated with symptomatic plaques , whose AUC respectively are 0.801,0.835 and 0.846. The combined all radiomic approach had a significantly higher AUC of 0.953. Combination of all features reached an AUC of 0.976, with accuracy

CONCLUSION

Radiomic analysis of intracranial artery plaque on HR-MRI accurately distinguished between plaques in patients who were symptomatic and plaques in patients who were asymptomatic. The highest accuracy was achieved by combining radiomic features with traditional assessment of clinical and morphological features.

CLINICAL RELEVANCE/APPLICATION

The favorable accuracy values in this study over those previously reported by conventional HR-MRI support the use of radiomic analysis to improve identification of acute symptomatic plaque.

SSG10-04 Arterial Transit Artefacts on ASL Perfusion-Weighted MRI in Patients with Carotid Artery Stenosis are a Better Predictor of Recent Symptoms than Degree of Stenosis or Carotid Plaque Morphology

Tuesday, Dec. 3 11:00AM - 11:10AM Room: N229

Participants

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PURPOSE

Using comprehensive advanced MR imaging at 3T, including carotid plaque imaging and ASL perfusion MR, we aim to identify parameters that best distinguish between asymptomatic and symptomatic carotid stenosis, and to gather new evidence regarding the mechanisms causing clinical symptoms.

METHOD AND MATERIALS

We recruited patients with ICA stenosis participating in ongoing trials, who had ASL and carotid plaque imaging in the same sitting. Patients were assessed clinically for recent symptoms of TIA or stroke. MR images were analysed for the degree of stenosis, plaque morphology, presence of intraplaque haemorrhage (IPH), collateral circulation of the circle of Willis, presence and severity of arterial transit artefacts (ATAs). We used t-test and Fisher's exact test to investigate which features were associated with symptomatic status.

RESULTS

44 patients met the inclusion criteria, 22 of these were symptomatic. ATAs were only seen in patients with a >70% stenosis (p for association <0.001), and were associated with the configuration of the circle of Willis (p=0.001), particularly the absence of anterior communicating artery (ACOM) (p=0.003). Associations between symptoms and degree of stenosis, IPH, and plaque surface morphology were non-significant. However, patients with ATAs (n=16) were significantly more likely to be symptomatic than those without ATAs (n=28) (p=0.004). Symptomatic status correlated further with the severity of ATAs (p=0.002).

CONCLUSION

ATA was the only predictor of recent ischaemic symptoms in patients with carotid stenosis.

CLINICAL RELEVANCE/APPLICATION

Haemodynamic factors play a greater role in the mechanism of TIA and stroke associated with carotid stenosis of >70% than currently appreciated.

SSG10-05 Susceptibility-Weighted Imaging in Hyperacute Phase of Ischemic Stroke

Tuesday, Dec. 3 11:10AM - 11:20AM Room: N229

Participants

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PURPOSE

Using a large animal experimental middle cerebral artery occlusion model, this work sought to determine if there was a significant change in the SWI signal intensity on regions of interest drawn in the penumbra and ischemic core based on perfusion and diffusion-weighted imaging.

METHOD AND MATERIALS

Eight mongrel canines (20-30kg) underwent permanent endovascular occlusion of an M1 segment of the middle cerebral artery (MCA) and acute ischemic stroke MR imaging. Anesthesia was chosen so as not to influence cerebrovascular reactivity. MRI was

acquired on a 3 Tesla unit (Achieva, Philips Healthcare, Best, Netherlands) and included susceptibility- weighted imaging (SWI), diffusion-weighted imaging (DWI) with the corresponding apparent diffusion coefficient (ADC) maps, and perfusion imaging. Susceptibility- weighted imaging was acquired within the first 60 minutes of MCA occlusion. The signal intensity was calculated on SWI images using Image J software (National Institutes of Health, Bethesda, Maryland). Regions of interests (ROI) were drawn manually on the infarct core, penumbra, and deep gray matter and was compared to that of the corresponding contralateral side. The infarct core was selected based on the hypointense areas on the ADC maps, penumbra chosen based on the perfusion imaging and identified by the defect between the ADC abnormality and the perfusion defect. The normality of data was assessed using the Shapiro-Wilk W test.

RESULTS

The median (interquartile range) of signal intensity on the infarct core (374.6 (366.5-393.6), vs. 432.6 (412.3-448.2), P-value<0.0001), and on the penumbra (433.7 (407.6-458.9) vs. 491.6 (467.6-510), P-value<0.0001) was significantly lower than signal intensity on their uninvolved contralateral side. The mean \pm SD of signal intensity was also significantly lower on deep gray matter compared to the uninvolved contralateral side (418.1 \pm 44.89 vs. 464.5 \pm 42.61, P-value<0.0001).

CONCLUSION

Signal intensity significantly drops during the hyperacute phase of MCA occlusion in the infarct core, penumbra, and deep gray matter comparing to the contralateral side. Presumably, this is a result of deoxyhemoglobin effect and venous vasodilation in the early stages of ischemia.

CLINICAL RELEVANCE/APPLICATION

Susceptibility- weighted imaging could possibly be used as a fast and noninvasive imaging to predict cerebral hemodynamic changes.

SSG10-06 Improvement of the Diagnostic Performance for Brain Hemorrhage Using Deep Learning-based Computer-Aided Detection System

Tuesday, Dec. 3 11:20AM - 11:30AM Room: N229

Participants

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PURPOSE

To elucidate the diagnostic performance with deep learning-based computer-aided detection (CAD) for non-expert and expert doctors in detecting cerebral hemorrhage from head CT.

METHOD AND MATERIALS

40 head CT datasets were evaluated by 15 doctors (5 board certificated radiologists, 5 radiology residents, and 5 interns). The CT datasets have 16 normal and 24 hemorrhagic patients with 48 intracranial hemorrhagic lesions including 5 types of cerebral hemorrhages: extradural hematoma, subdural hematoma, intracerebral hemorrhage, subarachnoid hemorrhage, and intraventricular hemorrhage. The doctors attended 2 reading sessions: diagnosing without and with CAD (more than a week between 2 reading sessions). All doctors annotated the hemorrhagic regions and gave them the degree of confidence on a scale of one to ten. Our CAD system was developed with 522 patients' head CT which consist of 242 normal (5,929 slices) and 280 hemorrhagic patients (2,899 slices), and detection results were displayed as corresponding probability heat maps using U-Net and a machine learning-based false-positive removal method. The normal and hemorrhagic patients were randomly split into training (90%) and validation (10%) datasets and used for constructing CAD. Sensitivity, specificity, and accuracy were evaluated using a paired t test. In addition, a figure of merit (FOM) derived from the jackknife free-response receiver operating characteristic were evaluated.

RESULTS

The mean accuracy of all doctors with patient-based evaluation significantly increased from 83.7% to 89.7% (p<0.01) by using CAD. In addition, the accuracies of board certificated radiologists, radiology residents, and interns showed 92.5%, 82.5%, and 76.0% (without CAD) and 97.5%, 90.5%, and 81.0% (with CAD), respectively. The rate of increase of the mean accuracy for non-expert doctors was 6.5%; it was greater than that for expert doctors (5.0%). The mean FOM of all doctors increased from 0.78 to 0.82 (p<0.05) by using CAD.

CONCLUSION

The diagnostic performance and confidence of intracranial hemorrhage detection improved among all doctors, especially for nonexpert doctors by using CAD.

CLINICAL RELEVANCE/APPLICATION

Our CAD software could improve the diagnostic performance of all doctors in detecting hemorrhage from head CT and reduce the missed reports of faint or small hemorrhage, especially for non-expert doctors.

SSG10-07 Deep Learning Model to Predict Patient Outcome in ICH Using Fluid-Attenuated Inversion Recovery Imaging Data

Tuesday, Dec. 3 11:30AM - 11:40AM Room: N229

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PURPOSE

Timely and accurate outcome prediction in intracerebral hemorrhage (ICH) patients is important for optimizing rehabilitation strategy. The objective of this study was to investigate if a deep neural network model can predict recovery outcome in patients with ICH at 3 months using T2-weighted fluid-attenuated inversion recovery (FLAIR) imaging data.

METHOD AND MATERIALS

A convenience sample of 53 left thalamocapsular ICH patients (hemorrhagic volume < 20cc; mean age = 52.4 yrs) were included from the Ethnic/Racial Variation in Intracerebral Hemorrhage (ERICH) study. T2-weighted FLAIR data were acquired using clinical protocols in this multicenter cohort. A deep learning model was trained to identify patients likely to have unfavorable outcomes, defined as 3-month modified rankin scale (mRS) score 3-6. As shown in Figure 1, we employed a pre-trained VGGNet-19 model as a feature generator to learn high-level features from input FLAIR images. We then built a convolutional neural network (CNN) classifier based on the high-level features to identify the patients with unfavorable outcomes. Rotation and shift-based data augmentation strategy was implemented to increase the training samples by 20 times (but not testing samples). Performance was evaluated using 5 fold cross-validation with the metrics of accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve (AUC).

RESULTS

Our model was able to correctly identify patients likely to have unfavorable outcomes with an accuracy of 81.8% (95% confidence interval: 80.7%, 82.9%), AUC of 0.82 (0.80, 0.83), sensitivity of 90.6% (89.6%, 91.6%) and specificity of 72.6% (70.1%, 75.1%).

CONCLUSION

This work demonstrates the feasibility of deep learning approach for predicting outcomes of ICH patients using only FLAIR imaging data with a promising accuracy. Future model improvements will include the incorporation of clinical data. A larger multidimensional study is important to validate our approach.

CLINICAL RELEVANCE/APPLICATION

Deep learning model on FLAIR imaging data can identify ICH patients likely to have unfavorable outcome. Such prognostic model can potentially help with the treatment decision and rehabilitation strategy optimization.

SSG10-08 Microstructural ASYmmetry (MASY) of DTI in Stroke Reveals Interaction Effect of Sex and Clinical Covariates

Tuesday, Dec. 3 11:40AM - 11:50AM Room: N229

Participants

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PURPOSE

Microstructural investigation of stroke is one of the flagship clinical applications of diffusion tensor imaging (DTI). The purpose of this work was to examine the interaction effect of sex and clinical scores on stroke microstructure measured using DTI. It was hypothesized that using the microstructural *difference* between the contra and ipsilesional regions would be statistically more powerful than using the microstructural measures within the lesion. It was further hypothesized that considering the *distributional difference* of their microstructure, instead of the difference between their averages, would be more sensitive in gleaning this effect.

METHOD AND MATERIALS

Diffusion weighted MR images on n=16 subjects (ages: 52.8+/-14.5(n=6 females), 62.4+/-14.1(n=10 males)) were acquired with a b-value of 2000 s/mm2 along 56 unique non-colinear gradient directions, in addition to 10 non-diffusion weighted (b=0) images. Preprocessing was performed using FSL's eddy to remove distortions from eddy currents and motion. The analysis was performed using the four main (DTI) measures: fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD) and radial diffusivity (RD) and two clinical covariates: the ratio of acute time period to age and normalized verbal fluency (corrected for age and education) at the time of MRI. The acute time period is the number of days between MRI visit and stroke onset. A linear model that

includes the interaction effect of sex and clinical covariates was fit for each of the following dependent variable: (1) average DTI in the acute ipsilesion mask, (2) difference between the average DTI in contra and ipsilesional masks and (3) *microstructural asymmetry (MASY)* computed using symmetrized Kullback-Leibler divergence between DTI distributions of contra and ipsilesional masks. The p-values for the interaction effect from the models were reported.

RESULTS

The main results are summarized in Figure 1. The microstructural features were positively correlated with acute time period ratio and inversely correlated with verbal fluency.

CONCLUSION

The relationships between clinical scores and microstructural asymmetry of DTI in stroke were more pronounced in males compared to females.

CLINICAL RELEVANCE/APPLICATION

(delaing with interaction effects in stroke microstructure) '*Distributional difference approach* is recommended for greater statistical sensitivity to relationships between clinical scores and imaging.'

SSG10-09 High Definition Imaging Reduces Procedure Time Without Impacting Patient Dose in Image-Guided Neuro Interventional Procedures

Tuesday, Dec. 3 11:50AM - 12:00PM Room: N229

Participants

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PURPOSE

To quantify the clinical impacts and radiation dose of a novel fluoroscopic x-ray detector that combines high definition (Hi-Def) crystalline-Si imaging modes with 76µm pixels and high efficiency amorphous-Si imaging modes with 194µm pixels.

METHOD AND MATERIALS

DICOM Radiation Dose Structured Report (RDSR) data was collected for all neurointerventional procedures performed before and after installation of the Hi-Def detector at a single center over a 32 month period. There were 1,702 pre- and 2,499 post-Hi-Def cases with over 390k irradiation events in total. A real-time patient skin dose tracking system was used to monitor peak skin dose during the Hi-Def cases. A two-sample student's t-Test analysis was performed to compare various technical parameters included in the RDSR before and after installation of the new Hi-Def technology. To further investigate any potential impacts on radiation dose, cumulative air kerma, dose area product and peak skin dose were plot as a function of Hi-Def utilization as a percentage of the total number of irradiation events.

RESULTS

Hi-Def modes were used in more than 50% of the most complicated cases defined as having procedure times lasting more than 90 minutes. Improved visualization capabilites were demonstrated especially during device deployment and manipulation. Average procedure time and the total number of irradiation events were both significantly reduced by 9% (p< 0.01). Average fluoro time, number of CBCT scans and cumulative air kerma were trending lower (5-10% less) but not yet reaching statistical significance (0.05< p < 0.16). Peak skin dose data was available for 1,518 cases with 97.7% and 99.5% of cases below 3Gy and 5Gy, respectively. No correlation was observed (R2< 0.10) using a best of all fits for all dosimetric indications as a function of Hi-Def utilization.

CONCLUSION

Preliminary results from over 4,000 neurointerventional procedures at a single center demonstrate that the improved spatial resolution of the Hi-Def detector may result in reduced procedure time and number of irradiation events. In addition, there was no observable increase in patient dose with the utilization of the Hi-Def detector.

CLINICAL RELEVANCE/APPLICATION

This is the first study investigating clinical benefits of a new detector that can provide more than 2x the spatial resolution of any other clinically available technology and no patient dose penalty.





ERS-TUA

Emergency Radiology Tuesday Poster Discussions

Tuesday, Dec. 3 12:15PM - 12:45PM Room: ER Community, Learning Center

ER

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants

Koenraad H. Nieboer, MD, Jette, Belgium (Moderator) Speakers Bureau, General Electric Company

Sub-Events

ER210-SD- Optic Nerve Sheath Diameter Measurement for Predicting Raised Intracranial Pressure in Patients TUA1 with Traumatic Brain Injury: A Meta-Analysis

Station #1

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PURPOSE

The aim of this meta-analysis was to evaluate the diagnostic feasibility of measurement of the optic nerve sheath diameter (ONSD), via brain computed tomography (CT) or ocular ultrasonography (US), for the prediction of raised intracranial pressure (ICP) in patients with traumatic brain injury (TBI).

METHOD AND MATERIALS

The PubMed and EMBASE databases were searched for studies assessing the diagnostic accuracy of brain CT or ocular US for predicting raised ICP. Bivariate and hierarchical summary receiver-operating-characteristic (HSROC) modeling were performed to evaluate the diagnostic feasibility of measuring the ONSD in patients with TBI. We examined pooled diagnostic odds ratios (DORs) and performed a subgroup analysis to evaluate the diagnostic feasibility of measuring the ONSD in patients with Severe TBI. Methodologic quality was assessed using the Quality Assessment of Diagnostic Accuracy Studies-2 tool. For heterogeneity exploration, we performed meta-regression analyses.

RESULTS

Twelve studies (1190 patients) were included. The ONSD had a pooled sensitivity of 0.90, pooled specificity of 0.86, and area under the HSROC curve of 0.94 for predicting raised ICP. Pooled DORs also indicated that the ONSD was informative for evaluating raised ICP (DOR, 56). The corresponding values in patients with severe TBI were 0.87, 0.81, and 0.90, respectively. Regarding meta-regression analysis, studies with ocular US tended to have a higher sensitivity and specificity than those with brain CT.

CONCLUSION

The ONSD may be a useful method for predicting raised ICP in patients with TBI.

CLINICAL RELEVANCE/APPLICATION

We recommend measuring the ONSD using ocular US, to more accurately diagnose raised ICP.

ER211-SD- Choosing Wisely: Imaging Recommendations Reduce Unnecessary Radiological Exams in an Emergency Department

Station #2

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PURPOSE

Alignment of radiological exams indication in the emergency department according to the Choosing WiselyR campaign. To promote awareness of the risks and benefits and rational use of radiological exams to health professionals and patients.

METHOD AND MATERIALS

A longitudinal study with prospective analyses, educational intervention in the emergency sector of a private hospital that has 100 thousand users, 8,500 adult and 6,500 pediatric monthly medical attendances. Choosing Wisely recommendations were applied to promote low risk patients supported by evidence: not duplicative tests, free from harm, truly necessary, engaging patients and doctors. In 2018 the program included internists (n=56) and pediatricians (n=52). In 2018, 3100 radiographs and 500 tomography are performed monthly. The 10 mostly common indications for radiological examinations and their protocols were reviewed. Justification of exams were supervised by another multispecialist medical team. Educational personalized activity, monthly analysis of percentages of radiological examinations and medical attendances, virtual education training based on Choosing WiselyR campaign were done.

RESULTS

In 2018, there was a reduction of 11.1% in requested radiological exams per attendance in adult and pediatric emergency department compared to the past two years. The most requested radiographies were chest (41.1%); paranasal sinus (17.5%) and abdomen (5.1%). Computed tomography of brain (45.1%); abdomen (30.8%) and thorax (5.5%). A high number of exams were identified in the age group 0 to 4 years. The main clinical indications were: abdominal pain (23.3%); headache (12.8%); paranasal sinus diseases (11.2%); low back pain (9.2%); chest pain (5.6%, dyspnea (5.6%), and urinary complaints (5.3%). Ten flowcharts protocols were implemented and continual educational strategies applied.

CONCLUSION

Justification and directed training with validated protocols allowed improvement in quality and patient safety. The Choosing WiselyR Campaign can be applied in emergency sectors promoting benefits to patients, physicians and institution, using specialist medical societies and international consensus.

CLINICAL RELEVANCE/APPLICATION

Choosing Wisely recommendations applied in emergency department can improve quality and safety of patient care, promote correct diagnosis and reduce radiation exposure.

ER212-SD-TUA3 Availability of the High-Pitch Helical Scan Using Dual-Source CT in Aortic Disease: ECG-Gated is No Longer Needed

Station #3

Participants Toshiya Ito, RT, Sayama, Japan (*Presenter*) Nothing to Disclose Atsushi Mochizuki, RT, Sayama City, Japan (*Abstract Co-Author*) Nothing to Disclose Daigo Fujii, RT, Sayama, Japan (*Abstract Co-Author*) Nothing to Disclose Jun Shionoya, RT, Sayama, Japan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

In the CTA examination aimed at aortic dissection and the like, ECG-gated scan is regarded as a golden standard. However, ECG-gated scan has the disadvantage that the scanning time is long and the exposure dose is large. In this study, we evaluate the feasibility of non-ECG-Gated scan by turbo flash scan using dual source CT.

METHOD AND MATERIALS

We compared the motion artifacts of each part with 50 patients who had turbo flash scan in the past and 50 patients who performed ECG-Gated scan.(Age55.4±16.7, BMI22.6±3.9 vs Age56.3±16.2, BMI22.1±2.9)Measurement sites were the ascending aorta, thoracic descending aorta, and abdominal descending aorta.The image quality scores were defined as 1 (excellent), 2 (good), 3 (adequate), and 4 (poor).The examination was conducted by 10 radiological technologists, 2 radiologists, and 2 cardiovascular surgeons.In addition, standard deviation (SD), and Dose-Length Product(DLP)were compared between the two groups.We also compared and studied MTF, SSPz, windmill artifacts between the two groups using a phantom.We evaluated the case where turbo flash scan was not suitable and devised the countermeasure.

RESULTS

Mean heart rate during scanning was 71.8±13.6 bpm in ECG-Gated scan and 72.2±13.2 bpm in turbo flash scan.(P=0.950)No significant differences were observed in the quality score between ECG-Gated scan and turbo flash scan.(1.16±0.15 vs 1.25±0.2 : p=0.633) DLP was significantly lower in the turbo flash group.(1730±41.3 vs 523±46.8 : p<0.0001)The MTF, SSPz and windmill artifact were not significantly different between the two groups.

CONCLUSION

Turbo flash scan showed no significant difference in image quality and diagnostic accuracy compared to ECG-Gated scan.

CLINICAL RELEVANCE/APPLICATION

With turbo flash scan, it is possible to make an equivalent diagnosis with an exposure dose of about 30% compared to ECG-Gated scan.

ER234-SD- Deep Learning-Based Computer Aided Diagnostic System Reduces Reading Time and Occupational TUA4 Fatigue of Radiologists in Thoracic Fracture

Station #4

Participants Chenglong Ren, Shanxi, China (*Presenter*) Nothing to Disclose Ning Pan, Xian, China (*Abstract Co-Author*) Nothing to Disclose Yao Ding, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose Yong Yu, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose Wei Wei, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose Guangming Ma, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose Yuanyuan Chen, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose Hui Zhong, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose Yanbing Guo, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To explore the potential of deep learning-based computer aided diagnostic system (DL-CAD) in reducing reading time and occupational fatigue of radiologists.

METHOD AND MATERIALS

4 attending radiologists with more than 5 years of experience were equally divided into two groups: group A and group B to interpret chest CT images for thoracic fracture diagnosis with and without a DL-CAD system (InferRead CT Bone Research, Infervision, Beijing). All 103 cases with thoracic fractures were diagnosed by each radiologist within seven hours. occupational fatigue index of each radiologist was assessed immediately after they completed the interpreting task with the improved Swedish Occupational Fatigue Scale which consisted of 5 evaluation indictors (lack of energy, physical consumption, physical discomfort, lack of motivation and sleepiness). The mean reading time for each patient of both groups were calculated. Two-samples t-test was used to examine the differences.

RESULTS

The mean reading time for group A and group B was 4.12 ± 0.23 min and 2.13 ± 0.17 min with significant difference (P<0.05). For the occupational fatigue assessment, there was a significant difference between group A and group B for all the 5 evaluation indictors.

CONCLUSION

DL-CAD reduces reading time and occupational fatigue of radiologists.

CLINICAL RELEVANCE/APPLICATION

It is recommended to use DL-CAD to accelerate clinical workflow and reduce occupational fatigue of radiologists in thoracic emergency.

ER235-SD- Peritoneal Infarcts: Timing of CT Scan

Station #5

Participants Abhishek Jha, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose Mohammad Haroon, MD, New Delhi, ON (*Abstract Co-Author*) Nothing to Disclose Vaibhav Gulia, Rohtak, India (*Abstract Co-Author*) Nothing to Disclose Yashmin Nisha, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose Ramender Singh, MBBS, Jind, India (*Presenter*) Nothing to Disclose Sandeep K. Dhillon, Gannaur, India (*Abstract Co-Author*) Nothing to Disclose Navneet Redhu, MBBS, DMRD, Rohtak, India (*Abstract Co-Author*) Nothing to Disclose Harinder Yant, Sonepat, India (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess the optimum time between the beginning of clinical symptoms and appearance of CT signs for diagnosing peritoneal infarcts

METHOD AND MATERIALS

This retrospective study was done on 91 adult patients with clinical suspicion of omental infarcts who underwent serial contrast enhanced MDCT, presenting to us over consecutive period of 3 years. These CT scans were done at the day of presentation and 3 days after the onset of symptoms and were reviewed by 2 Radiologists for presence or absence of any signs of peritoneal infarction, which included focal fat stranding, thrombosed central vessel and ill defined peritoneal collections. The results were interpreted as negative, which meant no sign of infarct, equivocal which meant one of the three signs being present and positive with more than above two signs seen. The diagnostic accuracy of initial scan with serial 3 day delayed scans were assessed and compared. The equivocal cases were considered as inconclusive and negative.

RESULTS

Out of 91 patients, 47 had omental infarcts. The sensitivity of initial CT scan in diagnosis of omental infarcts at Day 1 of presentation was 12.7%, whilst the sensitivity of a delayed scan done at Day 3 of presentation was 100%. The specificity of initial CT scan at Day 1 of presentation was 89.7%, whilst the specificity of a delayed scan done at Day 3 of presentation was 100%. The Positive predictive value of initial CT scan at Day 1 of presentation was 54.5%, whilst that of a delayed scan done at Day 3 of presentation was 99%. The Negative predictive value of initial CT scan at Day 1 of presentation was 94.1%.

CONCLUSION

Patients with suspected peritoneal infarcts should be scanned at an optimum time interval of 72 hours after the onset of symptoms as initial scans done at day of presentation may be inconclusive and falsely negative.

CLINICAL RELEVANCE/APPLICATION

Peritoneal infarction is emerging as a common cause of acute abdomen with advances in cross sectional imaging. However, appropriate and delayed timing is essential for its accurate diagnosis.

ER161-ED- Twenty Known and Emerging DECT Applications in Emergency Neuroradiology TUA6

Station #6

Participants Shobhit Mathur, MD, Vancouver, BC (*Presenter*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Saman Fouladirad, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Omar Metwally, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose John P. Walsh, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Sadia R. Qamar, MBBS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Pratik Mukherjee, MBBS, FRCR, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose Luck J. Louis, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Gordon T. Andrews, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

TEACHING POINTS

1. To highlight the applications of dual energy CT (DECT) in improving evaluation of different conditions affecting the brain, head and neck and spine. 2. To show how dual energy CT analysis works as a problem solving tool in various neurological emergencies.

TABLE OF CONTENTS/OUTLINE

DECT concepts Brain: Iodine staining vs hemorrhage, tumoral vs non tumoral hemorrhage, acute hemorrhage vs calcifications, enhancement within hematomas, SAH on CTA, metal artifact reduction in aneurysm clips, calcium subtraction to delineate aneurysm, bone subtraction to delineate extra-axial masses and collections, clot evaluation, enhancing subdural effusions Neck: calcium subtraction to delineate stenosis, soft tissue evaluation, foreign bodies/devices, vascular injuries Spine: Marrow abnormalities, vertebral fractures, arthritis including gout, epidural invasion by paraspinal tumors, disc evaluation, hardware complications Summary and future directions

ER166-ED- Review of Non-Traumatic Renal Emergency Conditions

Station #7

Participants Christopher G. Puchferran, MD, Miami, FL (*Presenter*) Nothing to Disclose Fabio M. Paes, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose Anthony M. Durso, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose David Dreizin, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG Jessica G. Kumar, Miami Beach, FL (*Abstract Co-Author*) Nothing to Disclose Daniel Suarez, MD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose Felipe Munera, MD, Key Biscayne, FL (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Review renal anatomy and retroperitoneal boundaries 2. Understand and differentiate non-traumatic emergent conditions which may or may not require immediate medical/surgical intervention 3. Discuss diagnostic pearls and common pitfalls in diagnosing non-traumatic emergent renal conditions on MDCT

TABLE OF CONTENTS/OUTLINE

Epidemiology of renal emergencies Annual health care costs of non-traumatic renal emergencies Associated comorbidities with most common non-traumatic renal emergencies Anatomy Retroperitoneal anatomy, boundaries General renal anatomy Etiologies and symptomatology of non-traumatic renal emergencies Infectious Acute/chronic pyelonephritis Emphysematous pyelonephritis vs pyelitis Renal Abscess Xanthogranulomatous Pyelonephritis Obstructive Staghorn calculi Nephrolithiasis Calyceal rupture Vascular Renal vein thrombosis Infarction Spontaneous hemorrhage Post Procedural Pseudoaneurysm Dissection Hematoma Urinoma Perinephric abscess Diagnostic pearls and pitfalls Take home points





ERS-TUB

Emergency Radiology Tuesday Poster Discussions

Tuesday, Dec. 3 12:45PM - 1:15PM Room: ER Community, Learning Center

ER

AMA PRA Category 1 Credit ™: .50

Participants

Zachary S. Delproposto, MD, Ann Arbor, MI (Moderator) Nothing to Disclose

Sub-Events

ER213-SD- MAPAC Project: Image Algorithm for Acute Chest Pain with Suspicion of Coronary Heart Disease in TUB1 the Emergency Department

Station #1

Participants Fernando Gonzalez-Tello, MD, Madrid, Spain (*Presenter*) Nothing to Disclose Nicolas A. Almeida SR, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Manuel Vicente Redondo, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Blanca Lumbreras-Fernandez, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Jesus Corres Gonzalez SR, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Agustina Vicente Bartulos, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Javier Zamora Romero, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether the Diamond-Forrest scale (DFS) used to calculate the pre-test probability (PTP) of ischemic heart disease in patients with chest pain, correlates with findings of coronary multidetector computed tomography (CMCT) in emergency department (ED). To evaluate the adherence to the recommendation of a computer decision support system (CDSS) on the appropriateness of exploration with CMCT.

METHOD AND MATERIALS

Retrospective study of 284 consecutive patients who underwent an urgent CMCT, recruited from February 2014 to March 2018, after implementing a CDSS aimed to aid in the selection of patients who would benefit or not from imaging test. Patients with a PTP of ischemic heart disease between 15-85% were recruited. CAD-RADS classification was used to harmonize the radiological diagnosis. Significant coronary stenosis (SCS) is considered when the luminal diameter reduction was >50% in at least one vessel. Diamond Forrest algorithm was implemented as a CDSS, using the clinical characteristics of age, sex and chest pain.

RESULTS

173 of the patients were men and 111 were women, with an average age of 57. Typical angina was present in 44 patients (15.4%), atypical angina in 70 (24.6%) and non-anginal pain in 170 (60%). 7.7% (22) of CMCT were not considered conclusive. Among the remaining 262 scans, none of them had PTP <15% or >85%. 244 patients had PTP within of 15-65%, in whose group only 22% had a radiological coronary stenosis >50%. The remaining 18 patients, with PTP in the range of 66-85%, only 33.3% showed a SCS >50%.

CONCLUSION

The observed frequency in our series reveals that the pathological findings found in the CMCT are correlated with the increase in the pretest probability according to the DFS. However, this scale overestimates the risk of ischemic heart disease. In our ED, clinicians fully adhered to the CDSS recommendations. We are currently conducting a prospective study to make a more adjusted scale than the DF.

CLINICAL RELEVANCE/APPLICATION

DFS is not well calibrated for being used in patients with chest pain. The score overestimates PTP, although it shows a positive correlation between DFS and prevalence of radiological finding.

ER214-SD- Is the Intravascular Gas of the Organs on Early Postmortem CT Always Related to Cardiopulmonary TUB2 Resuscitation?

Station #2

Participants Tomonori Murakami, MD, PhD, Nagasaki, Japan (*Presenter*) Nothing to Disclose Masataka Uetani, MD, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose Yuki Abe, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose Takehiko Murase, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose Hiromi Yamashita, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose Kazuya Ikematsu, Nagasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Intravascular gas (IVG) of the organs on early postmortem CT (PMCT) has been known as the results of cardiopulmonary resuscitation (CPR); however, it is not clear whether other factors, such as putrefactive change, are related with IVG. The purpose

of this study was to clarify the frequency and significance of IVG of the organs on early PMCT in subjects without CPR.

METHOD AND MATERIALS

Between August 2014 and July 2018, 1860 subjects underwent PMCT at our institute. Of these, 561 subjects underwent PMCT within 24 hours after death. Finally, 394 subjects were enrolled in this study. Excluded were 167 subjects who underwent CPR. A board-certified radiologist retrospectively assessed the incidence and frequency of IVG in the 6 organs (brain, heart, liver, kidney, spleen, and pancreas).

RESULTS

IVG of the organs was positive in 129 (32.7%) of 394 subjects (1 organ, 27 subjects; 2 organs, 24 subjects; 3 organs, 41 subjects; 4 organs, 17 subjects; 5 organs, 4 subjects; and 6 organs, 16 subjects). The number of subjects with IVG of each organ is: brain, 64 subjects; heart, 108 subjects; liver, 112 subjects; kidney, 52 subjects; spleen, 23 subjects; and pancreas, 23 subjects. IVG of the brain, heart, and liver was the most frequent combination and observed in 22 subjects.

CONCLUSION

IVG of the organs was frequently observed on PMCT obtained within 24 hours after death, even in subjects without CPR.

CLINICAL RELEVANCE/APPLICATION

IVG of the organs on early PMCT was frequently observed even in subjects without CPR or trauma. Thus, we should not mistake these findings for IVG related with fatal pathologic process before death.

ER236-SD- Small Bowel Feces Sign in The Setting of Mesenteric and Bowel Injuries Due to Blunt Bowel Trauma TUB3 Station #3

Participants

Muhammad O. Afzal, MD, MBBS, Memphis, TN (*Presenter*) Nothing to Disclose Lou J. Magnotti, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose Dina Filiberto, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose Sridhar S. Shankar, MD, MBA, Memphis, TN (*Abstract Co-Author*) Equipment support, Clarius Mobile Health Corp

PURPOSE

Small bowel feces sign is a common CT finding in patients with small bowel obstruction. In contrast, this is seen infrequently in patients with bowel and mesenteric injuries (BBMI) after blunt abdominal trauma. It is our contention that the presence of small bowel feces sign on CT following blunt trauma can accurately diagnose BBMI when associated with other signs of BBMI on CT. Thus, the purpose of this study was to determine the impact of small bowel feces sign on the diagnosis of BBMI.

METHOD AND MATERIALS

All patients undergoing laparotomy for suspected mesenteric injury after blunt trauma were identified over a 5-year period. Admission CT scans were reviewed by a radiologist (blinded to the patient's management) to identify the presence of small bowel feces sign. Patients were then stratified by operative intervention (therapeutic vs. non-therapeutic laparotomy) and compared. Sensitivity, specificity and positive predictive value (PPV) of the presence of small bowel feces sign was then determined.

RESULTS

Of the 114 patients undergoing operative intervention, 75 patients underwent therapeutic laparotomy. Small bowel feces sign was seen in 25 cases. Overall sensitivity, specificity and PPV of small bowel feces sign for the presence of BBMI resulting in a therapeutic laparotomy was 28%, 87%, and 79.2%, respectively.

CONCLUSION

Small bowel feces sign is seen infrequently in cases of suspected bowel and mesenteric injuries after blunt abdominal trauma. However, when present, in combination with other signs it is highly suggestive of BBMI. Thus, the presence of small bowel feces sign on CT following blunt trauma can potentially identify those patients that would benefit from prompt operative intervention.

CLINICAL RELEVANCE/APPLICATION

Small bowel feces sign in combination with other signs of bowel and mesenteric injuries increases the confidence to consider therapeutic laparotomy in patients suspected of bowel and mesenteric injuries due to blunt trauma.

ER167-ED- CNS Emergencies and Complications of HIV TUB4

Station #4 Participants Liwei Jiang, MD, Boston, MA (*Presenter*) Nothing to Disclose Charlotte Y. Chung, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Gayatri Joshi, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose Tarek N. Hanna, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc Keith D. Herr, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

After viewing this exhibit, the learner will: 1. Describe the epidemiology and pathophysiology of brain manifestations of HIV disease. 2. Describe the major brain conditions associated with HIV disease, such as opportunistic infections, HIV-associated neurocognitive disorder, immune-reconstitution inflammatory syndrome (IRIS) and central nervous system (CNS) malignancy. 3. Recognize the structural and functional neuroimaging features of HIV-related brain pathology and treatment using a range of imaging modalities. According to the most recent data from the Centers for Disease Control and Prevention, 1.1 million people in the US are HIVpositive. Of these, 49% have attained viral suppression with antiretroviral therapy. However, 1 in 7 are unaware of their diagnosis. Over 20% of newly diagnosed HIV cases are stage 3-disease (AIDS) at diagnosis. Neurologic complications of HIV contribute to significant morbidity & mortality. The most recent epidemiologic data regarding HIV infection and treatment will first be presented. This will be followed by case-based illustration of the range of HIV-related CNS pathology using CT, MRI and functional imaging, such as PET. The exhibit will focus on entities related to HIV infection itself, opportunistic CNS infections, treatment-related pathology (IRIS), and malignancy, such as CNS lymphoma.

ER168-ED-TUB5 The Temporal Rift: Making the Key Features of Temporal Bone Fractures Accessible to the Non-Neuroradiologist

Station #5

Awards Cum Laude

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

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TEACHING POINTS

-Key features for recognizing the 'occult' temporal bone fracture (to include unexplained emphysema in the glenoid fossa or adjacent to the skull base, pneumocephalus, mastoid air cell opacification, sphenoid hemosinus, soft tissue thickening of the walls of the external auditory canal) -Basic classification schemes, with emphasis on otic-capsule involvement, including anatomy, clues to diagnosis, and implications. -One key pathology to look for in the outer ear (fracture of the anterior wall of the external auditory canal), middle ear (ossicular dislocation) and inner ear (otic-capsule involving fracture) will be presented.

TABLE OF CONTENTS/OUTLINE

-Basics of anatomy: margins of the inner ear, middle ear and inner ear -Components of the otic capsule, with clear delineation of how a non-neuroradiologist can rapidly identify the otic capsule on CT - Tips and tricks to identifying the 'occult' temporal bone fracture -Significance/complications of the key injuries chosen for the outer ear, middle ear, and inner ear -Major classifications systems: longitudinal vs transverse and otic-capsule violating vs involving -Significance of the otic capsule and complications associated with otic-capsule involvement. -Other complications of temporal bone fracture (CSF leak, intracranial infection, encephalocele, vascular injury, perilymphatic fistula)







RCA34

Hands-on Artificial Intelligence for Non-coders: How is an Intracranial Hemorrhage Detection Algorithm Created? (Hands-on)

Tuesday, Dec. 3 2:30PM - 4:00PM Room: S401AB



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Luciano M. Prevedello, MD, MPH, Dublin, OH (*Moderator*) Nothing to Disclose Luciano M. Prevedello, MD, MPH, Dublin, OH (*Presenter*) Nothing to Disclose Felipe C. Kitamura, MD, MSC, Sao Paulo, Brazil (*Presenter*) Consultant, MD.ai, Inc Igor R. Dos Santos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose Ian Pan, MA, Providence, RI (*Presenter*) Consultant, MD.ai

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LEARNING OBJECTIVES

1) Understand some of the important steps in the development of Deep Learning algorithms in Radiology including: a) Data Curation: How to organize the dataset into training/validation/test sets and create appropriate classes and labels; b) Training: Important considerations related to algorithm development including image pre-processing and data-augmentation; c) Inference: Understand how to measure algorithm performance.

ABSTRACT

The resurgence of neural networks, and more specifically deep learning, applied to computer vision tasks has been revolutionizing many industry verticles. The technique will likely positively impact Medical Imaging and augment radiologists capabilities to provide excellent patient care. Having an intuition of how these techniques work will be key to interpret its results. In this session, attendees will learn, through practical hands-on examples, how current state-of-the-art artificial intelligence algorithms are created and how they can be used to enhance workflow, augment image interpretation and ultimately improve patient care.







SSJ06

Emergency Radiology (Trauma Imaging: New Concepts)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S406A

ER

AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 1.00

Participants

Ludo F. Beenen, MD, Amsterdam, Netherlands (*Moderator*) Nothing to Disclose Michael E. O'Keeffe, MBBCh, Vancouver, BC (*Moderator*) Nothing to Disclose

Sub-Events

SSJ06-01 Prognostic Utility of Magnetic Resonance Imaging (MRI) in Predicting Neurological Outcomes in Patients with Acute Thoracolumbar Spinal Cord Injury

Tuesday, Dec. 3 3:00PM - 3:10PM Room: S406A

Participants

Muhil Kannan, MD, Coimbatore, India (*Presenter*) Nothing to Disclose Ankith N. Vivekanandaswamy, Coimbatore, India (*Abstract Co-Author*) Nothing to Disclose Ajoy P. Shetty, Coimbatore, India (*Abstract Co-Author*) Nothing to Disclose Rishi M. Kanna, Coimbatore, India (*Abstract Co-Author*) Nothing to Disclose Anupama N. V., MBBS, FRCR, Coimbatore, India (*Abstract Co-Author*) Nothing to Disclose Rajasekaran Shanmuganathan, MS, Coimbatore, India (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Utility of MRI for predicting neurological outcomes in acute cervical spinal cord injury (SCI) is well established but its value in thoracolumbar (TL) SCI needs to be evaluated.

METHOD AND MATERIALS

Seventy six patients operated for acute TL spinal injuries between january 2014 to march 2016 were reviewed to obtain demographic details, neurology at admission and at final follow up. Patients were divided based on the neurology at presentation into group 1 (ASIA A), group 2 (ASIA B, C, D), group 3 (normal neurology). Preoperative MRI and CT scans were evaluated to measure parameters like osseus canal compromise (OCC), spinal cord compression (SCC), spinal cord swelling (SCS), length of cord swelling (LOS), length of edema (LOE) and presence of hemorrhage. The MRI parameters were compared between the groups for their predictive value of neurology on admission and at final follow up.

RESULTS

Of the 38 patients in group 1, 6 patients recovered by 1 grade, 9 patients recovered by 2 grades and there was no recovery in 23(60.5%) patients. Among group 2 patients, 9 (40.9%) out of 22 recovered to ASIA E neurology. On univariate analysis SCC (P=0.009), LOS (P=0.021), length of edema (P=0.002) were associated with complete neurological deficit at presentation. However on multivariate regression analysis only LOE was significant (P=0.007) in predicting neurology at admission and at follow up.

CONCLUSION

Greater the rostrocaudal Length of edema (LOE), worse is the neurology at presentation and it is associated with poor neurological recovery at follow up.

CLINICAL RELEVANCE/APPLICATION

Among the MRI parameters, Length of edema had the highest individual correlation with poor neurological presentation Length of edema - poor prognostic sign for recovery.

ssj06-02 Can Quantification of Pulmonary Contusion in the Setting of Blunt Trauma Predict Patient Outcome?

Tuesday, Dec. 3 3:10PM - 3:20PM Room: S406A

Participants

Ashwin Jain, MD, Boston, MA (*Presenter*) Nothing to Disclose Matthew Diamond, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Donghoon Shin, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Hristina Natcheva, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Stephan W. Anderson, MD, Cambridge, MA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Tejal Brahmbhatt, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Celina Duran, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Oam Bhate, Cary, NC (*Abstract Co-Author*) Nothing to Disclose Myoung J. Kim, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Heidi Wing, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To analyze patients with variable degrees of pulmonary contusion and assess correlation with complications of blunt thoracic trauma.

METHOD AND MATERIALS

This retrospective study was IRB approved and HIPAA compliant. Informed consent was waived. Patients >=16 years old who sustained blunt thoracic trauma with Injury Severity Score (ISS) >=15 and CT scan within 24 hours of admission from 1/30/13 to 6/30/17 were included. 153 patients met inclusion criteria. Of the 153 patients included, 121 were male (79.1%) and 32 were female (20.9%). The mean age was 46.2 [16-97] and the mean ISS was 22. AAST lung injury scale was assessed in a blinded fashion by fellowship-trained radiologist with >10 years of trauma experience. Pulmonary contusion was measured using the 3 largest dimensions on orthogonal planes. Other CT variables included pneumothorax, pleural effusion, hemothorax, pulmonary laceration, pneumatocele, rib/sternal/scapular fractures, flail chest, and number of lobes injured. Clinical parameters collected were ISS, pulmonary/cardiac/renal comorbidities, intubation on presentation, ventilation associated pneumonia (VAP), and ARDS. Statistical analysis was performed using t-test, Fisher's exact test, and logistic regression.

RESULTS

With respect to CT imaging findings, the number of pulmonary lobes injured was associated with ARDS (p=0.01) and the presence of rib fractures was associated with VAP (p=0.03). Flail chest was associated with mortality (p=0.03). For every 100 mL increase in volume of pulmonary contusion, the odds of death increased by 1.20 times (p=0.04). For every 100 mL increase in volume of pulmonary contusion, the odds of ARDS increased by 1.21 times (p=0.015). With respect to clinical parameters, ISS, thoracostomy tube placement, supplemental O2 requirement, and age were associated with ARDS. ISS and age were associated with VAP. ISS and intubation on presentation were associated with mortality (all p-values <0.05).

CONCLUSION

The volume of pulmonary contusion is associated with patient mortality with statistical significance. In the setting of blunt trauma, the number of pulmonary lobes injured, rib fracture and flail chest are associated with ARDS, VAP and mortality, respectively.

CLINICAL RELEVANCE/APPLICATION

With the importance of adequate resource allocation in trauma, CT imaging findings seen in the setting of blunt thoracic trauma that prognosticate morbidity and mortality may assist in optimizing triage.

SSJ06-03 Injury Incidence and Patterns Associated with Electric Scooter Accidents

Tuesday, Dec. 3 3:20PM - 3:30PM Room: S406A

Participants Aiza Ashraf, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose Mohsin Mukhtar, BS, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose Mark S. Frank, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose Scott D. Steenburg, MD, Zionsville, IN (*Abstract Co-Author*) Institutional research collaboration, IBM Corporation

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PURPOSE

Electric motorized rental scooters (e-scooters, such as Bird and Lime), touted as a solution for 'last mile' problem, have the potential for significant utility in urban areas and college campuses. These vehicles can reach speeds up to 15 miles per hour. Since their legalization in our municipality on September 4, 2018, anecdotal observations have included a spike in imaging exams for 'scooter' accidents performed within our hospital system. The purpose of this study was to describe the injury incidence and imaging ordering patterns associated with the use of e-scooters in our municipality.

METHOD AND MATERIALS

Electronic medical records (EMRs) and radiology archives in our institutional database were searched for instances of imaging exams ordered to for injuries related to scooter accidents. Inclusion criteria include age 18 years or higher, seen at the ER of a performance site from 2013 to 2018, and 'scooter' included as a key word in the imaging request. Basic statistical analysis of the number and distribution of injuries diagnosed on imaging were performed.

RESULTS

A total of 69 exams performed on 36 unique emergency department patients with a definitive description of involvement of an escooter were identified. Two-thirds of these patients were ages 18-30 years. Of the imaging exams, a total of 44 (63.8%) were radiographs of the extremities, including 15 (34.1% of extremity exams) of the forearm/hand/wrist and 17 (38.6% of extremity exams) of the knee/leg/ankle/foot. A total of 18 CT exams (26.1%) were performed, including 13 (72.2% of CT exams) of the head, face or cervical spine. Of the 36 patients, 52.8% (N=19 patients) had documented injuries on 29 separate imaging exams with an overall exam positivity rate of 42.0%. The most common injuries included distal radial fracture (N=6), followed by soft tissue injury of the head, face, wrist, and ankle (N=5).

CONCLUSION

Over half of individuals who received imaging in the setting of e-scooter accidents were found to have a radiographically apparent injury. The injuries vary but the most common patterns include distal radial fracture and soft tissue injuries involving the head,

face, wrist and ankle.

CLINICAL RELEVANCE/APPLICATION

Within our health system, imaging performed in the setting of e-scooter injuries was positive in over one half of instances. Radiographs of the extremities as well as CT of the head, face and cervical spine were the exams most likely to be ordered.

SSJ06-04 Assessment of an AI-Powered Algorithm for the Automatic Detection of Rib Fractures

Tuesday, Dec. 3 3:30PM - 3:40PM Room: S406A

Participants

Luca Noordtzij, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose Thomas Weikert, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose Jens Bremerich, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose Bram Stieltjes, MD,PhD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose Gregor Sommer, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose Alexander Sauter, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To analyze the diagnostic performance of a deep learning-based algorithm for the automated detection of rib fractures in trauma CT scans.

METHOD AND MATERIALS

We retrospectively identified all whole-body trauma CT scans referred from our emergency department between 01/2018 and 12/2018 (n=461). The exams were categorized as positive (n = 158) and negative (n = 303) for rib fractures according to the clinically approved written reports. After full anonymization, CT datasets (1.5 mm bone kernel) were analyzed using an algorithm for the detection of rib fractures based on a convolutional neural network that had previously been trained on an independent sample (n = 11,000). The review of the results was performed on a web-based feedback system by comparing the detected results with the findings in the written reports.

RESULTS

Twelve cases had to be excluded due to technical problems. Overall, the algorithm achieved a sensitivity of 78.8% (115/146; 95% confidence interval [CI]: 71.2%-85.1%) and a specificity of 94.1% (285/303; 95% CI:90.8%-96.4%) on a per exam level (positive predictive value of 86.5%; 95% CI: 80.2%-90.1%, F1 score: 83%). On a per finding level there were 285 false negative findings out of 855 fractures mentioned in our reports, corresponding to a sensitivity of 66.7% (570/855; 95% CI: 63.4%-69.8%) and a specificity of 80.7% (285/353; 95% CI: 74.3%-83.4%). Furthermore, 85 positive findings (58 acute and 27 chronic fractures) detected by the algorithm were not mentioned in our reports.

CONCLUSION

We found good performance of an algorithm automatically detecting rib fractures in whole-body trauma CT scans on a per exam level. On a per finding level, some limitations become evident. Fractures that had not been documented in the written reports were detected by the algorithm. Thus, it constitutes a fundament for further developments in direction of a clinical decision support tool that improves accuracy of healthcare provision.

CLINICAL RELEVANCE/APPLICATION

Rib fractures are often underdiagnosed due to time-restrictions and focus on urgent findings in an emergency setting. AI-based detection has the potential to support without reader distraction.

SSJ06-05 Optic Nerve Sheath Diameter is a Prognostic Biomarker of Computed Tomography (CT) in Patients with Traumatic Brain Injury and Its Comparison with Standard Rotterdam and Marshall Computed Tomography Scores (CT Scores)

Tuesday, Dec. 3 3:40PM - 3:50PM Room: S406A

Participants

Naveen Kumar, MD, Gulbarga, India (Presenter) Nothing to Disclose

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PURPOSE

The aim of this study is to prove that the optic nerve sheath diameter (ONSD) is an important and isolated predictor of outcome in patients with traumatic brain injury (TBI) and its comparison with standard Rotterdam and Marshall Computed tomography (CT scores).

METHOD AND MATERIALS

A prospective study of 100 patients performed in the department of radiology. About 100 patients underwent CT imaging for traumatic brain injury between January 2018 to June 2018. Bilateral ONSD was measured 3mm posterior to the eyeball in axial and sagittal planes and the mean value was calculated. RCTS and Marshall Score was assessed on the same CT images, the bias was eliminated by blinding RCTS and Marshall score to ONSD measurement.

RESULTS

100 patients were included, mean age of the group was 40-50 years. ONSD in mild TBI includes RCTS-2 and RCTS-3 was 3.3mm (SD

0.39 mm) and 4.1 mm (0.047 mm) respectively. Mean ONSD in moderate and severe TBI (RCTS score 4 and above) was 4.83 mm and above (SD 0.4 mm). Mean ONSD correlated with occurrence of diffuse cerebral edema, presence of subdural and extradural hematoma however, in isolation there was no statistical significance.

CONCLUSION

Diameter of optic nerve sheath is considered as a valid, reliable, and non-invasive screening tool in determining the elevated intracranial pressure in cases with traumatic brain injury and its indirect predictor of outcome in patients with TBI.

CLINICAL RELEVANCE/APPLICATION

Calculation of Optic nerve sheath diameter and its comparison with standard Rotterdam and Marshall CT scoring in TBI patients to confirm ONSD as a Prognostic Biomarker of outcome in TBI patients.

SSJ06-06 Laryngeal and Hyoid Fracture Detection in Forensic Post-Mortem CT: Comparison of Standard Post-Mortem CT with High Resolution Post-Mortem Cervical CT and Autopsy Findings

Tuesday, Dec. 3 3:50PM - 4:00PM Room: S406A

Participants

Andreas Bucher, MD, Frankfurt am Main, Germany (*Presenter*) Travel support, Guerbet SA; Boris Bodelle, MD, Frankfurt am Main, Germany (*Abstract Co-Author*) Research support, General Electric Company; Research support, Siemens AG Marcel A. Verhoff, Frankfurt/Main, Germany (*Abstract Co-Author*) Nothing to Disclose Mattias Kettner, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose Sara Heinbuch, Frankfurt am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the detection rate of laryngeal and hyoid fractures in suspected homicide victims with suspicion of strangulation in standard full body forensic CT imaging and high-resolution reconstructions from dedicated cervical CT against autopsy findings.

METHOD AND MATERIALS

This single-centre, observer-blinded study included a total 15 full post mortem full body CT examinations. All CT series were acquired on a third generation dual source CT. For each case an additional high-resolution scan was performed of the larynx and hyoid bone (CTHR). CTN was acquired as a neck spiral from full body CT at a tube voltage of 120 kV and reference tube current of 300 mAs; CTHR was acquired at a fixed tube current of 350 mAs at 120 kV. CTN was reconstructed with standard clinical reformations of the neck in axial, coronal and sagittal orientations at 3 mm slice thickness and 2 mm increment. CTHR was reconstructed in anatomically oriented sections of the larynx and hyoid bone in axial, coronal and sagittal orientation by autopsy report was available for all cases. Fracture location was recorded in a binary fashion for all anatomic regions. Image reporting was performed by an independent reader for reconstructions from CTN and CTHR seperately in a blinded fashion.

RESULTS

A total of 105 anatomical regions were compared from autopsy reports, CTN and CTHR reports. 17 fractures were identified on autopsy. Most fractures were located at the base of the right superior horn of the thyroid cartilage (29%). Sensitivity of fracture detection from CTN was 20% (4/17 fractures). Sensitivity of fracture detection from CTHR was 92.9% (15/17 fractures; p=0.001). Youden-index was improved from 0.17 in CTN to 0.82 in CTHR. Fractures of the hyoid bone were significantly less common, detection rate was identical in CTN and CTHR (1 of 2 cases each).

CONCLUSION

Post mortem CT imaging in cases of suspected strangulation provides good detection rate of larynx fractures with dedicated high resolution acquisition and reconstruction protocol, but is not adequate for fracture detection when standard reconstruction of clinical cervical protocol is performed.

CLINICAL RELEVANCE/APPLICATION

Post mortem CT imaging of the neck should include an additional high-resolution CT spiral with dedicated reconstructions to guide autopsy when cervical trauma or strangulation is suspected.





SSJ18

Neuroradiology (Traumatic Brain Injury)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S406B



AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants

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Sub-Events

SSJ18-01 Detection of Cerebral Microbleeds in American Football Players Using SWI: A Comparison of 3T to 7T MRI

Tuesday, Dec. 3 3:00PM - 3:10PM Room: S406B

Participants

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PURPOSE

American football players (AFP) experience repetitive brain trauma during their career and are at risk for developing a condition known as chronic traumatic encephalopathy. Cerebral microbleeds (CM) are a typical finding of repetitive brain trauma and diffuse axonal injury and show a frequency of about 9% in retired AFP (Casson IR et. al 2014). To our best knowledge all neuroimaging studies on CM in AFP have been performed on 1.5 or 3 T MRI. Ultrahigh field MRI with 7T shows significantly more CM in patients with diffuse axonal injury than 3 T SWI (Moenninghoff C et al 2015). The purpose of this study is to evaluate the diagnostic value of 7T SWI compared to 3T SWI for the detection of CM in AFP.

METHOD AND MATERIALS

Twelve professional AFP were enrolled in this prospective study (mean age: 23,4 years, range: 22-32 years, all male). All patients underwent a MRI scan with SWI imaging of the brain on 3T and 7T. Ultra-high field MR examinations were performed on a 7 T whole-body research system (Magnetom 7 T, Siemens AG, Germany). All examinations at 3 T were performed on a high-end clinical MR system (Magnetom Skyra, Siemens AG, Germany). Both MR systems were used in combination with 32-channel radiofrequency head coils. Image analyses were performed by two neuroradiologist in consensus reading on 3T MRI and on 7T MRI for number of CM and additional findings.

RESULTS

The readers identified a total of three CM in three different AFP in the 3T SWI (Fig. 1a). In the 7T SWI one of these CM was confirmed (Fig. 1b), moreover even two smaller adjacent CM were identified. The other two suspected CM at 3T in the other two AFP were identified at 7T as atypical small intracerebral veins (Fig. 1 c, d). As an additional finding a developmental venous anomaly (DVA) was found in one the AFP, which was well delineated in both 3T and 7T, whereas at 7T a more exact architecture of the DVA was definable.

CONCLUSION

7T SWI improves the depiction of CM. Moreover, 7T SWI allows a more accurate differentiation of lesions that were described as CM at 3T but identified as atypical venous blood vessels at 7T SWI.

CLINICAL RELEVANCE/APPLICATION

7T SWI could enable a more accurate detection of CM and help to understand pathophysiological processes in AFP, nevertheless larger studies at 7T are needed.

SSJ18-02 Influence of Callosal Microstructural Compromise on Interhemispheric Speed of Processing in Mild Traumatic Brain Injury

Participants

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PURPOSE

The corpus callosum (CC) is at specific risk in Mild Traumatic Brain Injury (MTBI) and critical for interhemispheric communication. Here we test the hypothesis that microstructural compromise as measured by diffusion MRI affects performance on a novel interhemispheric speed of processing task (IHSPT).

METHOD AND MATERIALS

The study is approved by the institutional review board. 36 MTBI subjects (11 male, 25 female; mean age 36 years) within 4 weeks of injury and 27 controls were included (12 male, 15 female; mean age 37 years). IHSPT measures latency over 80 trials between visual word stimulus presentation to the right vs left visual hemifield. Patients with positive IHSPT values were included (indicating probable left language dominance, necessitating information crossing the CC). Diffusion MRI was performed on 3T (Skyra,Siemens) with 5 b-values (up to 2.5ms/m2 with 60 directions). Diffusion metrics of fractional anisotropy, diffusivity and kurtosis (mean, radial and axial; MD, RD, AD, MK, RK, AK) were calculated as well as compartment-specific white matter microstructure metrics, including axonal water fraction (f), a measure of axon density, intra-axonal diffusion (Daxon), reflective of axonal integrity, and extracellular diffusion along and perpendicular to the axis of the axon (Depar and Dperp), sensitive to glial and inflammatory changes, and changes in myelination, respectively. Region-of-interest analysis was done using freesurfer segmentation of the CC. Relationship between IHSPT performance and diffusion measures was assessed using Pearson's partial correlation in both MTBI and control groups.

RESULTS

In controls, we found correlations between IHSPT and several diffusion measures all localizing to the splenium (MD,RD, AK, and Deperp; p<0.05), lost in MTBI subjects. MTBI subjects, on the other hand, showed significant correlations between IHSPT and kurtosis diffusion measures in the genu of the CC (MK, AK, and RK) (Table 1).

CONCLUSION

In MTBI subjects, we find a relationship between CC body microstructural complexity and IHSPT not seen in controls. Furthermore, the normal relationships seen in controls between tissue microstructure and interhemispheric processing are lost after MTBI.

CLINICAL RELEVANCE/APPLICATION

Understanding how white matter injury affects cognitive performance is the critical next step for better assessing MTBI patients. Here we show altered relationships between CC microstructure and specific IHSPT between MTBI patients and controls.

SSJ18-03 Subject-Specific White Matter Abnormalities in Chronic TBI Assessed by Biophysical Modeling Using Simultaneous Multi-Slice Multi-Shell Diffusion MRI

Tuesday, Dec. 3 3:20PM - 3:30PM Room: S406B

Participants

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PURPOSE

Conventional diffusion tensor imaging (DTI), assuming Gaussian distribution of water molecule diffusion, is not able to infer the microstructures cofounded by the effects of fiber crossings and orientation dispersion. Subject-specific analysis is crucial in traumatic brain injury (TBI) care and long-term follow up. The goal of this study is to demonstrate the feasibility of mapping subject-specific white matter abnormalities in chronic TBI using non-Gaussian diffusion MRI (dMRI) reconstruction techniques.

METHOD AND MATERIALS

Participants included 181 active service members diagnosed with possible TBI (M/F=180/1, age=35.40 ±7.88 years) and 43 non-TBI controls (M/F=31/12, age=40.35±5.99 years). 3T dMRI with inter-slice acceleration factor of 3 and inter-plane acceleration of 2 was prescribed using three shells (270 directions in each shell, diffusion gradients=3K, 2K, 1K, isotropic 1.7 mm) scheme. dMRI was preprocessed using TORTOISE package. Diffusion metrics were then reconstructed using several non-Gaussian dMRI models, including bi-tensor free water DTI, mean apparent propagator MRI, neurite orientation dispersion and density imaging model and multi-compartment microscopic diffusion model using the Spherical Mean Technique. For voxel-wise subject-specific analyses, the

group-wise means and the variances of the whole brain white matter of non-TBI controls were calculated after transforming to the MNI template and smoothing, and the Mahalanobis distance at each voxel was computed for the individual TBI subject, as well as leave-one-out approach for comparing individual control to the rest of controls.

RESULTS

Fig. 1 shows an example of the subject-specific analysis results of a mild TBI participant. There were no statistical difference of the total volumes of white matter anomalies between TBI and controls, though the TBI group tended to have a larger amount of anomalies.

CONCLUSION

Our results suggested that mapping microscopic features with methods that are not confounded by the effects of fiber crossings and orientation dispersion would have a better understanding of the complexity of axonal pathology in chronic TBI.

CLINICAL RELEVANCE/APPLICATION

Mapping subject-specific microstructural changes might help distinguishing the underlying pathology following brain injury, e.g. neuroinflammation vs axonal degeneration.

SSJ18-04 Relationship Of White Matter Microstructure To Working Memory Function As A Function Of Time-Since-Injury After Mild Traumatic Brain Injury: Diffusion MRI Study

Tuesday, Dec. 3 3:30PM - 3:40PM Room: S406B

Participants

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PURPOSE

Cognitive complaints can be one of the most troubling and persistent symptoms after MTBI[1-2] and there is a need to better understand how working memory deficits[3] relate to detectable microstructural injuries. Here, we aim to discover robust biomarkers that allow for early identification of patients at highest risk of working memory impairments.

METHOD AND MATERIALS

We studied 19 MTBI(mean,30y.o) and 20 normal subjects(NC;mean,33y.o). Diffusion MRI was performed on 3T(Skyra,Siemens) with 5 b-values. Diffusion metrics of FA, diffusivity and kurtosis (mean/radial/axial) were calculated. Auditory-verbal working memory was assessed using WAIS-IV[4]:Digit Span Forward(DSF), Backward(DSB) and Sequencing(DSS), and Letter-Number Sequencing(LNS). Region-of-interest(ROI) analyses were performed to assess the relationship between diffusion measures and working memory performance using Pearson's partial correlation with age/sex as covariates(family-wise-corrected p<0.05). Subgroups were also defined according to their working memory performance and time-since-injury(Table2). Subgroup comparisons were done using MANCOVA with age as covariate.

RESULTS

There was a significant correlation between axial kurtosis(AK) and DSB in the right superior longitudinal fasciculus(SLF) in MTBI(r=0.69), not present in NC(Table 1). In MTBI, we also found loss of the normal relationship between FA and LNS that was present in the right posterior corona radiata(pCR) in NC(r=0.67). Time-since-injury and division of subjects into high/low performer groups(z-score=1) influenced some of the relationships between regional diffusion measures and performance on working memory(Fig.1).

CONCLUSION

We show differences in the relationship between diffusion measures and working memory performance in MTBI and healthy subjects. Furthermore, preliminary results suggest both time-since-injury and relative performance level on working memory provide additional insight into these relationships.

CLINICAL RELEVANCE/APPLICATION

Our study elucidates microstructural changes in relation to working memory after MTBI, and suggest the potential utility for early identification of patients with working memory deficits.

SSJ18-05 Region-Based Blood-Brain Barrier Disruption in Mild Traumatic Brain Injury: Quantification Using DCE MR Imaging and Automatic Segmentation Method

Tuesday, Dec. 3 3:40PM - 3:50PM Room: S406B

Participants

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Roh-Eul Yoo, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To explore region-based blood-brain barrier disruption in mild traumatic brain injury (mTBI) patients with post-concussion syndrome

(PCS) using quantitative dynamic contrast-enhanced (DCE) MR imaging parameters and automatic segmentation method and to explore its clinical implications.

METHOD AND MATERIALS

Forty-one consecutive patients with PCS after mTBI and 29 controls, who had undergone MR imaging including DCE MR imaging at our institution between October 2016 and April 2018, were included in this retrospective study. After performing 3D T1-based brain segmentation with the FreeSurfer software package, mean Ktrans values from DCE MR imaging (derived using Patlak model) were analyzed at bilateral cerebral/cerebellar white matters, bilateral cerebral/cerebellar gray matters, corpus callosum, and brainstem. The Mann-Whitney U-test was performed to compare mean Ktrans between mTBI patients and controls. Ktrans values were correlated with neuropsychological test results using Mann-Whitney U-test and Spearman rank correlation in mTBI patients.

RESULTS

The median Ktrans (x10-1min-1) at bilateral cerebral gray matters was significantly higher in mTBI patients (0.010 [interquartile range: 0.008-0.013]) than in controls (0.008 [interquartile range: 0.007-0.012]) (P = .042). Ktrans tended to be higher in both the subgroup with the time interval between injury and MR imaging of 3 months or less and those with the interval longer than 3 months. Ktrans at bilateral cerebral gray matters was significantly higher in patients with atypical performance in auditory continuous performance test (commission errors) than in those with average or good performance (P = .041). In ROC analysis, Ktrans at bilateral cerebral gray matters had a sensitivity of 89% and a specificity of 70% for differentiating the two groups at a cut-off value of 0.009x10-1min-1. Ktrans at other regions were not significantly different between mTBI patients and controls.

CONCLUSION

BBB disruption was observed throughout bilateral cerebral gray matters in mTBI with PCS and the extent of BBB disruption as reflected by Ktrans was greater in patients with atypical performance in a neurocognitive test.

CLINICAL RELEVANCE/APPLICATION

DCE MR imaging can clearly depict BBB disruption in mTBI patients with PCS and is recommended as part of a MR study for the patients with otherwise normal conventional MR imaging findings.

SSJ18-06 The Application of Delayed-Contrast MRI (DCM) for Depicting Subtle BBB Disruption in TBI

Tuesday, Dec. 3 3:50PM - 4:00PM Room: S406B

Participants

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PURPOSE

TBI is a highly complex disorder caused by primary and secondary injury mechanisms. Alternations in gliovascular signaling are not established as a key secondary injury. Moreover, little is known regarding the long terms effects of BBB disruption. Here we studied the feasibility for applying DCM for depicting subtle BBB disruption in TBI and the correlation with histology of blood vessels coverage by astrocytes (BVCA).

METHOD AND MATERIALS

24 mice were followed by DCM 1/8/29/64/98 and 133 days post closed head injury. BBB disruption maps were calculated from the MRIs and BBB disruption levels in the lesions vicinity were calculated. Extracted brains were sectioned and stained for astrocytes and vessels. The percent of BVCA was calculated from samples within the lesion vicinity. In addition, 10 TBI mice and 6 controls were scanned 15 months post TBI, and 5 patients were scanned 1 year post TBI.

RESULTS

Significant BBB disruption levels were depicted in the maps in the lesion vicinity in all mice post TBI. Lesion volumes as depicted in the BBB maps up to 1 week post TBI were x2.5 larger than the enhancing volume on T1-Gd (p<0.02). Disruption levels decreased linearly with time between days 1 and 133 (r2=0.93, p<0.002). Significant correlation was found between the disruption level calculated from MRI and BVCA for the different time points (r2=0.77, p<0.05). When scanned 15 months post TBI, disruption levels depicted in the ipsilateral ventricle were significantly higher for TBI mice vs control (p<0.03). Preliminary clinical results in 5 TBI patients show subtle BBB disruption, undetectable by standard MRI, depicted for all patients. Initial analysis suggests several possible disruption patterns (local disruption in the brain tissue and the midline, local blood-CSF disruption, subarachnoid, ventricular and wide-spread).

CONCLUSION

DCM enables depiction of significant BBB disruption, with higher sensitivity than T1-Gd, up to long times post injury. Correlation between MRI-based disruption levels and BVCA observed in the animal model may be explained by alterations in gliovascular signaling resulting from TBI.

CLINICAL RELEVANCE/APPLICATION

DCM may be applied for depicting subtle BBB disruption induced by TBI up to long times post injury. This may be used for prognosis and treatment monitoring. The correlation with BVCA may be used to study the mechanism of secondary damage.





SSJ20

Neuroradiology (Stroke 3)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S404AB



AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 1.00

Participants

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Sub-Events

SSJ20-01 Technical Outcomes and Early Experience of a Centrifugally-Trained Interventional Radiology Stroke Service

Tuesday, Dec. 3 3:00PM - 3:10PM Room: S404AB

Participants

Eric Huh, MD, Baltimore, MD (*Presenter*) Nothing to Disclose Ferdinand K. Hui, MD, Richmond, VA (*Abstract Co-Author*) Speakers Bureau, Terumo Corporation Speakers Bureau, Penumbra, Inc Stockholder, Blockade Medical Inc Nikhil Bhagat, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose Abhishek Srinivas, MD, Cockeysville, MD (*Abstract Co-Author*) Nothing to Disclose Brian G. Johnson, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose Andrew S. Akman, MD, MBA, Washington, DC (*Abstract Co-Author*) Nothing to Disclose John Lynch, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose Victor Urrutia, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose Cameron McDougall, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose Kelvin K. Hong, MD, Baltimore, MD (*Abstract Co-Author*) Scientific Advisory Board, Boston Scientific Corporation; Scientific Advisory Board, BTG International Ltd; Research support, BTG International Ltd;

PURPOSE

Despite level 1A evidence for efficacy, rapidly accessible IR stroke care is not universally available. Judicious establishment of new IR stroke centers is one approach to improve access to care. We describe the development of a centrifugally-trained IR stroke team and the initial year of independent practice.

METHOD AND MATERIALS

A team of interventional radiologists learned best practices for stroke intervention with on-site proctoring by an experienced neurointerventionalist who was flown by a helicopter-physician transport system to proctor each case performed during the training period. Patient eligibility for and appropriateness of endovascular thrombectomy (EVT) was determined using DAWN criteria. Technical success of EVT was assessed using the Thrombolysis in Cerebral Infarction (TICI) scale. Secondary endpoints included time metrics of workflow upon arrival to the ED, early neurologic recovery, 90-day mortality and intervention-related complications. We compared our outcomes of our study with those of the DAWN trial and HERMES meta-analysis.

RESULTS

30 total cases of EVT were retrospectively reviewed. TICI 3 or 2b technical success was achieved in 83%, not significantly different from the rate observed in HERMES when using two-tailed proportional analysis. No cases of intervention-related intraparenchymal hemorrhage, hematoma or arterial perforation/dissection occurred. Major early neurologic recovery was observed in 36% of cases compared to 50% in HERMES. 90-day mortality was observed in 10% of cases, similar to 15.3% in HERMES. The median interval from patient arrival to the ED to groin puncture was 104 minutes, compared to 109 minutes in the DAWN trial.

CONCLUSION

When comparing the performance of our centrifugally-trained IR stroke team with the HERMES meta-analysis, there was no significant difference in the technical efficacy of EVT nor any increased occurrence of intervention-related complications. There was also no significant difference in the median interval of time between patient arrival to the ED and groin puncture when compared to the DAWN trial.

CLINICAL RELEVANCE/APPLICATION

We describe a proof-of-concept model of a centrigully-trained IR stroke team as a possible approach to improve access to interventional stroke care.

SSJ20-02 Cost-Effectiveness of Thrombectomy for Ischemic Stroke Patients Presenting Beyond 6 Hours of Last Known to Be Well Based on the AURORA Meta-Analysis

Wolfgang G. Kunz, MD, Munich, Germany (*Presenter*) Grant, Medtronic plc
Mohammed A. Almekhlafi, MD, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose
M.G. Myriam Hunink, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mayank Goyal, MD, FRCPC, Calgary, AB (*Abstract Co-Author*) Grant, Medtronic plc; Grant, Stryker Corporation; Grant, Cerenovus; Consultant, Stryker Corporation; Consultant, Medtronic plc; Consultant, Mentice AB; Licesning agreement, General Electric Company

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PURPOSE

The AURORA meta-analysis (Analysis of Pooled Data from Randomized StUdies of ThROmbectomy MoRe than 6 hours After Last Known Well) included patients that were randomized to endovascular thrombectomy (EVT) or to medical management (MM) presenting with large vessel occlusion stroke beyond 6 hours of symptom onset or last known to be well. Based on five pooled trials, EVT showed clear clinical benefits. We aimed to determine the cost-effectiveness of EVT in this context.

METHOD AND MATERIALS

A decision model based on Markov simulations estimated lifetime costs and quality-adjusted life years (QALY) associated with EVT or MM (Figure 1). The analysis was performed in a United States setting from a societal perspective. Input parameters for the model were based on most recent and best available evidence (Table 1), including pooled outcome data from patients randomized in five trials (DAWN, DEFUSE 3, ESCAPE, REVASCAT, POSITIVE, Figure 2). Probabilistic sensitivity analyses (PSA) were performed using 10,000 Monte Carlo simulations to estimate uncertainty. Incremental costs (IC), incremental effectiveness (IE), and incremental cost-effectiveness ratios (ICER) were derived. Cost-effectiveness acceptability rates were determined for varying willingness-to-pay (WTP) thresholds.

RESULTS

Based on outcome data of 458 patients randomized within the AURORA meta-analysis, the base-case analysis identified EVT as the strategy that resulted in incremental QALYs and cost-savings over the projected lifetime compared to MM (IC: -\$17,902; IE: +1.71 QALYs; ICER: EVT dominant). Adjusting for all input parameter uncertainty in PSA, EVT was the preferred strategy with acceptability rates of >99.9% at all WTP thresholds ranging from \$10,000 to \$150,000 per QALY (Figure 3). Simulations led to 94.46% dominant/cost-saving iterations (Figure 4).

CONCLUSION

EVT is projected to provide considerable long-term clinical benefit whilst also leading to considerable long-term cost-savings in the management of patients with large vessel occlusion stroke presenting beyond 6 hours of symptom onset or last known to be well

CLINICAL RELEVANCE/APPLICATION

The expanded EVT indication beyond traditional time windows increases the need for EVT. Based on the projected health and cost benefits, healthcare investments are justified to cover this new demand.

SSJ20-03 Correlation of ASPECTS with CT Perfusion Core Volume in Large Vessel Occlusion Ischemic Strokes: A Real World Experience

Tuesday, Dec. 3 3:20PM - 3:30PM Room: S404AB

Participants Sriharsha Voleti, BS, Rootstown, OH (*Presenter*) Nothing to Disclose Johnathan Vidovich, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose Brendan M. Corcoran, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose Bin Zhang, PhD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose Vivek J. Khandwala, PhD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose Pooja Khatri, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose Pooja Khatri, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose Poomas A. Tomsick, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose Thomas A. Tomsick, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose Achala S. Vagal, MD, Mason, OH (*Abstract Co-Author*) Research Grant, Cerovenus

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PURPOSE

The Alberta Stroke Program Early CT Score (ASPECTS) and CT perfusion (CTP) are commonly used to predict the ischemic core in acute ischemic strokes (AIS). CT angiogram source images (CTA-SI) can also provide additional information to identify the extent of ischemia. Our objective was to investigate the correlation of non-contrast CT (NCCT) ASPECTS and CTA-SI ASPECTS with CTP core volumes and final infarct volumes (FIV).

METHOD AND MATERIALS

We utilized a single institutional, retrospective registry of consecutive patients with AIS with large vessel occlusion (LVO) between May 2016 and May 2018. We graded ASPECTS both on NCCT and CTA-SI blinded to CTP results, measured CTP core using automated RAPID software (CBF<30%) and calculated FIV using follow up CT/MRI within 5 days of stroke onset. We used Pearson's correlation coefficients to evaluate the correlation between continuous variables.

RESULTS

A total of 58 patients fit the inclusion criteria of LVO and imaging work up of NCCT, CTA, and CTP. The mean age was 64.1 ± 16.1 years and 41.4% were female. The median NCCT ASPECTS was 7 (IQR, 6-9), CTA-SI ASPECTS was 5 (IQR, 4-7), and CTP core was 14.5 ml (IQR, 0-45 ml). There was a moderate correlation between NCCT ASPECTS and CTP core (correlation coefficient, R= -0.57, p<0.0001) and between CTA-SI ASPECTS and CTP core (correlation coefficient, R= -0.48, p=0.0002). The correlation coefficient between FIV and NCCT ASPECTS was -0.54 (p<0.0001), FIV and CTA-SI ASPECTS was -0.48 (p=0.0004), and FIV and CTP core

was 0.66 (p<0.0001). The optimal NCCT ASPECTS cutoff score to detect CTP core of 70 ml was 5 (sensitivity 0.57, specificity 0.84, Youden J 0.41) and the optimal CTA-SI ASPECTS was 4 (sensitivity 0.71, specificity 0.75, Youden J 0.46).

CONCLUSION

There was a moderate correlation between NCCT and CTA-SI ASPECTS in predicting CTP defined ischemic core and final infarct volumes.

CLINICAL RELEVANCE/APPLICATION

Our findings emphasize the need for further investigation into the use of CTA-SI ASPECTS for evaluating infarct extent in large vessel occlusions.

SSJ20-04 Successful Endovascular Thrombectomy Significantly Reduces Infarct Growth in both Early and Late Time Windows, but not for Patients with "Large" Admission Infarcts

Tuesday, Dec. 3 3:30PM - 3:40PM Room: S404AB

Participants

Fabio Noro, MD, MS, Brookline, MA (*Presenter*) Nothing to Disclose Ali Pourvaziri, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Shahmir Kamalian, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Ramon G. Gonzalez, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Thabele M. Leslie-Mazwi, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company; Research support, Siemens AG; Consultant, Takeda Pharmaceutical Company Limited; Renata R. Almeida, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Bernardo C. Bizzo, MD,MSc, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Endovascular thrombectomy (EVT) of acute stroke patients with large vessel occlusion (LVO) and small infarcts (<50ml) has been proven to be of benefit up to 24-hrs post ictus. Our purpose was to investigate the relationship between degree of recanalization and infarct growth, stratified by admission infarct volume and time-post-ictus.

METHOD AND MATERIALS

We retrospectively studied 223 consecutive LVO patients who underwent EVT between 6/1/2012 and 12/31/2017. 92/233 met inclusion criteria including available admission MR-DWI and follow-up CT or MR 12-hrs to 5-days post-procedure. Infarct growth was calculated as [final-admission infarct volume] / [admission volume] * 100, (measured as L*W*H/2). Degree of recanalization was determined according to the AOL and TICI scores, as good (AOL 2B/3, TICI 3/4), poor (AOL 0/1, TICI 0-2), or intermediate (everything in-between). Patients were stratified according to admission infarct volume (< vs > 50 ml) and time-post-ictus at presentation (< vs > 6 hours).

RESULTS

92/233 patients; 53 men/39 women. Mean age 68. LVO location included 25 ICA, 84 M1, and 27 M2. Success of recanalization was 43/92 (47%) good, 19/92 (21%) intermediate, and 30/92 (32%) poor. There were 72/92 (78%) and 20/92 (22%) patients with admission infarct volume less than and greater than 50 ml, respectively. There were 68/92 (74%) and 24/92 (26%) patients treated less than and greater than 6-hrs post-ictus, respectively. Mean infarct growth was significantly different among the 3 recanalization groups (good 13.4 ml, 76%; intermediate 45.5 ml, 203%; and poor 102.1 ml, 482%; p<0.01). These differences remained significant when stratified by time-post-ictus (10.8 vs 42.7 vs 116.4 ml, and 81 vs 194 vs 498 %; p<0.01) in the early window group; and remained significant in the late window group (24.5 vs 56.0 vs 80.6 ml, and 58 vs 235 vs 464 %; p<0.01). These differences also remained significant when stratified by admission infarct volume (9.0 vs 46.4 vs 118.4 ml, and 87 vs 229 vs 630 %; p<0.01) in the <50 ml group; but did not remain significant in the >50 ml group (30.0 vs 40.7 vs 57.4 ml, and 37 vs 66 vs 63 %; p=0.4).

CONCLUSION

Successful, robust recanalization following EVT results in significantly less core infarct growth - compared to intermediate and poor recanalization - for both early (<6hrs) and late (>6 hrs) time-window patients. Similarly, intermediate recanalization results in less infarct growth compared to poor recanalization. There was no significant benefit of EVT for infarct growth, however, for the subgroup with large (>50 ml) admission infarct volumes.

CLINICAL RELEVANCE/APPLICATION

EVT has been proven to benefit stroke patients up to 24 hours post ictus in the DAWN and DEFUSE-3 trials. We have shown that the degree of core infarct growth is significantly impacted by the degree of recanalization, and that this effect is equally robust in both early and late time windows.

SSJ20-05 Multi-Phase CT Angiography Registration and Subtraction Optimization to Improve Distal Arterial Occlusion Detection in Acute Stroke

Tuesday, Dec. 3 3:40PM - 3:50PM Room: S404AB

Participants

Eleyine Zarour, Montreal, QC (*Presenter*) Nothing to Disclose Claude Kauffmann, PhD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Laurent Letourneau-Guillon, MD, Outremont, QC (*Abstract Co-Author*) Nothing to Disclose William Tanguay, MD,MSc, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Anne Preville-Gendreau, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Ange Diouf, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In the context of an ischemic stroke, subtracting multi-phase whole-brain CT-angiography images may reveal a delayed vessel sign. However, this operation results in noisy images and is prone to patient motion between acquisitions. The purpose of the study is to develop a post-processing pipeline that automatically reduces motion and noise resulting from multi-phase CT-angiography subtraction, thereby improving the detection of distal arterial occlusion.

METHOD AND MATERIALS

To minimize motion between acquisitions, multi-phase images must be registered. During this process, a similarity metric is computed iteratively by random sampling of voxels from a region of interest (ROI). We tested registration methods targeting different ROIs, namely, the head, the skull, the calvaria and the cochleae. To reduce noise, we applied a smoothing Gaussian filter and a color gradient to highlight the areas corresponding to delayed contrast opacification (i.e. subtraction image voxels with positive values). We tested noise-reduction methods with different sigma parameters and color gradient thresholds. The motion-and noise-reduction methods were tested on 35 anonymized studies with a clinical suspicion of stroke. Method performances were evaluated by four radiologists who were blinded to the method-specific parameters. Registration methods were further evaluated using Dice similarity coefficients (DSC).

RESULTS

The motion-reduction method using the calvaria registration ROI was the most effective according to radiologists' assessment (p < 0.01) and to DSC (p < 0.05). The noise-reduction method with a sigma of 1.5 and a threshold of 1 HU was most highly ranked by radiologists (p < 0.01). Based on the best post-processed subtraction image, radiologists were in moderate agreement for the presence of delayed perfusion ($\kappa = 0.59$).

CONCLUSION

We evaluated different methods to reduce motion and noise resulting from subtracting multi-phase CT-angiography images. This allowed us to design a post-processing pipeline to assist radiologists in detecting distal arterial occlusion in the context of an acute stroke.

CLINICAL RELEVANCE/APPLICATION

We developed a multi-phase CT-angiography post-processing pipeline based on optimized registration and images subtraction to improve distal arterial occlusion detection in acute stroke.





MSES34

Essentials of Trauma Imaging

Tuesday, Dec. 3 3:30PM - 5:00PM Room: S100AB



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Guillermo P. Sangster, MD, Shreveport, LA (Moderator) Nothing to Disclose

Sub-Events

MSES34A Cervical Spine Trauma

Participants A. Orlando Ortiz, MD, MBA, Bronx, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ortizo@nychhc.org

LEARNING OBJECTIVES

1) Review the pertinent imaging anatomy of the cervical spine. 2) Understand the role of various imaging modalities in cervical spine trauma patients. 3) Provide an overview cervical spine injuries with an emphasis on mechanism.

ABSTRACT

The exposure of the cervical spine to traumatic forces such as flexion or extension is associated with serveral types of injury patterns to this segment of the spinal axis. The unique anatomic features of the upper and lower cervical spine further predispose these sub-segments to specific types of traumatic injury. A number of imaging modalities are available to assess patients with cervical spine trauma and modality utilization is dependent on the acuity and extent of the injury, the neurologic condition of the patient and whether or not the patient is able to undergo a specific imaging examination.

MSES34B Blunt and Penetrating Neck Injuries

Participants

Matthew S. Parsons, MD, Saint Louis, MO (Presenter) Nothing to Disclose

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parsonsms@wustl.edu

LEARNING OBJECTIVES

1) Identify pertinent anatomy for traumatic neck injuries. 2) Define the Denver Injury Grading Scale used in blunt cerebrovascular injury. 3) Detect common imaging signs of aerodigestive trauma.

MSES34C Blunt Traumatic Aortic Injuries

Participants Guillermo P. Sangster, MD, Shreveport, LA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

gsangs@lsuhsc.edu

LEARNING OBJECTIVES

1) Identify MDCT imaging findings of traumatic aortic injuries and the ability of the method to characterize different lesion types. 2) Substantiate the advantages of MDCT for the screening of stable patients suspected to have traumatic aortic injuries. 3) Recognize MDCT false positive findings that may be misinterpreted as traumatic aortic injuries.

ABSTRACT

Injuries of the aorta have catastrophic consequences if untreated. Timely accurate diagnosis of the aortic laceration/rupture is key for life saving repair. Images from patients of our Level I trauma center database substantiate the presentation. Mechanisms of traumatic aortic injury are reviewed and the spectrum of injury patterns illustrated including incomplete aortic rupture, complete aortic rupture, pseudoaneurysm, traumatic aortic dissection and acute intramural hematoma. MDCT findings are correlated with angiography before and after surgical or endovascular repair. Examples of false positive traumatic aortic injuries are presented.

MSES34D Interventional Radiology (IR) On-Call: When Time is of the Essence!

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Describe methods for transcatheter intervention in traumatic arterial and solid organ injury. 2) Explain rationale for selection of appropriate embolic agent based on angiographic findings. 3) Differentiate between expected finding in blunt versus penetrating injury.





RC408

Emergency Neuroradiology: Interventional Neuroradiology-What the Emergency Radiologist Needs to Know (at 3 AM) (Interactive Session)

Tuesday, Dec. 3 4:30PM - 6:00PM Room: S402AB



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

A. Orlando Ortiz, MD, MBA, Bronx, NY (Moderator) Nothing to Disclose

For information about this presentation, contact:

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Sub-Events

RC408A Cerebrovascular Interventions

Participants

Gregg H. Zoarski, MD, Bel Air, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the endovascular procedures and devices used to treat neurovascular diseases including acute embolic stroke, aneurysms, vascular malformations, intracranial atherosclerosis, venous stenosis and occlusion, and vascular trauma.

RC408B Neck Interventions

Participants

Michele H. Johnson, MD, New Haven, CT (*Presenter*) Scientific Advisory Board, iSchemaView, Inc; Medical Advisory Board, iSchemaView, Inc

RC408C Spine Interventions

Participants A. Orlando Ortiz, MD, MBA, Bronx, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ortizo@nychhc.org

LEARNING OBJECTIVES

1) To learn how image-guided spine interventions can be used in the early evaluation and management of patients presenting to the emergency department with either neck or back pain. 2) To understand the basic steps required for proper patient preparation prior to these urgent spine interventions. 3) To review specific diagnostic and therapeutic spine interventions with and emphasis on indication and contraindication.

ABSTRACT

Severe neck and/or back pain are a frequent cause of emergency department visits. While many of these patient presentations can be handled by conservative evaluation and management, the access to rapid imaging evaluation will indentify specific pathologic conditions that may subsequently require additional evaluation and treatment. In certain instances this subset of patients may benefit from diagnostic or therapeutic image-guided spine interventions. This presentation will discuss the rationale for the use of these interventions, the basic steps required for proper patient preparation, and the specific types of interventions that might be considered or performed.





RC431

The New Standard of Care of Large Vessel Stroke is Endovascular: Is Your Radiology Practice Ready?

Tuesday, Dec. 3 4:30PM - 6:00PM Room: N229



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Joshua A. Hirsch, MD, Boston, MA (*Moderator*) Consultant, Medtronic plc; Data Safety Monitoring Board, Johnson & Johnson; Committee member, Relievant Medsystems, Inc; Consultant, Whale Imaging Inc;

LEARNING OBJECTIVES

1) Describe the diagnostic evaluation and decision making algorithms leading to urgent endovascular treatment of acute stroke. 2) Review endovascular techniques for the treatment of acute stroke from microcatheter set up to intra-arterial thrombolysis to mechanical thrombectomy. 3) Discuss case examples of endovascular treatment including patient selection, technique, and pitfalls.

ABSTRACT

Rapid advances in the evaluation, selection, treatment and management of the acute stroke patient necessitates an ongoing educational event highlighing the newest information, techniques and strategies for obtaining the best outcomes for our patients. In this session, all of these topics will be covered in a practical 'how to' and case based approach which is designed to help the practitioner implement best practices. The course is useful for those performing imaging, treatment or both. Analysis of the latest ongoing trials, devices and techniques will be presented. Endovascular tips and tricks will be discussed, as well as pitfalls in the treatment of these patients.

Sub-Events

RC431A Neuroimaging, Artificial Intelligence, and Triage in the Age of Thrombectomy

Participants

Ramon G. Gonzalez, MD, PhD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

Understand the physiological changes that occur in acute stroke patients with large vessel occlusions.
 Identify the most important variables needed to select ischemic stroke patients for endovascular thrombectomy and the most reliable neuroimaging methods to identify these key variables.
 Review the data that has shown that there is high variability in the growth of the ischemic core that makes possible the endovascular treatment of large vessel occlusion patients up to 24 hours after stroke onset.
 Appreciate the large proportion of patients that are slow progressors (slow infarct growth) that may be transported for successful endovascular thrombectomy.

RC431B This is How I Do It: Practical Tips for Opening the Occlusion

Participants

Allan L. Brook, MD, Bronx , NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the essential ischemic stroke physiology parameters that are essential in selecting patients for endovascular treatment of a large vessel occlusion. 2) Be familiar with the imaging methods that can measure ischemic stroke physiology parameters and their relative accuracy. 3) Use the best available evidence, recognize the optimal imaging approach to select patients with acute ischemic stroke for endovascular treatment.

RC431C Health Policy and Reimbursement RE: Stroke

Participants

Joshua A. Hirsch, MD, Boston, MA (*Presenter*) Consultant, Medtronic plc; Data Safety Monitoring Board, Johnson & Johnson; Committee member, Relievant Medsystems, Inc; Consultant, Whale Imaging Inc;

LEARNING OBJECTIVES

1) Understand the essential ischemic stroke physiology parameters that are essential in selecting patients for endovascular treatment of a large vessel occlusion. 2) Be familiar with the imaging methods that can measure ischemic stroke physiology parameters and their relative accuracy. 3) Use the best available evidence, recognize the optimal imaging approach to select patients with acute ischemic stroke for endovascular treatment.

ABSTRACT

Properly selected patients with acute ischemic stroke caused by large vessel occlusion (LVO) may be effectively and safely treated endovascularly with modern thrombectomy devices. We have developed a high-precision imaging tool for selecting such patients. It is an experience and evidence-based clinical triage tool that uses advanced imaging to identify INDIVIDUAL patients most likely to benefit from endovascular stroke therapy. It was based on over a decade of using advanced imaging (CT, CTA, CT perfusion, DWI, MR perfusion) in acute stroke patients and a critical review of the literature and has been validated in clinical trials. The approach focuses on answering the following key questions using modern imaging: 1. Is there a hemorrhage? Noncontrast CT 2. Is there an

occlusion of the distal ICA and/or proximal MCA? CTA 3. Is irreversible brain injury below a specific threshold (e.g. <70ml)? DWI Perfusion imaging is not employed unless patients cannot undergo MRI, or they do not meet the criteria for intervention. Investigations to understand the reasons for the unsuitability of perfusion CT to substitute for DWI have revealed theoretical and practical shortcomings of CTP. A major problem is the low signal-to-noise (SNR) ratio of CT perfusion that results in a poor contrast-to-noise (CNR) ratio in severely ischemic brain. In a comparison between DWI and CTP in over 50 consecutive patients with LVA, Schaefer, et al. showed that the mean CNR of DWI was >4 while it was <1 for CTP derived CBF. The poor CNR results in large measurement error: using Bland-Altman analyses it was found that the 95% confidence interval was ~+/- 50 ml for ischemic lesion volume measurements in individual patients. The Cleveland Clinic adopted a nearly identical algorithm and their results were published. They reported that after the new algorithm was adopted, there was a ~50% reduction in mortality and a ~3-fold increase in good outcomes, despite a ~50% decrease in the number of procedures. A recent prospective observational trial at the MGH using stentrievers and this imaging approach demonstrated >50% favorable outcomes (mRS 0-2) that is similar to recent randomized clinical trials. However, only 3 patients were evaluated for every patient that was treated, a screening to treatment ratio that is much lower than in recently published clinical trials.1. Gonzalez RG, Copen WA, Schaefer PW, Lev MH, Pomerantz SR, Rapalino O, et al. The Massachusetts General Hospital acute stroke imaging algorithm: an experience and evidence based approach. Journal of neurointerventional surgery. 2013;5 Suppl 1:i7-12.2. Wisco D, Uchino K, Saqqur M, Gebel JM, Aoki J, Alam S, et al. Addition of hyperacute MRI AIDS in patient selection, decreasing the use of endovascular stroke therapy. Stroke; a journal of cerebral circulation. 2014;45(2):467-72.3. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet. 1986 Feb 8;1(8476):307-10.4. Schaefer PW, Souza L, Kamalian S, Hirsch JA, Yoo AJ, Kamalian S, Gonzalez RG, Lev MH. Limited reliability of computed tomographic perfusion acute infarct volume measurements compared with diffusion-weighted imaging in anterior circulation stroke. Stroke. 2015 Feb;46(2):419-24.

RC431D Q&A





ED004-WE

Emergency Radiology Wednesday Case of the Day

Wednesday, Dec. 4 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants

Gayatr¹ Joshi, MD, Charleston, SC (*Presenter*) Nothing to Disclose Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc Margarita V. Revzin, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Paige E. Sharp, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Robin B. Levenson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Judith A. Gadde, DO, Newark, DE (*Abstract Co-Author*) Nothing to Disclose Heishun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Aaron D. Sodickson, MD,PhD, Boston, MA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, General Electric Company Nikhar Kinger, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Elisa N. Flower, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Karen S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Araron MD, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Suzanne Czerniak, MD, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Elisa N. Flower, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Karen S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Andrew Wong, MD,PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) Recognize key imaging findings on multimodality imaging of emergency/trauma patients. 2) Identify pathologic conditions based on the clinical information and imaging findings provided. 3) Understand relevant pathophysiology and recommend appropriate next step in management when appropriate.





SPSH40

Hot Topic Session: Mass Casualty Incidents-When Disaster Strikes

Wednesday, Dec. 4 7:15AM - 8:15AM Room: E451A

ER

AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 1.00

Participants

Ferco H. Berger, MD, Toronto, ON (Moderator) Speaker, Siemens AG

For information about this presentation, contact:

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Sub-Events

SPSH40A The Situation Room: A Survival Guide for MCI

Participants Ronald M. Bilow, MD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Understand the difference between standard imaging department operations and during a disaster situation. 2) Obtain a basic understanding of disaster response planning considerations specific to radiology services.

ABSTRACT

In the face of disaster, imaging services remains an important component of emergent patient care. It is sometimes, erroneously, assumed that radiology departments, particular level one trauma centers, will handle the patient surge by simply performing their normal work at decreased throughput time. This is not only impossible, but many of the 'normal' steps in registering patients, entering examination requests and myriad other steps in the chain of events leading from patient needs to final results will be altered. Additionally, the traditional key players in providing services under disaster conditions make many false assumptions regarding how radiology departments can or are able to operate. This presentation will highlight some of the concepts one must consider in developing a viable disaster preparedness and response plan, as well as how to gain acceptance by other institutional services at the planning level.

SPSH40B Beyond Broken Bones: Non-trauma MCI and the Impact on Medical Imaging

Participants

Jamlik-Omari Johnson, MD, Atlanta, GA (Presenter) Nothing to Disclose

SPSH40C Global Disaster Response and Serving Regions with Scarce Resources

Participants Berndt P. Schmit, MD, Tucson, AZ (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Infrastructure and logistical challenges to implementing advanced radiology in the austere setting. 2) Cultural and political issues with providing services in another country. 3) Importance of local ownership and stakeholders for success.

ABSTRACT

There are a myriad of unique challenges to building radiology capacity in an austere setting whether created by poverty or disaster. Experiences with build sustainable radiology in the developing world will be shared including: finding and developing local partnerships, assessing and designing clinical programs, building vendor relationships, donor relationship and equipment issues, value stream and service line thinking, maintenance and engineering support, training and teaching local resources.




MSSR41

RSNA/ESR Sports Imaging Symposium: Upper Extremity Sports Injuries (Interactive Session)

Wednesday, Dec. 4 8:30AM - 10:00AM Room: E350



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Andrew J. Grainger, MD, Leeds, United Kingdom (*Moderator*) Consultant, Levicept Ltd; Director, The LivingCare Group; Laura W. Bancroft, MD, Venice, FL (*Moderator*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To appreciate common patterns of athletic injury in the shoulder and wrist. 2) To become familiar with the techniques available and imaging appearances of shoulder and wrist athletic injury. 3) To consolidate the knowledge gained from the session with interactive cases of upper limb athletic injury.

Sub-Events

MSSR41A Shoulder Injuries in the Throwing Athlete

Participants

Lynne S. Steinbach, MD, San Francisco, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the biomechanics of throwing forces as they relate to the shoulder. 2) To become familiar with rotator cuff, labroligamentous, and osseous abnormalities caused by overhead sports.

ABSTRACT

Overhead throwing athletes develop significant abnormalities as a result of acquired adaptations to the extremes of motion in the dominant shoulder. These abnormalities may eventually result in an inability to throw with the same velocity, the so-called "dead arm" syndrome. These abnormalities involve tendons, ligaments, labrum, muscles, nerves, vessels, and bones. This presentation will review the biomechanics of throwing forces as they relate to the shoulder. The MR imaging characteristics of the resultant abnormalities in the labroligamentous structures and the rotator cuff will also be highlighted. As a prototype, the throwing motion in baseball occurs over a period of approximately 2 seconds and is divided into six stages: wind up, cocking, early and late acceleration, deceleration, and follow through. The late cocking, acceleration, and deceleration phases produce the greatest stress on the glenohumeral joint structures. As with other throwing sports, the superior labrum and rotator cuff are often affected by these extreme forces.

MSSR41B Soft Tissue Wrist Injury in the Athlete

Participants

Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about the patterns of injury seen at the wrist in athletes. 2) To understand the advantages and disadvantages of different modalities for imaging the athlete's wrist. 3) To recognize the imaging appearances of cartilage and ligamentous injury at the wrist.

ABSTRACT

Wrist injuries account for 5 % of sports injuries. In the young athlete, fracturesare the most common injuries. The hand and wrist are the most common sitesfor fracture in the young athlete. Physeal injuries are typical overuse injuries ingymnasts. Chronic stress reactions with a widening of the growth plate areseen in the distal radial and less common in the ulnar growth plate. Injuries tothe TFCC in the athlete occur in acute trauma and with overuse. TFCC injuriesare an important cause for ulnar-sided wrist pain. The differential diagnosisincludes ulnar styloid impaction syndrome, ulnar impingement syndrome andtenosynovitis of the extensor carpi ulnaris tendon. Injury to the interosseousligaments may lead to carpal instability. Chronic injury of the intrinsic orextrinsic ligaments of the wrist may cause ganglion cyst formation.

MSSR41C Interactive Case Discussion

Participants

Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (*Presenter*) Nothing to Disclose Lynne S. Steinbach, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To appreciate pathologic and normal developmental changes in skeletally immature throwing athletes, especially around the physis. 2) To consolidate the knowledge gained from the session with interactive cases of upper limb athletic injury as it relates to the skeletally immature throwing athlete.

ABSTRACT

The first part of this interactive session will show some cases of pathologic and normal developmental changes around the physis of shoulders of skeletally immature throwing athletes. The second part of this intercactive sessions will show and diuscuss cases with athletic unjuries about the wrist.





RC505

Neuroradiology Series: Stroke

Wednesday, Dec. 4 8:30AM - 12:00PM Room: N228



AMA PRA Category 1 Credits ™: 3.25 ARRT Category A+ Credits: 4.00

Participants

Max Wintermark, MD, Lausanne, Switzerland (*Moderator*) Consultant, More Health; Consultant, Magnetic Insight; Consultant, icoMetrix NV; Consultant, Nines; Consultant, Subtle Medical; Consultant, Nous; Pamela W. Schaefer, MD, Boston, MA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

pschaefer@partners.org

LEARNING OBJECTIVES

1) To become familiar with evidence, advantages and challenges of CT based stroke imaging work up. 2) Improve knowledge of thrombectomy technique for ischemic stroke treatment. 3) Understand and apply aspiration thrombectomy, stent retriever thrombectomy, and combined approaches for ischemic stroke treatment.4) Describe and recognize the most common complications following thrombectomy for ischemic stroke treatment. 5) Understand the variance and penetrance of EVT across the world. 6) To understand the primary and potential future roles of magnetic resonance imaging in stroke diagnosis, prognostication, and treatment monitoring.

Sub-Events

RC505-01 CT-Based Imaging Workshop in Acute Ischemic Stroke: Evidence and Practical Pearls

Wednesday, Dec. 4 8:30AM - 9:00AM Room: N228

Participants

Achala S. Vagal, MD, Mason, OH (Presenter) Research Grant, Cerovenus

RC505-02 Location-Specific Alberta Stroke Program Early CT Score (ASPECTS) Paradigm in the Cohort of Acute Ischemic Stroke Patients

Wednesday, Dec. 4 9:00AM - 9:10AM Room: N228

Participants

Seyed Mohammad Seyedsaadat, MD, Rochester, MN (*Presenter*) Nothing to Disclose Waleed Brinjikji, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose JoAnna Schaafsma, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose John C. Benson, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose Ian T. Mark, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose Eric Polley, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose Sapna Rawal, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Timo Krings, MD, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose Alejandro A. Rabinstein, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose David F. Kallmes, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose Consultant, General Electric Company Consultant, Medtronic plc Consultant, Johnson & Johnson

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PURPOSE

Despite the importance of the occlusion site in predicting the outcome of acute ischemic stroke (AIS) patients, ASPECTS does not adjust the weight of the ten sub-regions based on their impact on patient's outcome. This study was performed in a cohort of AIS patients to determine the predictive value of each ASPECTS sub-region.

METHOD AND MATERIALS

In this retrospective, multi-center study, clinical and neuroimaging data of AIS patients who presented within the first 24 hours of symptom onset and underwent embolectomy from 2014 to 2018 was collected. Three expert neuroradiologists reviewed baseline non-contrast head CT scans to score early ischemic changes based on ASPECTS. Logistic regression analysis was performed to find the essential ASPECTS sub-regions in predicting the 3-month outcome of AIS patients.

RESULTS

Among a total of 353 patients, 214 patients had a 3-month poor outcome (mRS>2). Eighty one percent of patents with M4 infarct, 79% of Caudate, and 77% of those with M5 had poor outcomes (Figure 1). Univariate analysis showed significantly higher rate of poor outcome than favorable outcome in patients with infarction in Insula (68% vs. 32%; p-value=0.005), Caudate (79.49% vs.

20.51%; p-value=0.013), M2 (73.3% vs. 26.7%; p-value=0.023), M4 (81.5% vs. 18.5%, p-value=0.015), and M5 (76.9% vs. 23.1%, p-value= 0.022). Logistic regression analysis showed that infarction in M4 (OR: 2.93; 95%CI: 1.09- 9.43), Caudate (OR: 3.27; 95%CI: 1.33-8.45), and Insula (OR: 1.75; 95%CI: 1.08- 2.85) are significant predictors of 3-months poor outcome.

CONCLUSION

Infarction of Caudate, M4, and Insula are strongly associated with poor outcomes in patients with AIS. Our findings are consistent with similar studies that suggested an unequal impact of brain topography on the outcomes of AIS patients.

CLINICAL RELEVANCE/APPLICATION

Developing modified ASPECTS based on the proper weighting of each ten ASPECTS brain region seems to be a more accurate tool than the current ASPECTS for predicting the outcome of AIS patients.

RC505-03 Prognostic Value of Dual-Energy CT-based Detection of Distal Microemboli Following Stroke Thrombectomy

Wednesday, Dec. 4 9:10AM - 9:20AM Room: N228

Participants

Dylan Wolman, MD, Stanford, CA (*Presenter*) Nothing to Disclose Matthew B. Gologorsky, BS, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose Max Wintermark, MD, Lausanne, Switzerland (*Abstract Co-Author*) Consultant, More Health; Consultant, Magnetic Insight; Consultant, icoMetrix NV; Consultant, Nines; Consultant, Subtle Medical; Consultant, Nous; Jeremy J. Heit, MD,PhD, Stanford, CA (*Abstract Co-Author*) Consultant, Medtronic plc; Consultant, Terumo Corporation; Scientific Advisory Board, iSchemaView, Inc; Medical Advisory Board, iSchemaView, Inc

PURPOSE

Endovascular thrombectomy (ET) is an effective treatment for stroke due to large-vessel occlusion (LVO). Revascularization after ET stroke predicts good long-term neurologic outcomes. Current measures of revascularization, such as the modified thrombolysis in cerebral infarction score (mTICI), do not capture the location or number of residual microemboli (RME). We determined whether dual-energy CT (DECT) detects and localizes RME following ET and if RME presence predicts poorer outcomes.

METHOD AND MATERIALS

DECT following ET was prospectively performed in all patients who did not undergo MRI over one year. Two unblinded readers scored DECT for RME presence and location (Figure 1A-B). Manual ROI labels were placed at the treated vascular segment, within the contralateral control vessel (or M1 segment for basilar LVO), and at the site of putative RME on conventional appearing 120-kVp (standard) CT series, low-kVp weighted DECT series (Q34s), and virtual non-contrast (VNC) and iodine map (IM) reconstructions. Primary outcome measure was a good functional outcome (modified Rankin Scale [mRS] score 0-2) at 90-days. Pairwise Wilcoxon rank-sum and chi-square tests were performed to assess the discriminatory capabilities of DECT versus standard CT and to assess for correlation between 90-day neurologic outcomes and the site of detected RME, respectively.

RESULTS

Twenty-nine patients were included. DECT was performed 6 hrs (IQR 5-10) after ET. Successful revascularization was achieved in 27 (93% TICI 2b-3) patients. Twenty patients (69%) had RME on post-ET DSA, and DECT identified RME in 19/20 (95%) patients. Analysis of ROI attenuation values demonstrated that Q34s, VNC, and IM series differentiated RME from control vessels (P=0.004-0.01), while standard series could not (P=0.31). Good neurologic outcomes were achieved in 12/19 (63%) patients with RME versus 9/10 (90%) patients without RME. The proximity of RME detected on post-ET DECT inversely correlated with 90-day mRS scores in the anterior circulation (P=0.028).

CONCLUSION

Postinterventional DECT detects RME, the location of which may provide prognostic value.

CLINICAL RELEVANCE/APPLICATION

RME presence and location may offer additional prognostic information following ET.

RC505-04 Value of CT Perfusion for Morphologic Outcome Prediction in Acute Ischemic Cerebellar Stroke

Wednesday, Dec. 4 9:20AM - 9:30AM Room: N228

Participants

Matthias P. Fabritius, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose Paul Reidler, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose Kolja M. Thierfelder, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose Daniel Puhr-Westerheide, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose Stefan Maurus, MD, Munich, Germany (*Presenter*) Nothing to Disclose Philipp M. Kazmierczak, MD, Munchen, Germany (*Abstract Co-Author*) Nothing to Disclose Wolfgang G. Kunz, MD, Munich, Germany (*Abstract Co-Author*) Grant, Medtronic plc

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PURPOSE

The diagnosis of ischemic cerebellar stroke is challenging due to non-specific symptoms and very limited accuracy of commonly applied computed tomography (CT) imaging. Advances in CT perfusion imaging provide increasing value in the detection of posterior circulation stroke, but the prognostic value remains unclear. We aimed to identify imaging parameters that predict morphologic outcome in cerebellar stroke patients using advanced CT including whole-brain CT perfusion (WB-CTP).

METHOD AND MATERIALS

We selected all subjects with cerebellar WB-CTP pertusion deticits and follow-up-confirmed cerebellar infarction from a consecutive cohort with suspected stroke who underwent WB-CTP. Posterior-circulation-Acute-Stroke-Prognosis-Early-CT-Score (pc-ASPECTS) was determined on non-contrast CT (NCCT), CT angiography source images (CTA-SI) and on parametric WB-CTP maps. The cerebellar perfusion deficit volumes on all maps as well as the final infarction volume (FIV) on follow-up imaging were quantified. Uni- and multivariate regression analyses were performed.

RESULTS

Sixty patients fulfilled the inclusion criteria. pc-ASPECTS on CTA-SI (β , -9.239; 95% Confidence Interval [CI], -14.220 to -4.259; p<0.001) and CBF deficit volume (β , 0.886; 95% CI, 0.684-1.089; p<0.001) were significantly associated with FIV in univariate linear regression analysis. The association of CBF deficit volume (β , 0.830; 95% CI, 0.605-1.055; p<0.001) was confirmed in a multivariate linear regression model adjusted for age, sex, pc-ASPECTS on NCCT and CTA-SI and the National Institutes of Health Stroke Scale (NIHSS) score on admission. No other clinical or imaging parameters were associated with the cerebellar stroke FIV (p>0.05). Due to the relevant frequencies of concomitant brainstem and supratentorial involvement, clinical outcome evaluation was not feasible.

CONCLUSION

In contrast to NCCT and CTA, WB-CTP imaging contains prognostic information for morphologic outcome in patients with acute cerebellar stroke.

CLINICAL RELEVANCE/APPLICATION

As clinical assessment of the severity of cerebellar stroke is often difficult and limited, more objective imaging parameters like WB-CTP might potentially support clinical decision-making, and hence facilitate clinical trial design by identifying real ischemic target lesions and excluding stroke mimics, which may otherwise confound results in the low NIHSS clinical trial setting.

RC505-05 MRI in Stroke and Cerebrovascular Disease

Wednesday, Dec. 4 9:30AM - 10:00AM Room: N228

Participants

Seena Dehkharghani, MD, New York, NY (Presenter) Nothing to Disclose

RC505-06 Hot Topic Panel: Is CT-perfusion Now the Standard of Care for Stroke?

Wednesday, Dec. 4 10:10AM - 10:40AM Room: N228

Participants

Achala S. Vagal, MD, Mason, OH (*Presenter*) Research Grant, Cerovenus Seena Dehkharghani, MD, New York, NY (*Presenter*) Nothing to Disclose Jeremy J. Heit, MD, PhD, Stanford, CA (*Presenter*) Consultant, Medtronic plc; Consultant, Terumo Corporation; Scientific Advisory Board, iSchemaView, Inc; Medical Advisory Board, iSchemaView, Inc Johanna M. Ospel, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose

RC505-07 Neurointerventional Stroke Treatment: Techniques and Complications

Wednesday, Dec. 4 10:40AM - 11:10AM Room: N228

Participants

Jeremy J. Heit, MD, PhD, Stanford, CA (*Presenter*) Consultant, Medtronic plc; Consultant, Terumo Corporation; Scientific Advisory Board, iSchemaView, Inc; Medical Advisory Board, iSchemaView, Inc

RC505-08 Deep Learning-Based Penumbra Estimation Using DWI and ASL for Acute Ischemic Stroke Patients

Wednesday, Dec. 4 11:10AM - 11:20AM Room: N228

Participants

Yuan Xie, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose Yannan Yu, Palo Alto, CA (*Presenter*) Nothing to Disclose Jiahong Ouyang, Stanford, CA (*Abstract Co-Author*) Research support, General Electric Company Charles Huang, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose Enhao Gong, PhD, Menlo Park, CA (*Abstract Co-Author*) Stockholder, Subtle Medical Soren Christensen, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose Maarten Lansberg, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose Greg Zaharchuk, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Stockholder, Subtle Medical

PURPOSE

In acute ischemic stroke, estimating the penumbra, or region at-risk of infarction in the absence of reperfusion, is important to determine whether the patient is likely to benefit from treatment. The current gold standard for penumbra is based on the time-to-peak of the residue function (Tmax) map, which is reconstructed from bolus contrast perfusion weighted imaging (PWI), where tissue with a Tmax > 6s is generally considered to represent penumbra. We demonstrate that a deep learning model can predict the penumbra region based on non-contrast DWI and ASL-CBF images.

METHOD AND MATERIALS

60 patients were identified retrospectively from a multi-center stroke study. All patients underwent 3T MR imaging at baseline, with DWI, PWI, and ASL (either single post-label delay [2000 ms, 1.5T] or multidelay [700-3000 ms, 3T]). DWI images were acquired with TR/TE 4000/77.5ms and b=1000s/mm2. Penumbra mask was calculated using RAPID software using a criterion of Tmax > 6s (version 4.5.1, iSchemaView, Menlo Park, CA, USA) and used as ground truth. A residual deep convolutional neural network with a U-Net architecture was constructed using DWI, ADC maps, and ASL-CBF as input with Tmax>6s segmentations as ground truth. The model's output is an image where each voxel ranges between 0 and 1, representing the probability of the voxel being included in penumbra. 5-fold cross validation was used to evaluate the model performance. Assessments included receiver-operator

characteristic metrics (area-under-the-curve [AUC]), Dice score, precision, recall, specificity, and penumbra volume at optimal threshold.

RESULTS

The model produced a voxel-based AUC of 0.873, and a per-subject AUC of 0.86 ± 0.06 . At the prediction threshold yielding best performance, the Dice score was 0.40 ± 0.18 , the precision was 0.42 ± 0.17 , recall was 0.44 ± 0.23 , and specificity was 0.94 ± 0.03 . Mean absolute volume difference from ground truth was 33 ± 28 ml.

CONCLUSION

Using information available in ASL and DWI scans, a deep learning model can estimate the size and location of the penumbra without the use of contrast agents.

CLINICAL RELEVANCE/APPLICATION

Using deep learning, an acute stroke patient's penumbra region can be accurately outlined with diffusion weighted imaging (DWI) and cerebral blood flow map from arterial spin labeling (ASL-CBF), providing a quicker and non-contrast way to evaluate the potential benefit of thrombectomy treatment.

RC505-09 Correlation of National Incidence and Outcomes of Ischemic Strokes and Distribution of Joint Commission Certified Advanced Stroke Centers and CAST Certified Physicians to Perform Endovascular Therapies

Wednesday, Dec. 4 11:20AM - 11:30AM Room: N228

Participants

Neena A. Davisson, MD, Decatur, GA (*Presenter*) Nothing to Disclose Laura K. Findeiss, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Richard Duszak JR, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Danny Hughes, PhD, Reston, VA (*Abstract Co-Author*) Nothing to Disclose Nima Kokabi, MD, Atlanta, GA (*Abstract Co-Author*) Research support, Sirtex Medical Ltd

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PURPOSE

To determine whether the geographic distribution of Committee on Advanced Subspecialty Training (CAST) certified physicians and Joint Commission (JC) certified Comprehensive Stroke Centers (CSCs) correlate with the regional incidence and outcomes of ischemic stroke.

METHOD AND MATERIALS

Using the Centers for Disease Control and Prevention Interactive Atlas of Heart Disease and Stroke, the national incidence of ischemic stroke death for patients 35-75 years of age was identified at state-level. Rates of admission and outcomes of ischemic stroke in the Medicare population were also calculated. Using the same tool, the national distribution of JC CSCs was identified. Additionally, the national distribution of 2019 CAST certified physicians, as published by the Society of Neurological Surgery, was overlaid. Pearson Correlation (r) was performed between stroke hospitalization rates and outcomes with the number of JC CSCs and CAST physicians.

RESULTS

The average nationwide ischemic stroke hospitalization rate in the Medicare population in 2013-2015 was 10.4 per 1000 beneficiaries and the average ischemic stroke death rate in patients 35-75 years of age in 2014-2016 was 4.8 per 100,000. States with the highest stroke hospitalization rates (12.2 to 13.9 per 1000 beneficiaries) and stroke death rates (6.7 to 20 per 100,000 beneficiaries) were located mainly in the Southeast. JC CSCs (n=134) are located in 37 states and the District of Columbia with a predominance in the Northeast. CAST physicians (n=171) are located in 33 states with a predominance in the Northeast. There was no correlation between location of CAST physicians and stroke hospitalization rates or death rates with r = -0.01 and r = -0.01, respectively (p's>0.05). There was no correlation between JC CSCs and stroke hospitalization rates or death rates with r = -0.16 and r = 0.08, respectively (p's>0.05).

CONCLUSION

There is no correlation between the geographic location of CAST physicians or JC certified CSCs and the incidence and outcomes of ischemic stroke. More strategic planning is necessary to ensure the needs of communities are met, with sufficient availability of physicians and CSCs capable of treating ischemic strokes endovascularly.

CLINICAL RELEVANCE/APPLICATION

CAST physicians and JC CSCs are not strategically distributed where the incidence of ischemic stroke is highest. Efforts should be made to optimize availability of thrombectomy-capable physicians in these areas.

RC505-10 Understanding the Variance of Decision Making in Acute Stroke Based on the Principles of Neuroeconomics

Wednesday, Dec. 4 11:30AM - 12:00PM Room: N228

Participants

Johanna M. Ospel, MD, Basel, Switzerland (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

To understand current endovascular treatment practice patterns of physicians across different specialties and countriesTo learn about current real-life endovascular treatment decision-making in the absence of clear evidenceTo explore factors that influence endovscular treatment decision-making and possible thought processes behind these factors







RC508

Emergency Ultrasound Pitfalls and Pearls

Wednesday, Dec. 4 8:30AM - 10:00AM Room: E451B



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Leslie M. Scoutt, MD, Essex, CT (Moderator) Speaker, Koninklijke Philips NV

For information about this presentation, contact:

leslie.scoutt@yale.edu

LEARNING OBJECTIVES

1) Describe pearls and pitfalls in ultrasound evaluation of patients presenting with right upper quadrant pain with a focus on hepatobiliary pathology. 2) Discuss how to avoid mistakes in the ultrasound assessment of common pediatric emergencies. 3) Discuss pearls and pitfalls in ultrasound assessment of gynecologic emergencies.

ABSTRACT

As part of the series focused on the role of imaging in the emergency department, this course will focus on the role of ultrasound in the assessment of clinically suspected hepatobiliary pathology, pathology commonly encounteres and more specific to the pediatric population and gynecological emergencies. The goal of the presentations will be to focus on pearls so that the audience will learn how to best and most successfully use ultrasound and thereby avoid a more costly CT and the risks of radiation exposure and iodinate contrast. However, common pitfalls will also be addressed so that the audience learns how to avoid mistakes as well as when ultrasound is not adequate for complete patient evaluation and further imaging should be recommended. While ultrasound is often the first study ordered, one needs to learn 'when to hold 'em, and when to fold 'em' to do what is best for patient care.

Sub-Events

RC508A Hepatobiliary Ultrasound: Pearls and Pitfalls

Participants Leslie M. Scoutt, MD, Essex, CT (*Presenter*) Speaker, Koninklijke Philips NV

For information about this presentation, contact:

leslie.scoutt@yale.edu

LEARNING OBJECTIVES

1) Discuss the ultrasound findings of acute cholecystitis. 2) Describe the ultrasound appearance of complicated or advanced cholecystitis. 3) Discuss the role of ultrasound in the evaluation of obstruction of the biliary track.

RC508B Pediatric Ultrasound

Participants Susan D. John, MD, Houston, TX ($\ensuremath{\textit{Presenter}}\xspace$) Nothing to Disclose

For information about this presentation, contact:

susan.d.john@uth.tmc.edu

LEARNING OBJECTIVES

1) Perform effective ultrasound examinations for pediatric gastrointestinal conditions. 2) Avoid pitfalls of US of the GI tract in children by using best practices. 3) Recognize potentially confusing US findings in various pediatric conditions.

RC508C Non-Obstetrical Gynecologic Ultrasound

Participants Ana P. Lourenco, MD, Foxboro, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

alourenco@lifespan.org

LEARNING OBJECTIVES

1) Detect a variety of causes of acute female pelvic pain at ultrasound, including but not limited to torsion, hemorrhagic cysts, pelvic inflammatory disease, ovarian hyperstimulation, IUD complications, as well as various non-gynecologic etiologies. 2) Describe potential sonographic pearls and pitfalls in gynecologic ultrasound.





MSSR42

RSNA/ESR Sports Imaging Symposium: Lower Extremity Sports Injuries (Interactive Session)

Wednesday, Dec. 4 10:30AM - 12:00PM Room: E350



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Andrew J. Grainger, MD, Leeds, United Kingdom (*Moderator*) Consultant, Levicept Ltd; Director, The LivingCare Group; Laura W. Bancroft, MD, Venice, FL (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

laurabancroftmd@gmail.com

LEARNING OBJECTIVES

1) To appreciate common patterns of athletic injury in the knee. 2) To become familiar with the techniques available and imaging appearances of knee, foot and ankle athletic injury. 3) To consolidate the knowledge gained from the session with interactive cases of lower limb athletic injury.

Sub-Events

MSSR42A Sports-related Injuries of the Knee: What Does the Orthopedic Surgeon Need to Know?

Participants

Theodore T. Miller, MD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To be able to describe features of meniscal tears, ACL tears, and cartilage abnormalities that should be included in the MRI report. 2) To be able to recognize common sports-related injury patterns of the knee.

MSSR42B Multimodality Imaging of the Foot and Ankle Injuries in the Athlete

Participants

Andrew J. Grainger, MD, Leeds, United Kingdom (Presenter) Consultant, Levicept Ltd; Director, The LivingCare Group;

LEARNING OBJECTIVES

1) To appreciate the different and often contributory roles that imaging modalities have in the foot and ankle. 2) To recognize the most common ligamentous and tendon injuries in the ankle. 3) To understand how common patterns of injury relate to the mechanisms involved.

ABSTRACT

Abstract: Ankle injuries are common in many sports and the complicated anatomy of the ankle joint can be challenging the reporting radiologist. The ankle joint itself is a synovial hinge joint, but important movement for ankle function also occurs at the joints of the hind and midfoot which are also susceptible to injury. In addition to conventional radiographs, CT, MRI and ultrasound all have important roles to play in the diagnosis of foot and ankle injuries in the athlete. The ligamentous and tendon structures about the ankle are generally superficial in nature and readily amenable to assessment with ultrasound where assessment can be enhanced due to the dynamic capabilities of the technique. While MRI also demonstrates these structures, it has advantages for assessing deeper joint structures such as the chondral surfaces and bones. The complex 3d anatomy of the foot and ankle means that conventional radiographs can struggle to demonstrate bone injury which means CT also has an important role to play. This lecture will focus on the use of these imaging modalities for the assessment of acute and chronic ligamentous and tendon injury. Emphasis will be put on the mechanisms of injury and how they determine the resultant patterns of injury and the imaging appearances.

MSSR42C Interactive Case Discussion

Participants

Andrew J. Grainger, MD, Leeds, United Kingdom (*Presenter*) Consultant, Levicept Ltd; Director, The LivingCare Group; Theodore T. Miller, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To appreciate common patterns of athletic injury in the knee. 2) To become familiar with the techniques available and imaging appearances of the knee, foot and ankle athletic injury. 3) To consolidate the knowledge gained from the session with interactive cases of lower limb athletic injury.

ABSTRACT

Cases will be presented with the opportunity for audience response highlighting and consolidating ideas presented in the preceding lecture. Abstract for that Lecture: Ankle injuries are common in many sports, and the complicated anatomy of the ankle joint can be challenging the reporting radiologist. The ankle joint itself is a synovial hinge joint, but the important movement for ankle function also occurs at the joints of the hind and midfoot which are also susceptible to injury. In addition to conventional

radiographs, CT, MRI and ultrasound all have important roles to play in the diagnosis of foot and ankle injuries in the athlete. The ligamentous and tendon structures about the ankle are generally superficial in nature and readily amenable to assessment with ultrasound where assessment can be enhanced due to the dynamic capabilities of the technique. While MRI also demonstrates these structures, it has advantages for assessing deeper joint structures such as the chondral surfaces and bones. The complex 3d anatomy of the foot and ankle means that conventional radiographs can struggle to demonstrate bone injury which means CT also has an important role to play. This lecture will focus on the use of these imaging modalities for the assessment of acute and chronic ligamentous and tendon injury. Emphasis will be put on the mechanisms of injury and how they determine the resultant patterns of injury and imaging appearances.





SSK06

Science Session with Keynote: Emergency Radiology (Pulmonary Emboli - Current Cutting Edge, and the Future)

Wednesday, Dec. 4 10:30AM - 12:00PM Room: S103AB



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Clint W. Sliker, MD, Baltimore, MD (*Moderator*) Nothing to Disclose Michael N. Patlas, MD, FRCPC, Hamilton, ON (*Moderator*) Speaker, Springer Nature Jamlik-Omari Johnson, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSK06-01 Emergency Radiology Keynote Speaker: Pulmonary Emboli: Current Clinical Picture

Wednesday, Dec. 4 10:30AM - 10:50AM Room: S103AB

Participants

Clint W. Sliker, MD, Baltimore, MD (Presenter) Nothing to Disclose

SSK06-03 Radiation Dose, Subjective and Objective Image Quality of Two Dual-Source CT Scanners in Acute Pulmonary Embolism: A Comparative Study

Wednesday, Dec. 4 10:50AM - 11:00AM Room: S103AB

Participants

Waleed Abdellatif, MD, Vancouver, BC (*Presenter*) Nothing to Disclose Eric Esslinger, Kamloops, BC (*Abstract Co-Author*) Nothing to Disclose Kevin J. Kobes, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Amanda Wong, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Jennifer Powell, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

For information about this presentation, contact:

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PURPOSE

To compare radiation dose, mean acquisition time, objective and subjective image quality of two Dual Source CT scanners in the evaluation of acute pulmonary embolism (PE), operating in dual energy mode.

METHOD AND MATERIALS

Total of 221 scans on the 2nd generation SOMATOM Definition Flash CT scanner (the Flash) and 354 scans on the 3rd generation SOMATOM Force (the Force) were included, after adjusting the acquisition parameters to be the same. In a randomized blinded design, two radiologists independently reviewed both sets of scans in two settings (5-week interval) for subjective image quality using a 5-point Likert scale. Dose length product (DLP), CTDIvol and effective dose (ED) were calculated along with objective parameters such as image noise, Signal to Noise ratio (SNR), Contrast to Noise ratio (CNR) and dose-independent Figure of Merit (FOM= CNR2/ED).

RESULTS

Mean acquisition time was significantly lower in the Force in comparison to the Flash (2.81s +/-0.1 in comparison to 9.7s +/- 0.15 [mean+/- SD] respectively; p < 0.0001) with the Force 3.4 times faster than the Flash. The mean image quality score was found to be 4.33/5 and 4/5 for the Force and the Flash respectively with statistical significance (p < 0.0001 on the unpaired t-test; 95% CI= 0.17-0.49). Interobserver reliability for image quality indicates strong agreement on both, the Force (K= 0.83, P<0.005) and the Flash-generated scans (K= 0.85, P<0.005). DLP, CTDIvol and ED were significantly lower in the Force than the Flash (175.6 +/-63.7; 5.3 +/-1.9 and 2.8 +/- 1.2 in comparison to 266 +/- 255; 7.8 +/-2.2 and 3.8 +/-4.3 [mean +/- SD] respectively). Noise was significantly lower in the Force (p<0.01). SNR, CNR and FOM were significantly higher in the Force than the Flash (33.5 +/-23.4; 29.0 +/-21.3 and 543.7 +/-1037 in comparison to 23.4 +/- 17.7; 19.4 +/- 16.0 and 170.5 +/-284.3 [mean +/- SD] respectively used for emergency patients while the Flash was used for inpatients.

CONCLUSION

Objective and subjective image quality is significantly higher on the Force with significantly lower mean acquisition time and radiation dose in comparison to the Flash.

The improved image quality and speed of the Force could be very useful in emergency radiology setting with large patient volume while maintaining lower radiation dose.

SSK06-04 Diagnostic Accuracy of Dual-Energy CT in Detection of Acute Pulmonary Embolism: A Systematic Review and Meta-Analysis

Wednesday, Dec. 4 11:00AM - 11:10AM Room: S103AB

Participants

Waleed Abdellatif, MD, Vancouver, BC (*Presenter*) Nothing to Disclose Mahmoud Ebada, Zagazig, Egypt (*Abstract Co-Author*) Nothing to Disclose Souad Alkanj, Zagazig, Egypt (*Abstract Co-Author*) Nothing to Disclose Ahmed Negida, Zagazig, Egypt (*Abstract Co-Author*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Faisal Khosa, Vancouver, BC (*Abstract Co-Author*) Scholarship, Canadian Association of Radiologists Scholarship, Vancouver Coastal Health Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Stockholder, Canada Diagnostic Centres

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PURPOSE

To calculate sensitivity, specificity and diagnostic accuracy of Dual-Energy CT (DECT) in the detection of acute pulmonary embolism (PE) through meta-analysis framework (PROSPERO registration Number: CRD42019120143).

METHOD AND MATERIALS

We searched Medline (via PubMed), EBSCO, Web of Science, Scopus and the Cochrane Library for relevant published studies. We selected clinical trials assessing the accuracy of DECT in the detection of PE. Quality assessment of bias and applicability was conducted using the Quality of Diagnostic Accuracy Studies-2 tool. The sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and the diagnostic odds ratio were recorded. The summary receiver operating characteristic curve was drawn to get the Cochran Q-index and the area under the curve.

RESULTS

Seven studies with high homogeneity were included in our systematic review. The pooled sensitivity was 87.9% (95% confidence interval [CI]: 80.1- 93.4%), specificity was 93.3% (95% CI: 85.1- 97.8%), and diagnostic odds ratio was 51.59 (95% CI 17.28- 153.98). The pooled PLR was 8.72 (95% CI: 4.10- 18.54) and NLR was 0.20 (95% CI: 0.11- 0.39). Cochran-Q was 0.8794 and Area Under the Curve (AUC) was 0.9416 in the sROC curve.

CONCLUSION

DECT shows high sensitivity, specificity and diagnostic accuracy in the detection of acute PE. However, studies with larger sample size are still needed to support these findings.

CLINICAL RELEVANCE/APPLICATION

This meta-analysis shows the high diagnostic accuracy of dual energy CT (DECT) in diagnosis of acute PE. Astonishingly, a few studies have been published in the literature to discuss the value of DECT in this particular diagnosis. Hence, studies with larger sample size are still needed to support these findings.

SSK06-05 Pulmonary Embolism during Pregnancy: A 17-Year Single-Center Retrospective MDCT Pulmonary Angiography Study

Wednesday, Dec. 4 11:10AM - 11:20AM Room: S103AB

Participants

David Rotzinger, MD, Lausanne, Switzerland (*Presenter*) Nothing to Disclose Vincent Dunet, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose Olivier Hugli, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose Reto A. Meuli, MD, PhD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose Sabine Schmidt, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To determine the prevalence of pulmonary embolism (PE) and alternative diagnoses in pregnant women requiring computed tomography pulmonary angiography (CTPA); to assess the evolution of qualitative image quality and radiation dose over time.

METHOD AND MATERIALS

We retrospectively included all pregnant women referred to CTPA for clinically suspected PE over 17 years. Four different scanners were successively in use during the inclusion period, starting with a 4-MDCT system, then 16-MDCT, 64-MDCT, and finally 256-MDCT. Two blinded radiologists reviewed each CTPA in consensus regarding PE, alternative diagnoses and qualitative image quality. Radiation dose metrics, associated clinical and laboratory parameters were retrieved. Subgroup comparison was performed (Wilcoxon and Kruskal-Wallis tests).

RESULTS

After the exclusion of 8 (1.7%) patients due to inadequate technical CTPA quality, we analyzed 229 patients (mean age 31.7 years) with a mean gestational age of 28±7weeks. Qualitative image quality was similar across the four different CT systems used

over time (p=0.28). Sixteen (7%) patients had PE, 69 (30.1%) had an alternative diagnosis, and 144 (62.9%) had no radiological findings. Alternative radiological diagnoses in case of PE-negative CTPA included consolidation (n=14), other pulmonary infiltrates (n=33), pleural effusion (n=29), and basal atelectasis (n=43). Gestational age, symptoms and D-dimer levels were not significantly different between patients with or without PE (all p-values >0.05). We observed a 30% decrease in radiation exposure (dose-length product) over time (p<0.001), with a concomitant 4-fold increase of examinations per year.

CONCLUSION

In pregnant women, CTPA is rarely positive for PE and more often shows alternative diagnoses than PE. The use of CTPA in pregnancy has risen notably over 17 years, but radiation dose exposure has decreased by one third over the same period without a change in qualitative image quality.

CLINICAL RELEVANCE/APPLICATION

The use of CTPA in pregnancy has steadily risen over the last 17 years, and thanks to recent technical improvements, radiation dose exposure inherent in CTPA has considerably decreased while diagnostic image quality remains identical. In pregnant women, CTPA is rarely positive for PE and more often shows alternative diagnoses than PE.

SSK06-06 Attenuation Gradients Across Thoracic Vasculature on CT Pulmonary Angiography Predict Mortality Following Pulmonary Embolism

Wednesday, Dec. 4 11:20AM - 11:30AM Room: S103AB

Participants

Andrew D. Chang, MSc, Providence, RI (*Presenter*) Nothing to Disclose Lillian Dominguez-Konicki, Providence, RI (*Abstract Co-Author*) Nothing to Disclose Gian Ignacio, Providence, RI (*Abstract Co-Author*) Nothing to Disclose Michael K. Atalay, MD, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose Dan Shilo, MD, Staten Island, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Early risk stratification of pulmonary emboli (PE) has important clinical value in emergency and inpatient settings. While the PE Severity Index (PESI) is a well-validated prognostication tool for this purpose, its derivation requires multiple variables and has weak positive predictive value (PPV) in identifying high-risk patients. CT for pulmonary angiography (CTPA) captures the distribution of intravenous contrast across thoracic vasculature based on hemodynamic status. We hypothesize attenuation differences across this vasculature may be independently predictive of 30-day mortality, and improve the PPV of PESI score.

METHOD AND MATERIALS

We retrospectively identified 1000 consecutive patients who had positive CTPA studies between 1/1/2017 and 2/12/2019. The primary outcome was 30-day mortality following CTPA. Patient demographics and admission information were used to calculate PESI class. CTPA studies were performed with a fixed delay of 22 sec and injection rate of 4 cc/s. For each patient, densities (HU) were measured in the superior vena cava [SVC], main pulmonary artery [PA], left atrium [LA], and descending aorta [AO] on a single mid-thoracic transaxial slice. Density differences, PESI scores, and their combination were compared between groups.

RESULTS

We identified 1000 consecutive patients with positive CTPA studies within the study period. Compared to surviving patients (n=907, 90.8%), patients who died within 30 days (n=92, 9.2%) exhibited higher attenuation in the PA (446 ± 164 vs 377 ± 128 HU, p<0.001). The absolute density change from PA to AO (PA-AO) was associated with 30-day mortality (OR 1.002, 95%CI 1.001-1.004, p=0.001). This effect did not persist after adjusting for PESI score. With a threshold PA-AO difference of 150 HU, the combined PESI/PA-AO score had greater PPV for 30-day mortality than either independently (Combined 18.7% vs PESI 15.0% vs PA-AO 13.5%).

CONCLUSION

This study provides a simple, novel approach to identify high-risk PE patients by measuring vessel densities on a single transaxial CTPA image. Odds of high-risk PE increased with greater attenuation differences between the PT and AO, with a difference of 150 HU serving as a useful threshold that improves the predictive value of the PESI score.

CLINICAL RELEVANCE/APPLICATION

Vessel density changes on standard CTPA protocol may be used to improve identification of 30-day mortality following pulmonary embolism.

SSK06-07 Estimating Quantitative Lobar and Zonal Pulmonary Perfusion from Dual Energy CT Pulmonary Angiography: Accuracy and Applications in Pulmonary Embolism

Wednesday, Dec. 4 11:30AM - 11:40AM Room: S103AB

Participants

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PURPOSE

To assess accuracy and variations in lobar and zonal pulmonary perfusion on dual energy CT (DECT) pulmonary angiography in patients with and without pulmonary embolism with deep learning-based prototype and Lung AnalysisTM for automatic lung segmentation and quantitative perfusion on dual energy CT.

METHOD AND MATERIALS

Our IRB approved retrospective study included 88 adult patients (M:F=38:50; mean age= 56±19 years) who underwent DECT-PA on a 384-slice, third generation dual source CT (Siemens Somatom Force). Amongst these, 40 patients had pulmonary embolism (PE) and 48 had no PE. All CT exams were reviewed for location and distribution of PE. Transverse thin (1-1.5mm) DECT images (80kV;150kV) were exported and processed on a stand-alone prototype for automatic lung lobe segmentation (RUL, RML, RLL, LUL, LLL). The mean iodine concentration was normalized to main pulmonary artery. The mean attenuation numbers (M-HU), contrast amount (CA in mg) and normalized iodine concentration (NIC) were derived. The zonal volumes (RUZ, RMZ, RLZ, LUZ, LMZ, LLZ) and mean enhancement (M-HU) were derived from Lung Analysis (Siemens SyngoViaTM). Descriptive statistics and ANOVA were performed.

RESULTS

The deep learning-based automatic lung lobe segmentation was accurate in all DECT-PA (88;100%). Both lobar and zonal perfusions were significantly lower in patients with PE as compared to those without PE (p<0.0001). The mean M-HU, CA and NIC for PE negative and positive affected were: RUL (29,700,0.11; 23,556,0,08); RML (24,283,0.09;19,194,0.07); RLL (26,709,0.10; 20,471,0.07), LUL (26,776,0.10; 18,534,0.06) and LLL (26,628,0.09; 18,402,0.06) (p<0.0001). The zonal M-HU for PE negative and positive cases were: RUZ (32; 27), RMZ (30; 20), RLZ (29; 23), LUZ (31; 23), LMZ (29; 21) and LLZ (29; 20) (p<0.0001).

CONCLUSION

Accurate lung lobe segmentation and quantitative lobar lung perfusion can be obtained with application of deep learning-based segmentation tool on DECT pulmonary angiography.

CLINICAL RELEVANCE/APPLICATION

Quantitative parameters can improve diagnostic accuracy and may help predict patient outcome for pulmonary embolism on DECT pulmonary angiography.

SSK06-08 Can Pulmonary Embolism Rule-Out Criteria Replace the Need for D-Dimer Testing among Patients with Low Clinical Probability in the Emergency Department?

Wednesday, Dec. 4 11:40AM - 11:50AM Room: S103AB

Participants Ahmed Al Lawati, MD, Muscat, Oman (*Presenter*) Nothing to Disclose Ahmed Al Abri, MD, Al Athiba, Oman (*Abstract Co-Author*) Nothing to Disclose Rashid S. Al Umairi, MD, FRCR, Muscat, Oman (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The Pulmonary Embolism Rule-Out Criteria (PERC) rule has been suggested as an alternative to D-dimer testing in patients with low risk in pretest Pretest probability clinical scoring systems. This study looked at whether the PERC rule could safely replace the use of D-dimer in patients suspected of PE.

METHOD AND MATERIALS

Retrospectively we reviewed 350 patients with a suspected pulmonary embolism and had computed tomography pulmonary angiography (PCTA) and a blood sample for D-dimer level taken. PERC was retrospectively calculated for all patients and the diagnostic performance of the PERC rule was compared with a standard D-dimer level in the detection of PE

RESULTS

Of the 350 patients, 56 had positive CTPA and 294 had a negative scan. In these patients, the sensitivity of the PERC rule for detecting PE was 98.2% [95% confidence interval (CI): 90.45% to 99.95%], with a negative likelihood ratio of 0.16 (95% CI: 0.02 to 1.18). However, the negative predictive value of the PERC rule was 96.97 % % (95% CI: 81.70% to 99.57%). In comparison, the sensitivity for the standard D-dimer test was 98.21%% (95% CI: 90.45% to 99.95%), with a negative likelihood ratio of 0.24 (95% CI: 0.03 to 1.73). The negative predictive value for the standard D-dimer test was 95.65 % (95% CI: 75.17% to 99.38%).

CONCLUSION

The PERC rule has a high negative predictive value for excluding PE in patients presenting with suspected PE to the emergency department.

CLINICAL RELEVANCE/APPLICATION

Pulmonary embolism (PE) is a common and potentially fatal cardiovascular emergency. Pretest probability clinical scoring systems are used to stratify patients a suspicion of pulmonary embolism into low risk and high risk for PE. Patients with low risk for PE usually undergo D-dimer testing. A negative D-dimer in this low-risk group rules out PE with a high degree of certainty because of its high sensitivity. The D-dimer is, however, a poorly specific test and positive results often lead to unnecessary radiological imaging.

SSK06-09 Machine Learning Based Prediction of Pulmonary Embolism in the Emergency Department

Wednesday, Dec. 4 11:50AM - 12:00PM Room: S103AB

Participants Salim Bader, Ramat Gan, Israel (*Presenter*) Nothing to Disclose Ehud Grossman, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose Sara Apter, MD, Ganei Tikva, Israel (*Abstract Co-Author*) Nothing to Disclose Edith M. Marom, MD, Tel Aviv, Israel (*Abstract Co-Author*) Speaker, Bristol-Myers Squibb Company; Speaker, Boehringer Ingelheim GmbH; Speaker, Merck & Co, Inc; Officer, Voxellence ; ; ; ; Shelly Soffer, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose Yiftach Barash, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose Eli Konen, MD, Tel Hashomer, Israel (*Abstract Co-Author*) Nothing to Disclose Eyal Klang, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pulmonary embolism (PE) is a challenging diagnosis, often not recognized in timely fashion. The Wells score, based on specific anamnestic questions and clinical signs, is a known clinical decision tool for performing D-dimer blood test or CTA for suspected PE. Validation studies showed area under the curves of (AUC) of 0.75-0.80 for the Wells score. Our goal was to develop a machine-learning model for raising suspicion of PE without using specific anamnestic information or D-dimer results.

METHOD AND MATERIALS

An institutional review board granted approval for this retrospective study. We retrieved data for consecutive patients (1/2012 to 12/2018) who performed CTA in our ED for suspected PE. Clinical variables included demographics, vital signs, chief complaint, background medical history coded using ICD10 coding, chronic medications and blood tests other than D-dimer (complete blood count, chemistry panel). Number and time to previous ED visits and hospitalizations were also computed as variables. We verified PE presence in the scans using ICD10 coding. We evaluated the AUC of single variables to predict PE. We used a gradient boosting machine learning model (CatBoost) to predict PE. The model was trained on years 2012-2017 data and tested on year 2018 data. We evaluated the AUC of the model and used Youden's index to find the model's optimal sensitivity and specificity.

RESULTS

Overall, 4,701 patients were included in the study. From them, 367 patients (7.8%) were diagnosed with PE. Single variables with highest AUC for prediction of PE included: days from previous ED visit (0.69), chief complaint (0.69), oxygen saturation (0.68), Creatine Phosphokinase (CPK) (0.68), albumin (0.65), days to previous hospitalization (0.64), number of background diseases (0.63), heart rate (0.62), C reactive protein (CRP)(0.61) and number of previous hospitalizations (0.61). The machine learning model showed an AUC of 0.80 (95% CI: 0.765 - 0.845) for predicting PE. Using Youden's index, the model showed a sensitivity of 98.6% and specificity of 46.6% for predicting PE.

CONCLUSION

Readily available clinical and laboratory variables can be used to train a machine learning model for raising suspicion of PE in the ED setting with accuracy similar to the Wells score.

CLINICAL RELEVANCE/APPLICATION

Machine learning model can be used to flag patients with high probability for having PE, for performing D-dimer in these patients.







ERS-WEA

Emergency Radiology Wednesday Poster Discussions

Wednesday, Dec. 4 12:15PM - 12:45PM Room: ER Community, Learning Center

MK ER

AMA PRA Category 1 Credit ™: .50

Participants

Clint W. Sliker, MD, Baltimore, MD (Moderator) Nothing to Disclose

Sub-Events

Participants

ER215-SD-WEA1 Feasibility of Point-of-Care Knee Ultrasonography for Diagnosing Anterior Cruciate and Posterior Cruciate Ligament Tears in the Emergency Department

Station #1

Jung In Jo, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose Seong Jong Yun, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose Wook Jin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose Sun Hwa Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the feasibility of point-of-care knee ultrasonography (POCUS) compared with knee magnetic resonance imaging (MRI) for diagnosing anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) tears in patients with acute knee trauma.

METHOD AND MATERIALS

A prospective study was conducted in a tertiary hospital emergency department; acute (within 1-week) knee trauma patients with suspected ACL or PCL tear were recruited. Two POCUS performers (a board-certified emergency physician and a musculoskeletal radiologist) independently evaluated the ACL and PCL using POCUS. Findings were classified as normal appearance or ligament tear. Final radiology reports of knee MRI were used as the reference standard. We compared the diagnostic values for POCUS obtained by both POCUS performers using DeLong's test. Receiver operating characteristic (ROC) curve analysis was performed for calculation of areas under the ROC curves (AUCs). Kappa values (k) were calculated for agreement between each POCUS performer and the reference standard, and directly between the two POCUS performers.

RESULTS

Sixty-two patients were enrolled. Compared with the reference standard, POCUS showed acceptable sensitivity (90.6-100%), specificity (90.0-97.7%), accuracy (91.9-96.8%), and AUC (0.919-0.977); these diagnostic performance values did not differ significantly between reviewers (p=0.18-1.0). Agreement between each reviewer and the reference standard was excellent (k = 0.839-0.926), as was the inter-observer agreement (k = 0.853-0.903).

CONCLUSION

POCUS demonstrates excellent precision as compared to MRI in the diagnosis of ACL and PCL tears.

CLINICAL RELEVANCE/APPLICATION

The findings of POCUS could be used for immediate diagnosis and further pre-operative imaging in patients with acute knee trauma.

ER216-SD- Defining CT Based Imaging Variables that Correlate with Angiographic Findings and Clinical Outcome WEA2 in Trauma Patients

Station #2

Participants Mohamed Mansouri, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Amit Shrivstava, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Ali Bessissow, MD, Brossard , QC (*Abstract Co-Author*) Nothing to Disclose David A. Valenti, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Tatiana Cabrera, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Karl Muchantef, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Carlos I. Torres, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose Louis-Martin N. Boucher, MD, PhD, Montreal, QC (*Presenter*) Nothing to Disclose

PURPOSE

CT is the imaging modality of choice for trauma assessment. CT findings do not always correlate with angiographic or clinical outcome. This study aims to better define the key findings on CT that can predict these outcomes.

METHOD AND MATERIALS

Retrospective longitudinal cohort study in an academic center from September 2005 to August 2016 with ethics approval. Trauma patients with CT evidence of extravasation or pseudoaneurysm who then went to angiography were identified. Patients with incomplete data were excluded. Data was reviewed by three reviewers. This data included, among other things: CT-phases of contrast, anomaly specific findings such as number, location, edge sharpness, size of touching vessel, volume change between CT-phases, Houndsfield Units (HU), HU changes between CT-phases, volume change of associated hematoma between CT-phases, characterization on angiography, angiographic treatment, and mortality data. 100 patients fit the criteria. Statistics were performed using logistic regression and odds ratios.

RESULTS

76% males. 50 y.o. mean age. Cause of trauma: 38% MVA, 46% fall, 13% weapon. Average injury severity score: 25.4. Injury location: 31% spleen, 20% intrapelvic, 15% kidney, 12% liver, 22% other. Among other things, mortality correlated significantly with CT diagnosis of extravasation over pseudoaneurysm (p=0.02) and with angiographic treatment (p=0.04). CT diagnosis of pseudoaneurysm was confirmed by angiography in only 61%. CT findings that predicted correlation included early arterial phase (p=0.0001), # of pseudoaneurysms (p<0.0001), anomaly located in solid organs (p=0.0002), single organ injury (p=0.03), sharp edges (p=0.0005), vessel the touching anomaly (p=0.0005), stable size of anomaly between CT phases (p<0.0001), ratio of HU in anomaly versus aorta (p=0.05), drop in anomaly HU similar to aorta between CT phases (p=0.01). Using these variables increases significantly accuracy in identifying a pseudoaneurysm on CT (R=0.96).

CONCLUSION

Defining extravasation from pseudoaneurysm on a trauma CT is often based on gestalt. Our data demonstrates that correct characterization can impact mortality and that specific findings can help significantly increase accuracy.

CLINICAL RELEVANCE/APPLICATION

Specific findings on trauma CTs should be discussed in the report as these findings can help accurately differentiate active extravasation from pseudoaneurysms which can impact angiographic treatment and mortality.

ER217-SD-WEA3 Diagnostic Accuracy of Three-Dimensional Surface Rendering Reconstruction Images in Detection of Cervical Spine Injuries Using Multi-Planar Computed Tomography as Reference Standard

Station #3

Participants Muhammad Khan, MBBS, Karachi, Pakistan (*Presenter*) Nothing to Disclose Asad Shakil, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose Aeman Muneeb, MD, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose Muhammad Sami Alam, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose Noman Khan, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose Vaqar Bari, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Road traffic accidents are a leading cause of spinal trauma, which most commonly affects cervical spine. Cervical spine may also be injured in fall from height, sports injury and violence. C-Spine injuries are frightening as these may be associated with significant neurological damage, paralysis or even death. CT is the initial modality of choice in acute spinal trauma. CT is superior due to its wider availability, rapid scan time and excellent diagnostic performance in evaluation of fractures or dislocation. 3D reconstruction is a newer advancement which has become popular likely due to a better visual display of anatomic spatial relationships. The purpose of study is to assess diagnostic accuracy of three dimensional surface rendering reconstruction images in detection of cervical spine injuries in symptomatic post-trauma patients using multiplanar computed tomography (MPCT) as reference standard.

METHOD AND MATERIALS

The study was conducted at Department of Radiology, Aga Khan University Hospital from Jan 2017 to Dec 2017. All patients referred for CT from ER fulfilling the inclusion criteria were included. The final study population consisted of 205 patients. An experienced senior radiologist having more than 5 years of experience evaluated the 3-D reconstructions and 640 slice Multiplanar CT (MPCT) images separately to identify cervical spine injuries.

RESULTS

Three-dimensional CT scan for fractures in the cervical spine was found to have sensitivity of 71%, specificity of 100%, positive predictive value of 100% and negative predictive value of 96.8% with an overall diagnostic accuracy of 97%. On the other hand, three-dimensional CT scan for dislocations in the cervical spine was found to have sensitivity of 83.34%, specificity of 100%, positive predictive value of 100% and negative predictive value of 99.5% and diagnostic accuracy of 99.5%.

CONCLUSION

Three-dimensional CT scan has good sensitivity as a diagnostic tool in the detection of cervical spine injuries but to improve the overall patient care three-dimensional images and multiplanar CT images must be reviewed simultaneously.

CLINICAL RELEVANCE/APPLICATION

Three dimensional CT scan is equal to multiplanar CT in assessment of fracture or dislocation in cervical spine following trauma and may be a useful adjunct.

ER237-SD- A 2019 International Survey to Assess Trends in Follow-Up Imaging of Blunt Splenic Trauma WEA4

Station #4

Participants Devang Odedra, MD, Burlington, ON (*Presenter*) Nothing to Disclose Vincent M. Mellnick, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose Michael N. Patlas, MD,FRCPC, Hamilton, ON (*Abstract Co-Author*) Speaker, Springer Nature

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PURPOSE

There are no published societal guidelines on the follow-up imaging of conservatively managed blunt splenic trauma. Our goal was to survey emergency radiologists across North America and abroad to determine the patient population, time period and technique for follow-up imaging of blunt splenic trauma.

METHOD AND MATERIALS

With IRB approval, an anonymous 10-question online survey was distributed via email to 34 emergency radiologists around the world. The survey was open for a 2-week period in March 2019. A commercially available website (SurveyMonkey®) was used for survey generation and data acquisition.

RESULTS

We received 27 responses (79% response rate) primarily from USA, Canada and Europe (56%, 22% and 22% respectively). Majority of the institutions handled over 1000 trauma cases with over 500 blunt traumas per year (67% and 63% respectively). The initial trauma protocol consisted of arterial and portal venous phases in 78% of cases. Fifty nine percent of the institutions did not have a routine protocol for follow-up of patients with blunt splenic trauma. There was no consensus on which patients received follow-up imaging but most frequent responses had been case-per-case basis or injuries above a set AAST grade (42% and 37% respectively). Majority of the centres did not have a standard time-period for follow-up imaging of blunt splenic trauma but most often performed follow-up MDCT at 24-48 hours. The protocol of choice for follow-up imaging was most commonly arterial and portal venous phase (PVP) (69%) followed by PVP only (31%). Majority of the institutions (88%) utilized catheter angiography and embolization for hemodynamically stable patients with contained vascular injury or active extravasation.

CONCLUSION

There is no consensus on the optimal patient population or time period for follow-up imaging of blunt splenic trauma. Dual arterial and PVP follow-up MDCT is used for follow-up by majority of institutions. Catheter angiography with embolization is the most common method of treatment in hemodynamically stable patients.

CLINICAL RELEVANCE/APPLICATION

No consensus exists for the imaging of blunt splenic trauma and the decision most often rests in the hands of the clinical team.

ER238-SD- Can Pulmonary Embolism Rule-Out Criteria Replace the Need for D-Dimer Testing Among Patients WEA5 with Low Clinical Probability in the Emergency Department?

Station #5

Participants Ahmed Al Lawati, MD, Muscat, Oman (*Presenter*) Nothing to Disclose Ahmed Al Abri, MD, Al Athiba, Oman (*Abstract Co-Author*) Nothing to Disclose Rashid S. Al Umairi, MD, FRCR, Muscat, Oman (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The Pulmonary Embolism Rule-Out Criteria (PERC) rule has been suggested as an alternative to D-dimer testing in patients with low risk in pretest Pretest probability clinical scoring systems. This study looked at whether the PERC rule could safely replace the use of D-dimer in patients suspected of PE.

METHOD AND MATERIALS

Retrospectively we reviewed 350 patients with a suspected pulmonary embolism and had computed tomography pulmonary angiography (PCTA) and a blood sample for D-dimer level taken. PERC was retrospectively calculated for all patients and the diagnostic performance of the PERC rule was compared with a standard D-dimer level in the detection of PE

RESULTS

Of the 350 patients, 56 had positive CTPA and 294 had a negative scan. In these patients, the sensitivity of the PERC rule for detecting PE was 98.2% [95% confidence interval (CI): 90.45% to 99.95%], with a negative likelihood ratio of 0.16 (95% CI: 0.02 to 1.18). However, the negative predictive value of the PERC rule was 96.97 % % (95% CI: 81.70% to 99.57%). In comparison, the sensitivity for the standard D-dimer test was 98.21%% (95% CI: 90.45% to 99.95%), with a negative likelihood ratio of 0.24 (95% CI: 0.03 to 1.73). The negative predictive value for the standard D-dimer test was 95.65 % (95% CI: 75.17% to 99.38%).

CONCLUSION

The PERC rule has a high negative predictive value for excluding PE in patients presenting with suspected PE to the emergency department.

CLINICAL RELEVANCE/APPLICATION

Pulmonary embolism (PE) is a common and potentially fatal cardiovascular emergency. Pretest probability clinical scoring systems are used to stratify patients a suspicion of pulmonary embolism into low risk and high risk for PE. Patients with low risk for PE usually undergo D-dimer testing. A negative D-dimer in this low-risk group rules out PE with a high degree of certainty because of its high sensitivity. The D-dimer is, however, a poorly specific test and positive results often lead to unnecessary radiological imaging.

ER169-ED- Splenic Trauma: New 2018 AAST Injury Grading Scale for an Evolving Landscape towards Non-WEA6 Operative Management

Participants Charlotte Y. Chung, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Gayatri Joshi, MD, Charleston, SC (*Presenter*) Nothing to Disclose Syed A. Abidi, BS, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Keith D. Herr, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Tarek N. Hanna, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Evaluation with computed tomography (CT) allows for the diagnosis and stratification of splenic injuries according to the American Association for the Surgery of Trauma (AAST) splenic injury scale. This scale was revised in 2018, primarily to include splenic vascular injuries, to address increasing clinical preference towards non-operative management and angioembolization. The purpose of this exhibit is to: • Illustrate the new 2018 AAST splenic injury grading system, highlighting changes that are new to this revision. • Describe the appearance of splenic parenchymal and vascular injuries on multimodality (including CT and angiography) imaging. • Review the recent evolution in management of splenic injuries. • Discuss the implications of imaging findings and radiologic AAST grading on treatment and prognosis.

TABLE OF CONTENTS/OUTLINE

• Trends in management strategies for splenic trauma • Normal splenic anatomy, with an emphasis on splenic vascular anatomy and implications for injury and management • Overview of the new 2018 AAST splenic injury grading system • Pictorial review of the spectrum of splenic parenchymal and vascular injuries • Case Illustrations of splenic injuries and subsequent management, stratified according to the new AAST splenic injury scale

ER170-ED- Perilous Pipe Problems: Review of Abdominopelvic Arterial Emergencies

Station #7

Participants James Mahn, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose Amnah Aglan, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose William Sherk, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose Erica B. Stein, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose John D. Millet, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Become familiar with the spectrum of acute abdominal aortic aneurysm findings, including differentiating between different stages of rupture (impending and acute/contained rupture) and aneurysm subtypes necessitating urgent repair (enlarging, inflammatory and mycotic). 2. Learn to identify clinically relevant findings of type B aortic dissection involving the abdominal aorta, including evaluating for the potential of dynamic obstruction. 3. Review high yield common anatomic variants which are susceptible to iatrogenic and traumatic injury. 4. Learn to optimize imaging protocols to expedite accurate diagnosis of vascular pathologies.

TABLE OF CONTENTS/OUTLINE

I. Introduction a. Key anatomy b. Technical tips II. Abdominal aorta a. Aneurysm i. Impending rupture ii. Rupture 1. Aortoenteric fistula 2. Aortocaval fistula iii. Contained rupture b. Dissection i. Malperfusion due to dynamic obstruction ii. Malperfusion due to static obstruction III. Mesenteric arteries a. Vasculitis b. Thrombosis c. Aneurysm/Pseudoaneurysm IV. Anatomic variants a. Corona mortis b. Persistent sciatic artery V. Trauma a. Visceral arterial injury b. Mesenteric arterial injury VI. Pitfalls a. Protocol Optimization VII. Conclusion







ERS-WEB

Emergency Radiology Wednesday Poster Discussions

Wednesday, Dec. 4 12:45PM - 1:15PM Room: ER Community, Learning Center

ER

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants

Michael E. O'Keeffe, MBBCh, Vancouver, BC (Moderator) Nothing to Disclose

Sub-Events

ER218-SD-MAPAC Imaging Project: Value of a Clinical Decision Support System (CDSS) for the Worthiness of
Carrying Out an Abdominal Angio-CT for the Diagnosis of Acute Mesenteric Ischemia (AMI)

Station #1 Participants

Manuel Vicente Redondo, MD, Madrid, Spain (*Presenter*) Nothing to Disclose Blanca Lumbreras-Fernandez, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Fernando Gonzalez-Tello, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Nicolas A. Almeida SR, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Ines Pecharroman, PhD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Agustina Vicente Bartulos, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Borja Fernandez-Felix, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Alfonso Muriel Garcia, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the utility of the algorithm used in our emergency department for the suitability of performance of an abdominal angio-CT on patients with suspicion of AMI, and the association of the variables included in this algorithm with the radiological findings.

METHOD AND MATERIALS

An algorithm-based radiological approach was developed for clinical use of the CDSS. The algorithm considers two main groups of variables: data from the medical history and clinical presentation. The presence of at least one variable from each group recommends performing CT directly. We reviewed medical records of patients with abdominal angio-CT performed at our emergency department between April 2016 and July 2018 requested under suspected AMI. Scan reports were classified as normal, non-acute or relevant findings, according to clinical suspicion or with other acute diseases. To evaluate the association among the variables included in the decision algorithm and the findings in the CT, Chi-2 test and multinomial logistic regression were performed.

RESULTS

We found 213 patients meeting the established criteria. 14 patients (6.6%) had acute mesenteric ischemia, 131 patients (61.5%) had another acute disease and the rest were normal or had non-related/acute pathology (31.9%). We obtained statistically relevant results for the variable clinical presentation of occlusive AMI (sudden and severe abdominal pain, chills lasting 3 to 6 hours, with pain-free interval, followed by peritonitis). In patients with OAMI clinical presentation, the probability of getting an appropiate finding according to the suspicion was 7 times higher [RRR = 6.9 CI.95% (2; 24)]. Secondly, patients under vasoactive medication had a probability 5 times higher [RRR = 5.5 CI.95% (0.7; 42)] of obtaining AMI findings on CT, but this computation was not so statistically important.

CONCLUSION

In the emergency department, the use of an algorithm that includes clinical presentation and risk factors is not a clearly useful tool to optimize the diagnosis of AMI, despite the fact that the clinical presentation may have some value. Further investigations and more extensive sample of patients are needed to establish a truly beneficial algorithm.

CLINICAL RELEVANCE/APPLICATION

A clinical decision support system can be useful for determining the suitability of carrying out an abdominal angio-CT on patients with suspicion of acute mesenteric ischemia.

ER219-SD- Performance Evaluation of Deep Learning Algorithm in Measuring the Volume of Cerebral Hematoma WEB2

Station #2

Participants Zhiqiang Chen, Yinchuan , China (*Presenter*) Nothing to Disclose Tao Wang, Yinchuan , China (*Abstract Co-Author*) Nothing to Disclose Zichao Zhu, Yinchuan , China (*Abstract Co-Author*) Nothing to Disclose Jun Gu Sr, Beijing, China (*Abstract Co-Author*) Nothing to Disclose Jiajia Liu, Yinchuan , China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Hematoma volume is a powerful predictor of 30-day mortality after spontaneous intracerebral hemorrhage (ICH). Timely and accurate measurement of intracranial hematoma is critical to provide reference for clinical treatment option selection. To evaluate the performance of deep learning algorithm in measurement of hematoma volume for patients with spontaneous cerebral hemorrhage using head CT images.

METHOD AND MATERIALS

200 patients with cerebral hemorrhage from July 2017 to December 2018 were retrospectively collected in our hospital and 60 patients with acute sICH were finally included in this study. According to whether intracranial hemorrhage broke into the ventricle, 60 patients were divided into two groups: 28 cases of hemorrhage broke into the ventricle (group A) and 32 cases of hemorrhage did not break into the ventricle (group B). Two radiologists with more than 10 years' working experience used the Philips post-processing workstation software (Extended Brilliance Workstation) to delineate the intraparenchymal hematoma region (excluding the region of intraventricular and subarachnoid hemorrhage) for area calculation. Delineation time was also recorded. The volume of hematoma was calculated according to V= Σ hematoma area × layer thickness. The average of hematoma volume measured by two radiologists was used as gold standard volume. A deep learning-based artificial intelligence (AI) diagnostic system (InferRead CT Stroke Research, Infervision, Beijing) was used to measure the hematoma volume. The matched t-test was used to analyze the volume and delineation time between gold standard and deep learning algorithm.

RESULTS

In group A, the hematoma volume was (46.44 ± 8.27) ml for gold standard and (55.78 ± 9.02) ml for deep learning algorithm with statistically significant difference (p<0.05). In the group B, the hematoma volume was (22.80 ± 3.99) ml for gold standard and (22.42 ± 4.05) ml for deep learning algorithm without statistically significant difference (P>0.05). Delineation time was (11.63 ± 7.62) min for gold standard and (1.06 ± 0.11) min for deep learning algorithm with statistically significant difference (p<0.05).

CONCLUSION

AI can accurately and quickly measure the volume of hematoma that does not break into the intraventricular in head CT images. AI is also powerful in timely recognition of intraparenchymal hematoma although volume measurement compromised.

CLINICAL RELEVANCE/APPLICATION

It is recommended to use AI in clinical work to quickly and accurately measure the volume of intraparenchymal hematoma of patients with acute spontaneous cerebral hemorrhage for better treatment option selection.

ER220-SD-
WEB3Can Obstructive Urolithiasis Be Safely Excluded on Contrast-Enhanced CT?: A Retrospective
Noninferiority Analysis Between Contrast-Enhanced and Non-Contrast CT

Station #3 Participants

Brandon Z. Lei, MD, Staten Island, NY (*Presenter*) Nothing to Disclose Jonathan Scheiner, Staten Island, NY (*Abstract Co-Author*) Nothing to Disclose Morris Hayim, MD, Franklin Square, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The purpose of this study is to determine if contrast-enhanced CT is noninferior to noncontrast CT (the current reference standard) in ruling out obstructive urolithiasis.

METHOD AND MATERIALS

We performed a retrospective noninferiority cohort analysis to determine the negative predictive value (NPV) of contrast-enhanced CT vs noncontrast CT for the detection of obstructing urolithiasis. We defined obstructing urolithiasis as one or more calculi within the ureters. We hypothesized that the NPV of contrast-enhanced CT for obstructive urolithiasis would be noninferior to the NPV of noncontrast CT. We identified all noncontrast and contrast-enhanced CT studies of the abdomen and pelvis ordered by the ED at a single academic medical institution with an indication of flank pain from 2017. The prevalence of obstructive urolithiasis in each group was calculated. We then identified 200 consecutive studies from each of these groups that were reported negative for obstructive urolithiasis by the original interpreting radiologist. We used PACS follow up at 7 days as a reference standard for analysis. Cases in which patients were discharged from the ED and did not re-present with flank pain within 7 days were designated as true negative. Conversely, for patients that returned with flank pain within 7 days and were found to have an obstructing stone on follow up CT, the original CT study was designated false negative.

RESULTS

Among the 200 consecutive noncontrast CT studies that were initially read as negative for obstructive urolithiasis, 1 study was a false negative (NPV = 99.5%). Among the 200 consecutive contrast-enhanced CT studies that were initially read as negative for obstructive urolithiasis, there were no false negatives (NPV = 100%). The prevalence of obstructive urolithiasis was 351/797 (44.0%) across all noncontrast CTs for flank pain in 2017 and 86/459 (18.7%) across all contrast-enhanced CTs for flank pain in 2017. The purpose of calculating prevalence in both groups was to demonstrate that neither prevalence was close to 0%. Thus, the difference in prevalences would not affect the inherent ability of a CT study to rule out obstructive urolithiasis.

CONCLUSION

Contrast-enhanced CT is noninferior to noncontrast CT in excluding obstructive urolithiasis.

CLINICAL RELEVANCE/APPLICATION

Our study suggests contrast-enhanced CT may be able to supplant noncontrast CT as the standard imaging study for evaluating patients with flank pain.

ER239-SD- Assessment of CT Scan Need for Patients with Delayed Presentation of Head Trauma WEB4

Station #4

Participants Muhammad Khan, MBBS, Karachi, Pakistan (*Presenter*) Nothing to Disclose Noman Khan, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose Muhammad Sami Alam, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose Asad Shakil, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose Wasim A. Memon I, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The National Institute for Health and Care Excellence (NICE) guidelines are commonly used to triage patients presenting with head trauma for need of CT scan. This tool was validated and developed with data for patients presenting within 24 hours of trauma. Thus it is not clear whether these guidelines hold true for patients with head trauma presenting after 24 hours of injury. The purpose was to estimate the proportion of CT scans done for late presenters, compare their rate of abnormalities on CT with early presenters, and compare the sensitivity of NICE guidelines in both groups. The objective of the study was to determine incidence of significant injury in patients with delayed presentation (> 24 hrs)) despite survival beyond 24 hours and compare the rate of intracranial abnormalities with patients who present earlier (<24 hrs).

METHOD AND MATERIALS

This was a retrospective cohort study, conducted at Aga Khan University Hospital. All adult patients referred to for CT scan from ER for evaluation of head injury in the period July 2014-July 2016 were included. Of the 2009 eligible patients, 7 were excluded due to lack of medical records. The final study population consisted of 2002 patients. The medical records were searched to establish time of injury for all patients. Patients were then grouped into two. Patients who underwent CT within <24 hrs were grouped as early presenters. Patients who underwent CT > 24 hrs after innjury grouped as late presneters.

RESULTS

Overall, 52% there was evidence of traumatic injury in 52 % of cases. The overall mortality rate was 2.3%. 32.2% of study population underwent CT after > 24 hours of trauma. Tramatic injury was seen in 46.7% of early presenters and 63% of late presenters. The sensitivity of NICE guidelines for intracranial injury was 93% for early and 83% for late presenters

CONCLUSION

Patients presenting after 24 hours of head injury form a significant proportion. NICE guidelines have low sensitivity in patients who present after 24 hours of head injury. As these patients constitute a significant proportion of trauma patients, injuries may be missed if CT is not obtained.

CLINICAL RELEVANCE/APPLICATION

CT head may reveal significant abnormalities in patients who present after later than 24 hours onset of head injury.

ER240-SD-Impact of Added CT Venography Performed in Combination with CT Pulmonary Angiography on theWEB5Detection of Deep Venous Thrombosis and Relevant Occult CT-Findings

Station #5

Participants Pauline Douek, Lausanne, Switzerland (*Presenter*) Nothing to Disclose David Rotzinger, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose Reto A. Meuli, MD, PhD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose Vincent Dunet, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose Sabine Schmidt, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the additional diagnostic value of CT venography (CTV) simultaneously performed with CT pulmonary angiography (CTPA) in thromboembolic disease for the detection of deep venous thrombosis (DVT) and other relevant occult CT findings.

METHOD AND MATERIALS

We retrospectively and consecutively included all patients admitted to the emergency room for suspected pulmonary embolism (PE) who underwent CTPA combined with CTV over 2 years. Two blinded radiologists independently analyzed CTV images in view of DVT of the lower extremities and other, yet unknown, pelvic findings, which were classified into non-relevant or major. The latter were further divided according to therapeutic consequences. One radiologist reviewed patients' clinical records. Inter-observer agreement for the detection of DVT was calculated using the Cohen's kappa coefficient.

RESULTS

The final cohort consisted of 696 patients. PE was present in 119 (17.1%) patients and DVT in 54 (7.8%) patients: 38 (5.5%) had both PE and DVT, 81 (11.6%) had only PE and 16 (2.3%) had only DVT, of which 0.1% (n=1) had thrombi in the inferior vena cava or pelvic veins alone without distal involvement. CTV led to the diagnosis of major incidental findings in 40 (5.7%) patients. No therapeutic consequences were observed in 26 (1.4%) of them, but in 8 (1%) patients the incidental finding triggered further diagnostic imaging. In 14 (1.9%) patients, incidental findings had therapeutic consequences: such findings included tumors (n=4), infections (n=4), vascular diseases (n=2) or progression of already known tumors (n=4). Patients with DVT had a 1.4-fold higher risk for incidental findings than patients without DVT, irrespective of PE.Overall, additional CTV to CTPA lead to a change of therapeutic management in 30 (4.3%) patients, consisting in anticoagulation therapy (n=16, 2.3%) because of DVT without PE, and change of treatment (n=14, 2.0%) due to the incidental detection of relevant pelvic findings.

CONCLUSION

CTV in patients with suspected PE rarely leads to the detection of isolated DVT. However, incidental pelvic findings may be seen, especially in patients with DVT, being at higher risk for incidental findings than other patients.

CLINICAL RELEVANCE/APPLICATION

CTV simultaneously performed with CTPA provides limited incremental value regarding the detection of DVT but can reveal other relevant CT-findings, which may change the therapeutic management.

ER171-ED- Imaging Findings in Intimate Partner Violence

WEB6

Station #6 Awards

Identified for RadioGraphics

Participants

Francesco Alessandrino, MD, Boston, MA (*Presenter*) Nothing to Disclose Abhishek R. Keraliya, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Jordan Lebovic, BA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose George Dyer, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Mitchel B. Harris, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Paul Tornetta, Boston, MA (*Abstract Co-Author*) Editorial Advisory Board, Journal of Orthopaedic Trauma Royalties, Smith & Nephew plc Royalties, Wolters Kluwer nv Bharti Khurana, MD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To provide an overview of the public health problem of intimate partner violence (IPV) and of the human and social challenges associated To define the role of radiologist in diagnosis of IPV To illustrate imaging findings associated with IPV

TABLE OF CONTENTS/OUTLINE

Overview of IPV Epidemiology according to US data Description of human and healthcare costs of IPV Limitations of current identification methods Health consequences Demographic and clinical factors associated with IPV Role of radiologists in diagnosis Radiologists often first providers who can identify IPV victims Value of serial imaging evaluation System-based description of imaging findings associated with IPV Craniofacial injuries Brain injuries Thoracic injuries Abdomen and obstetric-gynecologic injuries Musculoskeletal injuries For each system Reported prevalence and clinical correlation Mechanism of injuries Description of imaging findings with representative examples Differential diagnosis with other non-IPV injuries Current needs and future perspective Raise awareness of radiologists for IPV diagnosis Value of imaging findings in conjunction with clinical evaluation to improve IPV diagnosis Inclusion of radiologists in multidisciplinary teams for IPV diagnosis

ER172-ED- The Dark Side of Postpartum: A Pictorial Review of Puerperal Complications WEB7

Station #7

Awards

Identified for RadioGraphics

Participants

Marta Gonzalo Carballes, BMBCh, Barcelona, Spain (*Presenter*) Nothing to Disclose Eva Castella-Fierro, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose Xavier Guri Azogue, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose Pilar Coscojuela-Santaliestra, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose Alberto Escudero, Barcelona , Spain (*Abstract Co-Author*) Nothing to Disclose Marina Conangla-Planes, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose Miguel A. Rios-Vives, MD , Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose Jose Miguel Escudero-Fernandez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To know the spectrum of normal imaging findings during the postpartum To make a list with the most uncommon as well as the most common complications of the postpartum and posttermination patients. To provide a plain list of imaging key findings to face these challenging conditions

TABLE OF CONTENTS/OUTLINE

Background B asic anatomy Imaging techniques Normal imaging findings Postpartum complications <u>Infectious</u>: endometritis, parametritis, pyometra, septic pelvic thrombophlebitis, perineal/episiotomy infections <u>Vascular</u>: Thrombotic: Ovarian vein thrombophlebitis, aortic thrombosis, acute pulmonary embolism, Amniotic fluid embolism, Uterine arterio-venous malformations, HELLP syndrome <u>Postpartum Hemorrhage</u>: Retainded products of conception, Atonic uterus--> Hematoma: pelvic, rectus sheath hematoma, periuterine , abdominal wall, Active bleeding, Pseudoaneurysms <u>Uterine rupture-dehisence</u>, vaginal rupture <u>Cesarean delivery and Iatrogenic complications</u>: abdominal wall hematoma-abscess, uterine rupture-perforation, urinary complications (vesico-vaginal fisutla, ureteral section). <u>Neurological complications</u>: vascular complications, PRES, hypofisary complications <u>Other complications</u>: pyelonephritis, appendicitis, cholecystitis gastric ulcer, necrotic uterine myomatosis Conclusion







MSSR43

RSNA/ESR Sports Imaging Symposium: Musculoskeletal Interventional Procedures (Interactive Session)

Wednesday, Dec. 4 1:30PM - 3:00PM Room: E350



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Andrew J. Grainger, MD, Leeds, United Kingdom (*Moderator*) Consultant, Levicept Ltd; Director, The LivingCare Group; Laura W. Bancroft, MD, Venice, FL (*Moderator*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To learn the targeted approach to injecting joints, ligaments, tendons and tendon sheaths. 2) To appreciate pitfalls to avoid in MSK procedures for treatment of sports-related injuries. 3) To understand evidence-based data on various MSK procedures in order to give patients realistic expectations after treatment.

Sub-Events

MSSR43A Diagnostic and Therapeutic Injections in the Athlete: Pearls and Pitfalls

Participants

Philippe A. Peetrons, MD, Brussels, Belgium (Presenter) Research Consultant, Canon Medical Systems Corporation

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LEARNING OBJECTIVES

1) To become familiar with the most common requests and indications for sports-related injuries. 2) The learn about technical considerations for performing MSK injections. 3) To understand reasons to delay injections or avoid certain injectables.

ABSTRACT

The main pitfall is from far an mistake in the diagnosis done before sending the patient to the ultrasound guided treatment. Good examination and looking carefully to the examinations done before is mandatory. Among pearls, some innovative technique for injecting will be shown, such as Trapezo-metacarpal joint, sternoclavicular joint, Morton's neuroma, subtalar joint, hip and shoulder joints, carpal tunnel and de Quervain tenosynovitis. Treatment of nerve injuries will also be depicted and illustrated. Some tips will be given for ganglia tretment

MSSR43B Injectables, Percutaneous Tendon Fenestration and Tenotomy: Clinical Outcomes and Current Evidence

Participants

Jon A. Jacobson, MD, Ann Arbor, MI (*Presenter*) Research Consultant, BioClinica, Inc; Advisory Board, Koninklijke Philips NV; Royalties, Reed Elsevier

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LEARNING OBJECTIVES

1) To be aware of the indications and benefits of available injectables used to treat sports-related injuries. 2) To learn about technical considerations for performing tendon fenestration and tenotomy. 3) To become familiar with current evidence on results of MSK procedures in the literature.

ABSTRACT

For joint abnormalities and tendinopathy, there exists many percutaneous treatment options. Anaesthetic agents are used, often combined with corticosteroids, to inject joints and bursae for diagnostic and therapeutic purposes. With regard to anaesthetic agents, all are cytotoxic to chondrocytes and synovial cells to some degree. Corticosteroids may be used to decrease inflammation within a synovial space. The use of corticosteroid to treat tendinopathy is counterintuitive, as inflammation is not present, injection into tendon causes tenocyte death, and the analgesic effect of corticosteroids is short lived, and therefore the underlying tendon pathology is not treated. A number of ultrasound-guided tendon treatments can be used for tendinopathy. One treatment is percutaneous tendon fenestration or tenotomy. With this procedure, a needle is passed through the abnormal tendon segment repeatedly to break up the degenerative process, induce bleeding and inflammation, and initiate the healing of the abnormal tendon. Other procedures include the injection of autologous whole blood during the fenestration process, as well as the injection of platelet-rich plasma during fenestration. With this latter technique, the autologous whole blood is centrifuged to concentrate the platelets for injection. All three of these percutaneous tendon treatments have been shown to be effective, although it is

controversial which technique is best. The cost of each procedure should also be considered. There exists newer and more controversial percutaneous tendon treatment, such as injection of mesenchymal stem cells, human amniotic membrane, and deer antler velvet. These procedures are largely considered experimental until research studies demonstrate their safety and efficacy.

MSSR43C Interactive Case Discussion

Participants

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Philippe A. Peetrons, MD, Brussels, Belgium (Presenter) Research Consultant, Canon Medical Systems Corporation

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LEARNING OBJECTIVES

1) To learn the targeted approach to injecting joints, ligaments, tendons and tendon sheaths. 2) To appreciate pitfalls to avoid in MSK procedures for treatment of sports-related injuries. 3) To understand evidence-based data on various MSK procedures in order to give patients realistic expectations after treatment.







SSM07

Emergency Radiology (Acute Care Imaging Utilization)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: N228

ER

AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 1.00

Participants

Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose Felipe Munera, MD, Key Biscayne, FL (*Moderator*) Nothing to Disclose

Sub-Events

SSM07-01 Can AI Outperform a Junior Resident? Comparison of Deep Neural Network to First-Year Radiology Residents for Identification of Pneumothorax

Wednesday, Dec. 4 3:00PM - 3:10PM Room: N228

Awards

Trainee Research Prize - Resident

Participants

Paul H. Yi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose Tae Kyung Kim, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose Alice Yu, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose Bradford Bennett, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose John Eng, MD, Cockeysville, MD (*Abstract Co-Author*) Nothing to Disclose Cheng Ting Lin, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To develop a deep learning system for identification of pneumothorax and compare its performance to that of two 1st-year radiology residents.

METHOD AND MATERIALS

We obtained 112,120 frontal chest radiographs (CXRs) from the NIH ChestX-ray 14 database, of which 4360 cases (4%) had been labeled as pneumothorax by natural language processing. We utilized 111,494 CXRs to train and validate the ResNet-152 deep convolutional neural network (DCNN) pretrained on ImageNet to identify pneumothorax. DCNN testing was performed on a hold-out set of 602 CXRs (176 with pneumothorax and 426 without), whose groundtruth was determined by re-interpretation by a cardiothoracic radiologist with 5 years of post-fellowship experience; images were presented at 1024 x 1024 resolution and had a mix of both subtle and more obvious pneumothorax using a 6-point Likert scale to reflect levels of confidence ranging from low to intermediate to high. Receiver operating characteristic (ROC) curves were generated for the DCNN and 2 residents with area under the curve (AUC) calculated to evaluate test performance. AUCs were compared using the DeLong parametric method (significance defined as p<0.05).

RESULTS

The best-performing DCNN achieved AUC of 0.841 for identification of pneumothorax at a rate of 1980 images/minute. In contrast, both 1st-year residents achieved significantly higher AUCs of 0.942 and 0.905 (p<0.01 for both compared to DCNN; Figure 1), but at a slower rate of 2 images/minute.

CONCLUSION

Our DCNN for pneumothorax identification achieved significantly lower test AUC than two 1st-year radiology residents. However, the DCNN was able to interpret images >1000x as fast. Further work is warranted to compare the relative performance of AI to radiologists of varying levels, and the relative benefits of image interpretation speed to accuracy, particluarly for use in time-sensitive settings like the Emergency Department.

CLINICAL RELEVANCE/APPLICATION

1st-year radiology residents outperformed a deep learning system for pneumothorax detection, but the deep learning system interpreted images >1000x faster.

SSM07-02 New Diagnoses of Torso Cancer Based on CT Imaging is Low in the Emergency Department

Wednesday, Dec. 4 3:10PM - 3:20PM Room: N228

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PURPOSE

Emergency department torso (chest, abdomen and/or pelvis) CT occasionally demonstrates cancer. It is unknown what the rate of new cancer diagnosis is based on torso CT is in this setting. The purpose of this study is to determine this rate.

METHOD AND MATERIALS

All reports for ED CT studies involving the chest, abdomen or pelvis or combinations of these were selected for the 2017 calendar year. Each report impression was searched for the following keywords: mass, tumor or cancer. Each report with a keyword was manually checked whether the text was reporting a lesion, absence of a lesion (e.g. There is no mass effect), or hedge for a lesion (ie favored a non-cancer diagnosis but suggested that an underlying mass could not be excluded). Among reports describing a lesion, the electronic medical record was used to determine whether it was an old lesion, new lesion or was indeterminate based on lack of follow up or workup. Each lesion was also categorized as being related to the chief complaint or as an incidental finding.

RESULTS

During the 2017 calendar year, there were 339,593 ED visits, by 203,412 unique patients. 19,496 CT exams including a portion of the torso were performed. Of these, 1606 included one of the keyword: 621 were known cases of cancer, 490 were describing the abscess of a mass, 231 hedged the presence of cancer, 60 were of subcentimeter lung nodules, 21 were indeterminate (as there was no workup or follow up), and 180 were confirmed new diagnoses of cancer. The breakdown of cancer types is demonstrated in the figure. This yielded a CT-based new torso cancer diagnosis rate of 9 new diagnoses per 1000 torso CTs and 0.5 diagnoses per day (based on our average daily CT volume of 53 exams). Among the 180 new cases of cancer, 122 (68 %) were, 38 (21%) were not, and 20 (11%) were possibly related to the presenting symptoms.

CONCLUSION

CT-diagnosis of a new torso cancer is uncommon in the ED setting. The top three diagnose were, gastrointestinal tract (mostly colorectal cancer), lung and genitourinary (mostly renal cell carcinoma). Most CT based new torso cancers will be related to the patient's presenting symptoms.

CLINICAL RELEVANCE/APPLICATION

This data provides new insight into the diagnostic makeup of patients undergoing CT in the emergency department. This may also have implications for ED radiologist staffing.

SSM07-03 Assessing Prior Neuroimaging Utilization to Identify Recidivistic Patients with Psychosocial Maladies

Wednesday, Dec. 4 3:20PM - 3:30PM Room: N228

Participants

Daniel Braga, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose Sukhwinder J. Sandhu, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Dinesh Rao, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Peter J. Fiester, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Patrick Natter, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Marie Crandall, MD,MPH, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Erik R. Soule, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose Victoria Villescas, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The purpose of this study is to determine if a correlation exists between patients who undergo repeat computed tomography (CT) imaging of the brain on multiple separate emergency department (ED) visits with the presence of psychosocial illness such as mental health illness, substance abuse, or interpersonal violence.

METHOD AND MATERIALS

An IRB-approved retrospective chart review was performed on 27,004 patients presenting to the adult ED or trauma center at our institution from 2013 to 2017. Patients who had at least one CT of the brain as part of their diagnostic workup met inclusion criteria. The number of head CT's on separate ED visits was counted. ICD-9 and 10 codes were analyzed from admission data to identify diagnoses of mental health illness, substance abuse, and/or interpersonal violence for each patient. Statistical analysis was then performed to explore the correlation between the number of head CT's per patient and the presence of these underlying psychosocial maladies.

RESULTS

Linear logistic regression was used to determine whether the number of CT scans is associated with psychosocial illness. We found that with each additional CT, the odds of psychosocial diagnosis increases by 1.93 (p < 0.0001). The magnitude of the associations was described using odds ratio (OR), along with its 95% confidence intervals (CI). The level of significance was set at 5%. All analyses were done in SAS® for Windows Version 9.4.

CONCLUSION

Each additional unenhanced CT of the head performed on patients during separate distinct ED visits increases the likelihood of psychosocial illness with an odds ratio of 1.93. The presence of multiple head CT's in a patient's medical record may suggest the presence of mental health illness, substance abuse, or interpersonal violence.

CLINICAL RELEVANCE/APPLICATION

Assessment of prior neuroimaging in recidivistic patients with psychosocial illness could aid in diagnostic identification, prevent over-utilization of health care resources, and guide early interventions directed at this elusive patient population.

SSM07-04 Chest CT's During Immune Checkpoint Inhibitor Therapy in the Emergency Department: A Single Institute 9-Year Experience in 139 Patients

Wednesday, Dec. 4 3:30PM - 3:40PM Room: N228

Participants

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PURPOSE

To assess chest CT findings of oncology patients on immune checkpoint inhibitor (ICI) therapy who present to the emergency department (ED) with acute chest symptoms.

METHOD AND MATERIALS

A retrospective review was performed of 139 adult oncology patients on ICIs who presented to the ED and received chest CT imaging. These patients included adults >=18 years old at a single institution from 2010-2018 who received treatment with >=1 ICI. Chest CT findings were reviewed to evaluate tumor burden and assess immune-related adverse events (irAEs).

RESULTS

The 139 patients included 55% males and 45% females with a mean age of 65. The most common cancer types included lung (63%), melanoma (11%), and bladder/kidney (9%). 163 chest CTs were acquired at unique ED visits, with a median time of 50 days between first dose of ICI and ED visit. Common imaging indications included dyspnea (64%), chest pain (28%), cough (14%), and hypoxia (10%). 85% of chest CTs were ordered as pulmonary embolism (PE) protocols, with new PE detected in 7% of cases. Worsening tumor burden was identified in 60% of ED chest CTs at a median of 37 days after ICI initiation. 21 (13%) of chest CTs demonstrated immunotherapy-induced pneumonitis with a median duration of 60 days between initiation of ICI and ED presentation. These cases of ICI-associated pneumonitis included 6 reflecting radiation recall pneumonitis, with the remainder reflecting patterns of HSP (4), AIP/ARDS (4), bronchiolitis (3), COP (2), and NSIP (2). All but two (90%) of the 21 patients presenting with ICI-associated pneumonitis received high-dose steroids. 79% of ED encounters resulted in hospital admission after chest imaging. 63% of patients demonstrated clinical or radiographic improvement during their ED/hospital visits, whereas 37% experienced no significant clinical improvement, were discharged to hospice, or died during their admission.

CONCLUSION

60% of oncology patients on ICI therapy who present to the ED demonstrate worsening tumor burden on chest CT, with a median time of 37 days from ICI initiation to disease progression on ED chest CT. Immunotherapy-induced pneumonitis is the second most common chest CT finding in the ED setting, occurring in 13% of patients.

CLINICAL RELEVANCE/APPLICATION

This study provides insight into the radiographic findings on chest CT associated with acute presentations to the ED among oncology patients on immune checkpoint inhibitor therapy.

SSM07-05 Evaluation of the Effectivity and Therapeutic Impact of CT in ICU Patients with Unknown Focus of Infection

Wednesday, Dec. 4 3:40PM - 3:50PM Room: N228

Participants

Daniel Kuetting, MD, Bonn, Germany (*Presenter*) Nothing to Disclose Julian A. Luetkens, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose Anton Faron, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose Daniel K. Thomas, MD, PhD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose Ron Martin, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the impact of computerized tomography (CT) on diagnosis and change of therapy in ICU patients with fever, systemic inflammatory response syndrome (SIRS) or sepsis with unknown focus of infection

METHOD AND MATERIALS

Non-ECG-gated chest/abdominal CT examinations of ICU patients (internal medicine, surgery, heart surgery, neurology/ neurosurgery) were prospectively analyzed for inflammatory foci. Both confirmation of and changes in the diagnosis or therapy based on CT findings were analyzed. Prior CT, X-Ray, MRI, bronchioalveolar lavage, urine analysis and ultrasound examinations, performed during the same ICU treatment but prior to the CT, were cross-checked to verify whether foci were actually new.

RESULTS

In 99 out of 112 (88,4 %) consecutively evaluated patients (34,8% female, mean age 64,8 years), a total of 147 possible foci (thoracic: n=92; abdominal: n=55) were detected. Of the 147 foci (58,5% defined as definite, 41,5% as questionable), prior examinations had suspected inflammatory focus in 64 cases, confirmed focus in 20 cases. CT diagnosis lead to 77 changes in therapy regimen in 58 of 99 Patients (59%): change/initiation of antibiotics: 52,7%, CT guided thoracic/abdominal puncture: 21,6%, operation: 8,1%, change in patient positioning: 8,1%; other: 9,5%.

CONCLUSION

CT examinations in ICU patients with unknown focus of infection leads to diagnosis in most cases as well as to adaption in therapy regimen and thus should be considered in patients with obscure clinical infection.

CLINICAL RELEVANCE/APPLICATION

CT is an effective diagnostic tool for the evaluation of patients with unknown focus of infection. CT should be considered a routine procedure in the workup of septic patients when other diagnostic evidence of infection is absent.

SSM07-06 CNN-Based Regression Model Learning the Abbreviated Injury Scale Predicts Respiratory Distress Syndrome in Polytraumatized Patients at Admission

Wednesday, Dec. 4 3:50PM - 4:00PM Room: N228

Participants

Johannes Hofmanninger, Vienna, Austria (*Abstract Co-Author*) Siemens AG Boehringer Ingelheim GmbH Sebastian Roehrich, MD, Vienna, Austria (*Abstract Co-Author*) Consultant, contextflow GmbH Lukas Negrin, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose Georg Langs, Vienna, Austria (*Presenter*) Co-founder, contextflow GmbH; Shareholder, contextflow GmbH Helmut Prosch, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To automate lung-related risk stratification of polytraumatized patients based on chest computed tomography (CT) by training deep-learning models to predict abbreviated injury scale (AIS) scores for the thorax.

METHOD AND MATERIALS

The dataset used contains 123 polytraumatized patients, not younger than 18 years and with an assigned Injury Severity Score (ISS) of at least 15. Patients which died within 48 hours after admission, suffered burning injuries or had known oncologic or chronic inflammatory lung diseases were excluded. All scans were conducted on the same scanner and were conducted within one hour of the accident. We automatically extracted the lungs including pleural effusions via a U-Net convolutional neural network (CNN). After stripping of image areas outside the lung, we resampled the volumes to an isotropic voxel resolution of 1mm and cropped the images to the lung masks. Subsequently, we generated maximum intensity projections (MIP) in the axial and coronal direction and resampled the images to 200x200 pixels. We trained two independent CNNs (axial & coronal) to predict the AIS scores (thorax only) associated with the patients. Finally, the predictions of the two networks were averaged to receive the final risk score

RESULTS

To test whether the resulting risk scores have predictive power for lung complications, we used the score to predict acute respiratory distress syndrome (ARDS) according to the Berlin definition. Note, that the CNN was not trained to predict ARDS. However, after 5-fold cross-validation, using 99 patients for training and 24 for prediction, the resulting risk score yielded an area under the curve (AUC) of 0.76 for ARDS prediction compared to 0.68 and 0.66 when using the AIS score or ISS, respectively.

CONCLUSION

The AIS score encodes injuries with and without involvement of the lung and does not fully encode the lung specific extent of the injuries. By providing only image information of the lung and excluding the surrounding tissue, we forced the neural networks to learn lung related severity when predicting AIS scores. By this, we were able to disentangle the lung specific component of the AIS score and to learn an organ specific risk score without explicit training data available.

CLINICAL RELEVANCE/APPLICATION

By automatically extracting the organ specific component of overall scores such as AIS, risk stratification for complications related to the organ of interest can be optimized.







SSM20

Neuroradiology (Vascular, Non-Stroke)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S502AB



AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 1.00

Participants

Alexander M. McKinney IV, MD, Minneapolis, MN (*Moderator*) CEO, VEEV, Inc Daniel M. Mandell, MD, PhD, Toronto, ON (*Moderator*) Nothing to Disclose Luca Saba, MD, Cagliari, Italy (*Moderator*) Nothing to Disclose

Sub-Events

SSM20-01 Intracranial Aneurysms In Hereditary Hemorrhagic Telangiectasia

Wednesday, Dec. 4 3:00PM - 3:10PM Room: S502AB

Participants

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PURPOSE

Hereditary hemorrhagic telangiectasia (HHT) is an autosomal dominant disease induced by mutation of genes involved in angiogenesis' regulation, around 10-20% of patients may have cerebral vascular malformations. Intracranial aneurysms (ICA) are acquired vascular lesions, with prevalence of 3-5% in general population. HHT has not been specifically linked to ICA. Our purpose is to describe the frequency of ICA in population with HHT diagnosis in a reference center.

METHOD AND MATERIALS

We performed a cross sectional study. We included patients with HHT who had performed an angiographic study: MR angiography, CT angiography or digital angiography from 2010 to 2018, with available images for interpretation. We recorded the location, the geometric characteristics and the presence of other cerebral vascular malformations. We evaluated the result of genetic test when available and it's association with ICA.

RESULTS

We included 151 patients with an angiographic studies, 96 female and 55 male. The average age was 47,7 years old (SD 18,3). We found 24 ICA in 22 (14,5%) patients. The location of aneurysms were: middle cerebral artery 7/24 (29,2%) ophthalmic artery 5/24 (26,1%), intracavernous carotid artery 3/24 (12,5%), posterior communicating artery 3/24 (12,5%), anterior communicating artery 2/24 (8,3%), 1/24 (4,2%) in basilar tip and 1/24 (4,2%) anterior cerebral artery. The mean diameter of ICA was 3,4mm (SD 1.18mm). Genetic test was available in 65 patients, we found ICA in 9 of them. No statistical association was found between the presence of ICA and genetic mutations. We found cerebral AVMs in 43 patients (28,5%), in this subgroup 12 patients also had ICA, (association between both vascular malformations p=0,004). The odds ratio of having both ICA and cerebral AVMs was 4,2 (CI 95%=1,6-11,4)

CONCLUSION

We found a frequency of ICA in HHT (14,5%). This finding may be related to arterial wall disorders induced by known genetic mutations in this disease. According to this findings, the risk of having an ICA increases approximately 3 to 5 times in patients with HHT compared to general population and its presence is associated with cerebral AVMs.

CLINICAL RELEVANCE/APPLICATION

There is an increased risk of having an intracranial aneurysm in patients diagnosed with HHT. This is important because it requires increasing suspicion in this patients for the diagnosis and treatment of the aneurysms.

SSM20-02 Readmission and Retreatment after Elective Treatment of Unruptured Cerebral Aneurysm: A Nationwide Readmission Database Analysis

Wednesday, Dec. 4 3:10PM - 3:20PM Room: S502AB

Participants Pedram Golnari, MD, Chicago, IL (*Presenter*) Nothing to Disclose Pouya Nazari, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Roxanna M. Garcia, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Hannah K. Weiss, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Sameer A. Ansari, MD,PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Ali Shaibani, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Matthew B. Potts, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Michael C. Hurley, MBBCh, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose Babak S. Jahromi, MD,PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Mortality rates following treatment of unruptured cerebral aneurysm (UA) have decreased over the past decades, which may be due to use of modern microsurgical and endovascular techniques as well as overall increased volumes of UA treatment. However, treatment of UA harbors a small but finite risk, and resulting readmission and retreatment rates have not been well described.

METHOD AND MATERIALS

Adult patients who underwent elective coiling or clipping of UA were extracted from the Nationwide Readmission Database spanning 2010 to 2015. Primary diagnosis for non-elective readmission within 30 and 90 days were identified and readmission and retreatment rates for coiling vs clipping were compared. To calculate 30 and 90-day readmission and retreatment rates, we included patients within the first 11 and 9 months of each year, respectively. Poisson regression was performed using generalized estimating equations and adjusted risk ratio (aRR)s were obtained for factors associated with 30 and 90 day readmission and retreatment. The adjusted model included terms for patient- and hospital-specific factors, comorbidity scores and disease severity.

RESULTS

Of 61,894 UA patients treated and discharged alive, 5.98% and 8.99% patients were readmitted and 0.14% and 0.33% patients were retreated within 30 and 90 days, respectively. The most common primary diagnoses for readmission within 30 and 90 days, respectively, was ischemic or hemorrhagic stroke (16.13%, 21.82%). The 30 and 90-day readmission rate for coiling vs clipping was 4.87% vs 8.68% (p<0.001) and 7.82% vs 11.87% (p<0.001), respectively (figure). The 30 and 90-day retreatment rates for coiling vs clipping were 0.18% vs 0.04% (p<0.001) and 0.37% vs 0.22% (p=0.007), respectively. Patients undergoing clipping had a higher adjusted risk of 30 and 90 day retreatment (aRR=0.33; 95%CI, 1.49-1.90; p<0.001) and aRR=1.40; 95%CI, 1.27-1.54; p<0.001) but a lower adjusted risk of 30 day retreatment (aRR=0.33; 95%CI, 0.12-0.89; p=0.029) than patients having coiling.

CONCLUSION

The most common primary diagnoses for 30 and 90 day non-elective readmission after treatment of UA is stroke. Readmission rates are higher for clipping, but retreatment rates are higher for coiling.

CLINICAL RELEVANCE/APPLICATION

Patients undergoing clipping of UA have higher readmission rates but lower retreatment rates. These data may help patients and clinicians in selection of treatment modality for UA.

SSM20-03 Management of Tiny Unruptured Intracranial Aneurysms: A Cost-Effectiveness Analysis

Wednesday, Dec. 4 3:20PM - 3:30PM Room: S502AB

Participants

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PURPOSE

To evaluate the effectiveness, costs and incremental cost of routine treatment (aneurysm coiling) versus 3 different strategies for imaging surveillance in relation to no preventive treatment or routine follow-up of tiny UIAs.

METHOD AND MATERIALS

A decision-analytic model-based cost-effectiveness analysis was constructed using inputs from the medical literature. Five different management strategies for tiny unruptured intracranial aneurysms (UIAs) were evaluated - annual magnetic resonance angiography (MRA) screening, biennial MRA screening, MRA screening every 5 years, coiling and follow-up and, no treatment or preventive follow-up. Markov decision model for lifetime rupture was constructed from a societal perspective per 10,000 patients with incidental, tiny UIAs. Outcomes were assessed both in terms of cost and quality-adjusted life years (QALYs). Incremental cost-effectiveness ratio (ICER) and net monetary benefit (NMB) for each strategy were evaluated. Probabilistic, one-way, and two-way sensitivity analyses were performed.

RESULTS

The base-case calculation shows no treatment or preventive follow-up to be the most cost-effective strategy. Among the imaging follow-ups, MRA every 5 years is the best strategy with the next highest effectiveness. The conclusion remains robust in probabilistic and one-way sensitivity analyses. No routine follow-up remains the optimal strategy when the annual growth rate and rupture risk of growing aneurysms are varied. When the annual rupture risk of non-growing UIAs is <2.1%, no follow-up is the optimal strategy. If annual rupture risk is >2.1%, coiling should be performed directly.

CONCLUSION

Given the current literature, no preventive treatment or imaging follow-up is the cost-effective strategy in patients with aneurysms <=3 mm, resulting in better health outcomes and lower healthcare spending. More aggressive imaging surveillance for aneurysm growth or preventive treatment should be reserved for patients with high risk of rupture.

CLINICAL RELEVANCE/APPLICATION

Civen our findings we need to critically evaluate the annronriateness of our current clinical practices and notentially determine

specific guidelines to reflect the most effective management strategy for patients with incidental, tiny UIAs.

SSM20-04 Multi-Modal Convolutional Neural Networks with 2D and 3D Information Can Improve It's Sensitivity and Specificity for Detecting Cerebral Aneurysms in MR Angiography

Wednesday, Dec. 4 3:30PM - 3:40PM Room: S502AB

Participants

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PURPOSE

Convolutional neural networks (CNN) with two-dimensional inputs for detecting cerebral aneurysm in magnetic resonance angiography (MRA) images have been proposed. The CNN can archive high sensitivity, although its outputs contain a large number of false positives. Various efforts for reducing false positives were implemented so far, but techniques applying three-dimensional information have not been reported. The purpose of this study was to develop multi-modal CNN taking advantage of both 2D and 3D information, and to investigate the performance improvement of aneurysms detection. As the 2D and 3D streams extract different features from inputs, we hypothesized multi-modal CNN could obtain new feature representations different from CNN with 2D input only.

METHOD AND MATERIALS

This study included 142 aneurysms (mean size, 4.1 mm \pm 1.7 [standard deviation]; range, 1.3 - 9.7 mm) in 125 patients (76 men and 49 women; mean age, 67.6 years; range, 13 - 86 years). MRA were acquired with 81 1.5-T and 44 3.0-T MRI units, respectively. Two radiologists delineated volumes of interests (VOI) of each aneurysm on MRA with consensus. Multi-modal CNN with two streams, 2D and 3D CNNs was developed. Maximum intensity projection (MIP) images around VOI were input into 2D CNN, and a box containing VOI was directly used as the input voxel of 3D CNN. 4-fold cross validation was performed to calibrate generalization ability of the model. The new model was compared with conventional CNN with only 2D input using free-response receiver operating characteristic (FROC) analysis.

RESULTS

The average sensitivities of the 2D CNN and multi-modal CNN to detect aneurysms were 92.4% and 95.2% in eight positive candidates. Although the best sensitivity of 2D CNN was 92.4% at 6.7 false positives per image (FPI), multi-modal CNN achieved the same sensitivity as above at 5.7 FPI. In particular, the number of true positives increased at the middle cerebral artery using the proposed model.

CONCLUSION

Multi-modal CNN using 3D appearance information in addition to conventional 2D shape information improved sensitivity and specificity for detecting cerebral aneurysms compared with conventional CNN with 2D input only.

CLINICAL RELEVANCE/APPLICATION

Adding an auxiliary three-dimensional information can improve sensitivity and specificity of convolutional neural networks-based system for detecting cerebral aneurysms in MR angiography.

SSM20-05 Increased Diagnostic Accuracy of Giant Cell Arteritis Using Three-Dimensional Fat-saturated Contrast-Enhanced Vessel-Wall Magnetic Resonance Imaging at 3 Tesla

Wednesday, Dec. 4 3:40PM - 3:50PM Room: S502AB

Participants

Guillaume Poillon, MD, Paris, France (*Presenter*) Nothing to Disclose Adrien Collin, Paris, France (*Abstract Co-Author*) Nothing to Disclose Cecile Pinson, MD, Rouen, France (*Abstract Co-Author*) Nothing to Disclose Ygal Benhamou, Paris, France (*Abstract Co-Author*) Nothing to Disclose Gaelle Clavel, Paris, France (*Abstract Co-Author*) Nothing to Disclose Frederique Charbonneau, Paris, France (*Abstract Co-Author*) Nothing to Disclose Catherine Vignal, Paris , France (*Abstract Co-Author*) Nothing to Disclose Thomas Sene, Paris, France (*Abstract Co-Author*) Nothing to Disclose Julien Savatovsky, MD, Saint Mande, France (*Abstract Co-Author*) Nothing to Disclose Emmanuel Gerardin, MD, Rouen Cedex, France (*Abstract Co-Author*) Nothing to Disclose Augustin Lecler, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To compare the diagnostic accuracy of 3D versus 2D Contrast-Enhanced Vessel-Wall (CE-VW) MRI in the diagnosis of GCA.

METHOD AND MATERIALS

This prospective two-center study was approved by a national research ethics board and included 79 patients (51 GCA and 28 non-GCA) from December 2014 to October 2017. Two neuroradiologists, blinded to clinical data, individually analyzed 2D and 3D CE-VW MRIs separately and in random order. Discrepancies were resolved by consensus by a third neuroradiologist. The primary judgment criterion was the presence of GCA-related inflammatory changes, determined by arterial wall thickening and mural enhancement of extracranial arteries. Secondary judgment criteria included inflammatory changes of intracranial arteries and the presence of artifacts. A McNemar's test was used to compare 2D to 3D CE-VW MRIs.

RESULTS

3D CE-VW was significantly more sensitive and specific than 2D CE-VW when showing inflammatory change of extracranial arteries: 80% versus 70% (p= 0.03) and 100% versus 85% (p= 0.04), respectively. 3D CE-VW showed higher sensitivity when detecting inflammatory changes of intracranial arteries: 20% versus 8% (p=0.01).Interobserver agreement was excellent for both 2D and 3D CE-VW MRI: K = 0.84 and 0.82 respectively. There was a negative correlation between CE-VW MR diagnostic accuracy and a longer corticosteroids-MRI delay with an optimal threshold of 3 and 5 days for 2D and 3D CE-VW respectively.

CONCLUSION

3D CE-VW MRI supported more accurate diagnoses of GCA than 2D CE-VW. MRI should be performed as soon as possible, ideally before or within the first five days after corticosteroid therapy.

CLINICAL RELEVANCE/APPLICATION

3D Contrast-enhanced Vessel-wall Magnetic Resonance Imaging is a highly precise non-invasive tool that might compete for time to complete a temporal artery biopsy when Giant Cell Arteritis is suspected.

SSM20-06 Diagnostic Accuracy of Routine Non-Contrast MRI Sequences for Dural Venous Sinus Thrombosis

Wednesday, Dec. 4 3:50PM - 4:00PM Room: S502AB

Participants

Minako Azuma, Miyazaki, Japan (*Abstract Submitter*) Nothing to Disclose Yoshiyuki Watanabe, MD, PhD, Suita, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation; Research Grant, Dai Nippon Printing Co, Ltd; Speakers Bureau, General Electric Company Yoshihito Kadota, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose Zaw Aung Khant, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose Youhei Hattori, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose Toshinori Hirai, MD, PhD, Miyazaki, Japan (*Presenter*) Research Grant, Bayer AG

PURPOSE

To determine what routine non-contrast MR imaging (MRI) sequence or combination of MRI sequences is most useful for the diagnosis of dural venous sinus thrombosis (DVST).

METHOD AND MATERIALS

This multicenter study included 81 DVST patients (39 men, 42 women; age range 20-91 years; mean age 50 years) who underwent routine non-contrast 1.5- or 3T MRI within 14 days of digital subtraction angiography (DSA), contrast-enhanced MR venography, and/or CT venography. The controls were 243 age- and sex-matched individuals without DVST. They also underwent routine 1.5- or 3T MRI before- or within one month after DSA. The DVSTs were located in the transverse-, sigmoid-, and/or superior sagittal sinus. Three independent, blinded observers separately evaluated T1-, T2-, diffusion-, T2*-, and susceptibility-weighed images (T1WI, T2WI, DWI, T2*WI, and SWI) and FLAIR images for the presence or absence of DVST. The area under the receiver operating characteristics curve (AUC) was calculated for each MRI sequence. Fleiss κ statistics were applied to assess interobserver agreement. Univariate and multivariate analyses were performed to evaluate the predictive value of the sequences.

RESULTS

The overall accuracy for the diagnosis of DVST was 0.592 for T1WI, 0.914 for T2WI, 0.874 for FLAIR, 0.871 for DWI, 0.792 for T2*WI, and 0.673 for SWI. T2WI and DWI were most predictive of DVST [odds ratio (OR): 41.0; 95% confidence interval (CI) 7.8 - 216.3 and OR 75.1; 95% CI 15.6 - 361.6, respectively]. The combined use of T2WI and DWI yielded significantly better diagnostic performance than each sequence alone (p<0.05); the AUC was 0.802 (95% CI, 0.749 - 0.856). Interobserver agreement was good for T1WI (κ =0.681), T2WI (κ = 0.795), FLAIR (κ =0.719), and T2*WI (κ =0.745). It was moderate for DWI (κ = 0.600) and fair for SWI (κ = 0.351).

CONCLUSION

Among the examined routine non-contrast brain MRI sequences, the combined use of T2WI and DWI was the most predictive of DVST.

CLINICAL RELEVANCE/APPLICATION

Routine non-contrast brain MRI sequences, especially T2WI and DWI, were useful for evaluating DVST.





MSSR44

RSNA/ESR Sports Imaging Symposium: Postoperative Imaging of Sports Injuries (Interactive Session)

Wednesday, Dec. 4 3:30PM - 5:00PM Room: E350



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Andrew J. Grainger, MD, Leeds, United Kingdom (*Moderator*) Consultant, Levicept Ltd; Director, The LivingCare Group; Laura W. Bancroft, MD, Venice, FL (*Moderator*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To review MRI findings of ACL reconstruction and cartilage repair. 2) To review the expected and abnormal MR imaging findings after labral repair, capsular shift/capsulorrhaphy and Laterjet/Bristow procedures. 3) To consolidate the knowledge gained from the session with interactive cases of postoperative sports imaging.

Sub-Events

MSSR44A Postoperative Shoulder MRI after Instability Surgery

Participants

Laura W. Bancroft, MD, Venice, FL (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES

1) To become familiar with the expected and abnormal MR imaging findings after labral repair. 2) To learn about the postoperative imaging features after capsular shift/capsulorrhaphy. 3) To appreciate normal imaging and complications after remplissage and Laterjet/Bristow procedures.

ABSTRACT

Purpose: To become familiar with the expected and abnormal MR imaging findings after labral repair, capsular shift/capsulorrhaphy, remplissage and Latarjet/Bristow procedures. Methods and Materials: MR imaging will be used to demonstrate the various normal and abnormal imaging appearances after shoulder instability surgery. Results/Conclusion: Labral re-tear will be evident as contrast or joint fluid extension into linear or complex tear cleft, absent/truncated/fragmented labrum, or labral displacement from anatomic location. Capsular shift results in smaller capacity joint and sometimes irregular capsular nodularity. Complications of capsulorrhaphy include capsular tears and subluxation of humeral head. Postoperative MR imaging can evaluate healing after combined remplissage and Bankart repair for moderate size, engaging Hill-Sachs lesions. Laterjet and Bristow procedures may be performed in patients with recurrent dislocations and glenoid deficiency. Incorporated bone will yield non-anatomic glenoid configuration, and complications include non-union, fatty degeneration of subscapularis muscle, and osteoarthrosis.

MSSR44B ACL Reconstruction and Cartilage Repair

Participants

Claudia Weidekamm, MD, Auckland, New Zealand (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES

1) To review the common and uncommon ACL reconstruction techniques. 2) To appreciate the expected and abnormal MR imaging findings after ACL reconstruction. 3) To understand common cartilage repair techniques, and corresponding normal and abnormal postoperative MRIs.

ABSTRACT

The aim of ACL reconstruction is to stabilize the knee and prevent chondral and meniscal injuries, which are sequelae of anteroposterior translation and are associated with early osteoarthritis. The idea of the double-bundle ACL graft was to restore normal joint kinematics by anatomic reconstruction of the anteromedial and the posterolateral bundle of the original ACL. This was expected to improve clinical outcomes and restore anterior and rotational knee stability. The single-bundle technique, however, causes less osseous defects and is still a popular technique. Complications, such as ACL graft failure, impingement, cyclops lesion, arthrofibrosis, and patellar inferior syndrome, are discussed. The second part of this presentation will illustrate cartilage repair techniques and imaging findings. The radiologist must be familiar with the different cartilage repair procedures and characteristics in cartilage imaging to evaluate long-term progression or failure. Abnormal postoperative findings include hypertrophic filling, incomplete integration of the transplant into the surrounding cartilage, or subchondral defects, osteophytes, cysts, and persistent

bone marrow edema and joint effusion.

MSSR44C Interactive Case Discussion

Participants Laura W. Bancroft, MD, Venice, FL (*Presenter*) Nothing to Disclose Claudia Weidekamm, MD, Auckland, New Zealand (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To review the expected and abnormal MR imaging findings after labral repair, capsular shift/capsulorrhaphy and Laterjet/Bristow procedures in a case-based format. 2) To become familiar with the diagnosis features of failed ACL reconstructions, intact and failed cartilage repair. 3) To consolidate the knowledge gained from the session with interactive cases of postoperative sports imaging.





SPSC41

Controversy Session: Contrast Agent Controversies

Wednesday, Dec. 4 4:30PM - 6:00PM Room: N228



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose Andrew B. Rosenkrantz, MD, New York, NY (*Moderator*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To discuss the pros and cons based on the current literature and clinical experience of the use of oral contrast for abdominal and pelvic CT in the emergency setting. 2) To review the current role of gadoxetate for hepatobiliary MR imaging, including the advantages and disadvantages, current protocols, and its role compared with the use of extracellular gadolinium-based MR contrast agents. 3) To review the current role of intravenous ultrasound contrast agents for abdominal and pelvic imaging, including a brief review of the current literature, clinical experience, barriers to its use, and geographic variability of its use.

Sub-Events

SPSC41A Pro and Con: Use of Oral Contrast for Emergency Abdominal and Pelvic CT

Participants

Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Stockholder, SHINE Medical Technologies, Inc; Stockholder, Elucent Medical; Advisor, Bracco Group;

Ania Z. Kielar, MD, Shanty Bay, ON (Presenter) Nothing to Disclose

SPSC41B Cheerleader versus Realist: Use of Gadoxetate for Liver MRI

Participants

Bachir Taouli, MD, New York, NY (*Presenter*) Research Grant, Bayer AG; Research Grant, Takeda Pharmaceutical Company Limited; Research Grant, Regeneron Pharmaceuticals, Inc; Consultant, Alexion Pharmaceuticals, Inc; Consultant, Bayer AG; ; Victoria Chernyak, MD,MS, Bronx, NY (*Presenter*) Consultant, Bayer AG

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LEARNING OBJECTIVES

1) To understand the effect of gadoxetate use on the quality of the hepatic arterial phase. 2) To review limitations of the hepatobiliary phase in patients with and without parenchymal liver disease. 3) To review challenges that gadoxetate use presents in diagnosis of hemangioma. 4) To review challenges of gadoxetate use in diagnosis of HCC and application of LI-RADS.

SPSC41C Use of IV Contrast for Abdominal US: Barriers/Issues and Current Literature Summary/Experience

Participants

Sheila Sheth, MD, Baltimore, MD (Presenter) Nothing to Disclose

Aya Kamaya, MD, Stanford, CA (Presenter) Royalties, Reed Elsevier; Researcher, Koninklijke Philips NV; Researcher, Siemens AG




ED004-TH

Emergency Radiology Thursday Case of the Day

Thursday, Dec. 5 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants

Gayatr^I Joshi, MD, Charleston, SC (*Presenter*) Nothing to Disclose Jennifer W. Uyeda, MD, Boston, MA (*Abstract Co-Author*) Consultant, Allena Pharmaceuticals, Inc Margarita V. Revzin, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Paige E. Sharp, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Robin B. Levenson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Judith A. Gadde, DO, Newark, DE (*Abstract Co-Author*) Nothing to Disclose Heishun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Aaron D. Sodickson, MD,PhD, Boston, MA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, General Electric Company Nikhar Kinger, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose Suzanne Czerniak, MD, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose Karen S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Araro S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Suzanne S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Karen S. Lee, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Andrew Wong, MD,PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) Recognize key imaging findings on multimodality imaging of emergency/trauma patients. 2) Identify pathologic conditions based on the clinical information and imaging findings provided. 3) Understand relevant pathophysiology and recommend appropriate next step in management when appropriate.







RC608

Emergency Radiology Series: Contemporary Topics in Imaging of Trauma

Thursday, Dec. 5 8:30AM - 12:00PM Room: S401CD



AMA PRA Category 1 Credits ™: 3.25 ARRT Category A+ Credits: 4.00

Participants

Ferco H. Berger, MD, Toronto, ON (*Moderator*) Speaker, Siemens AG Michael N. Patlas, MD, FRCPC, Hamilton, ON (*Moderator*) Speaker, Springer Nature Felipe Munera, MD, Key Biscayne, FL (*Moderator*) Nothing to Disclose

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Sub-Events

RC608-01 Whole Body CT of Trauma

Thursday, Dec. 5 8:30AM - 9:00AM Room: S401CD

Participants Ferco H. Berger, MD, Toronto, ON (*Presenter*) Speaker, Siemens AG

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LEARNING OBJECTIVES

1) To be familiar with currently worldwide accepted protocols in polytrauma CT imaging. 2) To know clinical conditions requiring whole-body CT. 3) To comprehend the selection of trauma patients for targeted CT examinations.

ABSTRACT

In the western world, polytrauma is the major cause of mortality in people under 45 years of age. Furthermore, it is a major contributor to loss of quality of life and ability to work. The setting of polytrauma is almost always chaotic, not a favourable environment to come to timely diagnosis and treatment. To decrease morbidity and mortality, time is everything. It is our job as radiologist to contribute to the trauma team and help facilitate timely diagnosis - and in many cases, also timely treatment by interventional radiology. To reach the best treatment strategy for the patient as quickly and accurately as safely possible, is the goal. In this update on imaging of polytrauma patients, the focus is on the role of CT to achieve this goal. With the progress in CT scanner development, different protocol options arise. Which CT protocols are being used and what factors do they depend upon? In addition, there is a widespread increase in use of whole body CT internationally, is this a good thing or should we be more selective? What is the current evidence to select patients for targeted CT examinations in polytrauma? A lot of these questions have not been definitively resolved. This lecture aims to provide an update of the current insights into the use of CT for trauma care, with the goal to choose wisely on how to investigate the polytrauma patient in a timely and meaningful fashion.

Active Handout: Ferco H. Berger

http://abstract.rsna.org/uploads/2019/19000911/Active RC608-01.pdf

RC608-02 Whole-Body Trauma Completion CT for Transfer Patients: Impact on Injury Detection

Thursday, Dec. 5 9:00AM - 9:10AM Room: S401CD

Participants

Jeffrey Y. Shyu, MD, Boston, MA (*Presenter*) Nothing to Disclose Reza Askari, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Roger Lacson, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Aaron D. Sodickson, MD,PhD, Boston, MA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, General Electric Company Ali Salim, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Bharti Khurana, MD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Indications for whole-body trauma CT are unclear. This study evaluates patients transferred to a level 1 trauma center, who had

selective CT at the originating hospital and completion whole-body CT at the accepting hospital, to determine if additional CT imaging detects clinically significant injury.

METHOD AND MATERIALS

This was a single center study at a level 1 trauma center with a dedicated Emergency Radiology division. 243 consecutive trauma patients transferred from outside hospitals were included from 9/6/2015 to 12/20/2015. A review of the patient's acute traumatic injuries was obtained from chart reviews, radiology reports, and abbreviated injury scale (AIS). Whole-body CT was defined as CTs of the head, cervical spine, chest, abdomen, and pelvis. A patient is considered to have had 'completion' CT imaging if she or he obtained some of the whole-body CT components at the outside institution, and the rest at the accepting institution. Injuries that were detectable with radiographs (such as extremity fractures) were excluded.

RESULTS

35 received whole-body CT at the outside institution, and 45 received completion CT at the accepting institution. Of those who received completion CT, 13 (29%) had additional injuries on completion CTs that were not detected on CTs or radiographs from the outside institution. An additional 9 patients had indeterminate injuries in the radiology report that were not given a corresponding AIS. The additional injuries with AIS scores were subdural hemorrhage (1 patient), rib fractures (5), clavicle fracture (1), and thoracic (4) and lumbar (5) spine fractures. One patient who died in the trauma completion group had a lumbar spine fracture found on completion imaging, not considered to be the primary cause of death. Average ISS of transfer patients who received whole-body CTs at the outside institution was 13.9, compared to 10.6 for the completion group. A statistically significant difference between ISS was found between the transfer whole-body group and completion CT group (p = 0.044).

CONCLUSION

Completion whole-body CT for trauma transfer patients detects additional injuries in 29% of patients. Rib and spinal fractures are the most commonly detected injuries. Further work is needed to determine if this increase in diagnostic yield translated into patient management changes.

CLINICAL RELEVANCE/APPLICATION

This study clarifies the role of whole-body completion CT for patients with major trauma.

RC608-03 Unsupervised Detection of Multiple Traumatic Lesions in Severe Trauma Patients on Whole-Body CT Using Anomaly Detection with Generative Adversarial Networks (GANs)

Thursday, Dec. 5 9:10AM - 9:20AM Room: S401CD

Participants

Yura Ahn, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose Gil-Sun Hong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose Hyun-Jin Bae, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Co-founder, Promedius Inc; CEO, Promedius Inc Jihye Yun, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose Sungwon Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose Young Ji Song, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose Won-Jung Chung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Supervised learning has limitation in that it requires a large amount of annotated data. The purpose of this study is to determine if anomaly detection with generative adversarial networks (AnoGANs) are useful for detecting multiple various traumatic lesions on whole-body CT (WBCT) in an unsupervised manner.

METHOD AND MATERIALS

We trained a Progressive Growing of GAN (PGGAN) to generate realistic artificial CT images, using the training set of 11,775 normal chest and/or abdominopelvic CT scans (172,249 chest slices and 301,584 abdominopelvic slices). Test set consisted of total 200 axial slices of WBCT images (100 abnormal and 100 normal images) in trauma patients. Using our simplified AnoGAN model, PGGAN-trained generator yields a corresponding realistic fake image to a given test image by minimizing mean square error between the fake and the test images. The differences between the fake and the test image on attention maps can detect and localize abnormal findings. For evaluation of the detection performance, we defined 7 clinically significant traumatic lesions (hemothorax, hemomediastinum, pneumothorax, pneumomediastinum, hemoperitoneum, hemoretroperitoneum and pneumoperitoneum). If the attention map partially included the traumatic lesions, it was considered a positive detection.

RESULTS

Total sensitivity per slice was 95.0% (95/100) and total sensitivity per lesions was 94.4% (135/143). For each traumatic lesion, sensitivity was 100% for hemothorax, 95.2% for hemomediastinum, 95.5% for pneumothorax, 93.3% for hemoperitoneum, 84.6% for hemoretroperitoneum, and 100% for pneumoperitoneum. Evaluation of other parameters of performance was limited due to difficult quantification and calculation of non-pathologic false positives.

CONCLUSION

We suggest that unsupervised learning of GANs using healthy dataset can be used to detect multiple traumatic lesions on unseen data and has high sensitivity to detect anomalies.

CLINICAL RELEVANCE/APPLICATION

We propose that this model can be useful to develop deep learning algorithm to screen emergency or traumatic patients with multiple various lesions.

RC608-04 Incidence of Blunt Cerebrovascular Injuries and Anoxic Brain Injury in the Setting of Self-Inflicted Hanging

Thursday, Dec. 5 9:20AM - 9:30AM Room: S401CD

Participants

Jean Mutambuze, BS, Indianapolis, IN (*Presenter*) Nothing to Disclose Stephen F. Kralik, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose Scott D. Steenburg, MD, Zionsville, IN (*Abstract Co-Author*) Institutional research collaboration, IBM Corporation

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PURPOSE

Near hanging injuries are included as a high risk mechanism for the development of blunt cerebrovascular injuries (BCVI), despite there being a paucity of evidence-based data in support of this practice. As a result, this group of patients has been coalesced under the BCVI group which includes a myriad of different mechanisms of injury. The purpose of this study was to determine the incidence of BCVI in a large series of self-inflicted hanging patients who received neck CTA, and to guide appropriate diagnostic imaging in this specific group.

METHOD AND MATERIALS

A 10-year retrospective review of self-inflicted hanging patients who received neck CTA at two urban Level 1 trauma centers was performed. The medical record was used to confirm self-inflicted hanging mechanism of injury, as well as key demographic data, airway status, physical exam findings, neurological status and deficits, drug screen results, and mortality. Neck CTA were evaluated for neck arterial injuries, cervical spine fractures and signs of ligamentous injury. CT Head and/or MRI brain exams performed during hospitalization were evaluated for infarction and ischemic brain injury. A Fisher's exact test was used to compare variables associated with patients with positive versus negative neck CTA exams with p < 0.05 considered statistically significant.

RESULTS

A total of 151 patients (mean age 31.6 years) of which 113 were male (74.8%) were included for analysis. Five patients (3.3%) were diagnosed with BCVI. A total of 74% had abnormal neck examination, 64% had abnormal drug screen, 63% had GCS <15, 33% were intubated, 30% had abnormal neurologic examination, 15.2% had anoxic brain injury resulting in death, and 0% had cervical spine fracture or ligamentous injury. Neurological deficit (p=0.027), and mortality (p=0.03) were significantly higher in CTA positive patients, while abnormal neck examination (p=1.0), positive drug screen (p=1.0) and intubation (p=0.33) were not significantly different.

CONCLUSION

The incidence of BCVI among patients with self-inflicted hanging was 3.3%. A total of 15% of patients died due to anoxic brain injury.

CLINICAL RELEVANCE/APPLICATION

The incidence of BCVI in the setting of self-inflicted hanging is similar to that seen in other high risk mechanisms of injury. Thus including hanging injuries as a high risk mechanism for screening neck CTA remains prudent. Death due to anoxic brain injury poses a greater risk than that of BCVI.

RC608-05 Follow-up CT Imaging Post Liver Trauma: When is the Best Time to Image?

Thursday, Dec. 5 9:30AM - 9:40AM Room: S401CD

Participants

Aurelio Cosentino, MD, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose Dylan Lewis, MBBCh, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Bhavna Batohi, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Lisa M. Meacock, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose Adeel E. Syed, FRCR, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

PURPOSE

The purpose of the study is to determine the value of liver injury CT grade in predicting the potential for subacute/late complications, and to determine the ideal timing of follow-up (FU) CT imaging to detect complications.

METHOD AND MATERIALS

From August 2017 to July 2018, 58 major trauma patients (Pts) were diagnosed with liver injury. In this retrospective observational study, the admission CT and relevant clinical data were available for 53 Pts (43 male, 10 female; mean age 37.2 years ± 18.2). Hepatic injuries detected on the admission CT were graded by two trauma radiologists using the AAST grading system. Mechanism of injury, liver-related subacute/late complications, and timing of follow-up CT imaging were reviewed.

RESULTS

The mechanisms of injury were as follows: vehicle incident/collision (n=25), fall >2 m (n=16), fall <2 m (n=1), penetrating trauma (n=10), rugby injury (n=1). There were 6 grade I liver injuries, 14 grade II, 14 grade III, 15 grade IV, and 4 grade V. Two Patients died within 30 days from presentation. Liver-related complications were observed in 10 patients (see Table) and included bilomas, biliary stricture and vascular complications. A statistically significant correlation between penetrating trauma and the occurrence of complications was observed (p<0.014). No correlation was observed between the injury grade and the trauma mechanism or the occurrence of complications. In 50% of cases, the complication was identified at FU CT within 7 days from the trauma (mean 6 days, range 5-7), in 50% of cases it was identified at further FU CT (mean 14 days, range 9-55).

CONCLUSION

Independent of the CT injury grade, a higher incidence of liver related complications occured with penetrating than a blunt

mechanism of trauma. An initial follow-up CT between 5 and 7 days after the trauma is adequate to reveal early liver-related complications, but a subsequent FU CT within 15 days is recommended to detect complications in those patients with high grade liver injury.

CLINICAL RELEVANCE/APPLICATION

A follow-up CT 5-7 days after traumatic liver injury is adequate to reveal early complications, a FU CT within 15 days is recommended in patients with high-grade injury and in penetrating liver trauma

RC608-06 Diaphragmatic Trauma

Thursday, Dec. 5 9:40AM - 10:10AM Room: S401CD

Participants

Michael N. Patlas, MD, FRCPC, Hamilton, ON (Presenter) Speaker, Springer Nature

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LEARNING OBJECTIVES

1) To review the radiological and surgical literature of the potential pitfalls in diagnosis of diaphragmatic injuries. 2) To describe direct and indirect signs of blunt and penetrating diaphragmatic injury. 3) To highlight factors affection detection of diaphragmatic injuries.

RC608-07 Bowel and Mesenteric Trauma

Thursday, Dec. 5 10:20AM - 10:50AM Room: S401CD

Participants

Michael E. O'Keeffe, MBBCh, Vancouver, BC (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES

1) Review imaging pearls and pitfalls in the assessment of mesenteric injury in trauma patients. 2) Focus on the anatomy of the small and large bowel mesentery, patterns of mesenteric injury, and their appearance on MDCT. 3) Review specific CT appearance of isolated mesenteric injury and polytrauma cases.

ABSTRACT

The small and large bowel mesentery are all too frequently underestimated as potential sites of significant injury in the trauma patient. In fact many would now argue that the mesentery itself has enough individual anatomical components and physiological roles to be considered a separate organ within the human body. As such we need to review the mesentery as a unique anatomical entity. It demonstrates a recognizable pattern of injury on CT imaging. These "fingerprints of trauma" can be searched or in every case and provide a valuable guide to potentially serious bowel and vascular injury.

RC608-08 Role of CT in Predicting Therapeutic Operative Intervention in Cases of Suspected Bowel and Mesenteric Injuries Due to Blunt Abdominal Trauma

Thursday, Dec. 5 10:50AM - 11:00AM Room: S401CD

Participants

Muhammad O. Afzal, MD, MBBS, Memphis, TN (*Presenter*) Nothing to Disclose Lou J. Magnotti, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose Sridhar S. Shankar, MD, MBA, Memphis, TN (*Abstract Co-Author*) Equipment support, Clarius Mobile Health Corp Dina Filiberto, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT plays an important role in the workup of stable patients after blunt trauma. Suspected bowel or mesenteric injuries (BBMI) often present with subtle and inconsistent imaging findings. Various radiographic signs have been used to predict the presence of these injuries. However, the optimal predictor for BBMI remains controversial. It is our contention that one of the best predictors is the overall impression of the reviewing radiologist. Thus, the purpose of this study was to identify radiographic predictors of therapeutic operative intervention in patients after blunt abdominal trauma.

METHOD AND MATERIALS

Patients with a discharge diagnosis of a mesenteric injury after blunt trauma were identified over a 5-year period. Admission CT scans were reviewed for potential predictors of BBMI, including mesenteric hematoma, acute arterial extravasation, bowel wall hematoma, bowel devascularization, fecalization of small bowel, free air, fat pad injury. In addition, the overall impression of the scan by the reviewing radiologist was recorded. Patients were then stratified by therapeutic laparotomy and compared. Multivariable logistic regression (MLR) was then used to identify predictors of therapeutic laparotomy.

RESULTS

Over the study, 114 patients underwent operative intervention: 75 patients (66%) underwent therapeutic laparotomy. After adjusting for the above predictors including the overall impression of the radiologist, MLR identified the impression of the radiologist (OR 3.14; 95%CI 1.19-8.27, p=0.021), fat pad injury (OR 3.5; 95%CI 1.24-9.99, p=0.018) and bowel devascularization (OR 8.2; 95%CI 0.962-9.91, p=0.054) as independent predictors of therapeutic laparotomy. Interestingly, the overall impression of the radiologist had a positive predictive value of 82.1%.

CONCLUSION

CT remains vital in the evaluation of patients suspected of having bowel and mesenteric injuries after blunt trauma. An experienced radiologist remains invaluable in assessing often subtle signs of BBMI. A simplified scoring system utilizing these predictors could potentially aid the radiologist and surgeons in identifying those patients that would benefit from early operative intervention.

CLINICAL RELEVANCE/APPLICATION

CT helps identify stable patients suspected of mesenteric/bowel injuries who would benefit from early operative intervention.

RC608-09 Damage Control Surgery CT: An Analysis in Diagnosing Abdominopelvic Surgically Significant Injuries

Thursday, Dec. 5 11:00AM - 11:10AM Room: S401CD

Participants

Zohaib Ahmad, MD, Boston, MA (*Presenter*) Nothing to Disclose Arthur Baghdanian, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Royalties, Reed Elsevier Stephan W. Anderson, MD, Cambridge, MA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Armonde Baghdanian, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the incidence in diagnosis and misses of surgically relevant abdominopelvic injuries on computed tomography (CT) imaging in the Damage Control (DC) patient.

METHOD AND MATERIALS

This retrospective study was IRB approved and HIPAA compliant. Informed consent was waived. Patients aged 18 and older who sustained blunt or penetrating trauma requiring DC surgery without a prior CT at Boston Medical Center 2/21/2005 - 9/26/2018 were included. 59 patients met inclusion criteria (52 male, 4 female, mean age of 29). A CT was obtained 24 hours after the initial surgery. Each study was assessed by a single blinded fellowship trained radiologist. Outcomes were evaluated through failed surgical repair warranting surgical intervention, a clinically significant injury discovered on CT in a surgically explored area, a clinically significant injury discovered on CT in a surgical variables were evaluated by percentages.

RESULTS

In a cohort of 57 patients, a total of 7 (12.5%) patients had a failed surgical repair discovered on initial CT (12.3%); of those 7 patients, 3 (42.8%) had failed repair of the liver. 6 (10.7%) patients had a clinically significant injury discovered on CT in a surgically explored area; of those 6 patients, 2 (33.3%) had injury of the kidney. 6 (10.7%) patients had a clinically significant injury discovered on CT in a surgically unexplored area. 9 (16.1%) patients who had a clinically significant injury that was missed on the initial CT; of those 9 patients, 3 (33.3%) had a missed injury to the large bowel.

CONCLUSION

As a staged surgical process in a critically traumatic injured patient, Damage Control (DC) surgery is a burgeoning life-saving method to address both traumatic and metabolic derangements in a timely manner. Further knowledge of common surgically and radiographically missed injuries is important to provide accurate diagnoses in these patients especially in the retroperitoneum and gastrointestinal system.

CLINICAL RELEVANCE/APPLICATION

Accurate interpretation of computed tomography (CT) imaging during this process is vital to assessing for any surgically missed injury or assessment of repair in the critically ill DC patient.

RC608-10 Diagnostic Performance of Triple-Contrast versus Single-Contrast Multi-Detector Computed Tomography for the Evaluation of Penetrating Bowel Injury

Thursday, Dec. 5 11:10AM - 11:20AM Room: S401CD

Participants

Fabio M. Paes, MD, Miami, FL (*Presenter*) Nothing to Disclose Anthony M. Durso, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose Kim M. Caban, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose Brian Covello, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose Daniel Suarez, MD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose Douglas S. Katz, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose Felipe Munera, MD, Key Biscayne, FL (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Selecting low risk penetrating trauma patients to forego laparotomy can be challenging. Bowel injury may prevent nonoperative management. Our goal is to compare the diagnostic performance of triple-contrast (oral, rectal, and IV) against IV contrast only CT in detecting bowel injury from penetrating abdominopelvic trauma, using surgical diagnosis during exploratory laparotomy as standard.

METHOD AND MATERIALS

997 patients who underwent CT for penetrating trauma between 2009-2016 were enrolled in this IRB-approved retrospective cohort study. A total of 143 patients, including 15 females (ages 16-41), and 123 males (ages 14-83) underwent preoperative CT followed by exploratory laparotomy. Of these, 56 patients received triple-contrast CT. CT examinations were reviewed by 2 attending radiologists, blinded to surgical outcome and clinical presentation. Direct and indirect signs of bowel injury were documented. Results were stratified by contrast type and mechanism of injury and subsequently compared based upon diagnostic performance indicators of sensitivity, specificity, NPV, and PPV. AUCs were analyzed for determination of diagnostic accuracy.

RESULTS

Bowel injury was present in 45 out of 143 patients. Specificity and accuracy were higher with triple-contrast CT (98% specific [0.95, 1.00]), 97-99% accurate) compared to IV contrast only CT (66% specific [0.56, 0.75], 78-79% accurate). Sensitivity was highest with IV contrast only CT (91% sensitive [0.85, 0.98]) compared with triple-contrast CT (75% sensitive [0.56, 0.94]), although not statistically significant. Triple contrast CT increased diagnostic accuracy for both reviewers regardless of mechanism of injury. For reader 1, diagnostic accuracy with triple contrast CT versus IV contrast only CT was (99% [0.98, 1.00]) vs. 80% [0.62, 0.97]) for stab wounds and (100% vs. 76%[0.61, 0.91]) for gunshot wounds. For reader 2, diagnostic accuracy with triple-contrast CT versus IV contrast only CT was (95% [0.85, 1.00] vs. 79% [0.66, 0.92]) for gunshot wounds.

CONCLUSION

In our retrospective study, triple-contrast CT had greater accuracy, specificity, and NPV when compared to IV contrast only CT in evaluating for bowel injury from penetrating wounds.

CLINICAL RELEVANCE/APPLICATION

Triple-contrast CT has greater accuracy, specificity, and NPV when compared to IV contrast only CT in evaluating for bowel injury from penetrating trauma.

RC608-11 Multi-Institutional Observational Study of Detection, Treatment and Outcomes of Splenic Vascular Injuries Discovered at CT

Thursday, Dec. 5 11:20AM - 11:30AM Room: S401CD

Participants James T. Lee, MD, Lexington, KY (*Presenter*) Nothing to Disclose Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Emily Slade, PhD, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose Armonde Baghdanian, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose Nagaramesh Chinapuvvula, MBBS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose Richard Tsai, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose Ken F. Linnau, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose Ken F. Linnau, MD, Seattle, WA (*Abstract Co-Author*) Royalties, Cambridge University Press Research Grant, Siemens AG Scott D. Steenburg, MD, Zionsville, IN (*Abstract Co-Author*) Institutional research collaboration, IBM Corporation Suzanne T. Chong, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose Arthur Baghdanian, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Demetrios A. Raptis, MD, Frontenac, MO (*Abstract Co-Author*) Nothing to Disclose Kathirkamanathan Shanmuganathan, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Report trends for treating splenic injuries from 8 US trauma centers over 7 years Evaluate the frequency of reported splenic vascular injuries Evaluate factors influencing surgeon's decision to invasively treat (surgery or embolization) or conservatively manage

METHOD AND MATERIALS

IRB approved, retrospective review of splenic injuries recorded from Level 1 trauma registries over 7 years from 8 institutions. Inclusion: Adults (>=18) with blunt splenic trauma, CT within 12 hours of admission Exclusion: penetrating trauma to the abdomen/pelvis, splenectomy prior to CT, left AMA, CT <16 detector, and death before splenic treatment. Descriptive statistics as well as regression analysis was performed, adjusting for multiple covariates.

RESULTS

918 subject were identified, 776 met inclusion criteria. 268 female. Original CT reports indictated active splenic hemorrhage (ASH) in 25%. 36% received invasive treatment (14% IR, 22% OR) and 64% were managed conservatively. A steady increase in IR management of splenic injuries and respective decrease in operative and conservative management over the study period. Multinomial logistic regression was performed for multiple outcomes including odds of recieving embolization or operative treatment and length of stay. Not surprisingly, AIS spleen, AIS Head/Neck and ISS scores showed significant increase in odds for invasive treatment. Presence of ASH on CT report was extremely predictive of invasive treatment when compared to conservative observation: Odds ratios for embolization: 22.063 and for operative 9.374 (while controlling for gender, age, synchronous major organ injury, vital signs, hemoglobin, INR, Platelets and if blood products received at admission). Regarding length of stay, on average, for every one unit increase in ISS, the length of stay increases by 1.031 days. Interestingly, on average, ASH demonstrated a 0.933 days longer than those without ASH; however this was not statistically significant (p=0.961).

CONCLUSION

We observed changing trends in treatment of splenic vascular injuries over the study period, as well as institutional differences in utilization of embolization versus operative management. Radiologic description of active splenic extravasation was highly predictive of embolization

CLINICAL RELEVANCE/APPLICATION

Radioloaist detection of active hemorrhade or contained vascular iniurv is highly predictive of invasive treatment of blunt splenic

injury

J

RC608-12 Pancreatic Trauma

Thursday, Dec. 5 11:30AM - 12:00PM Room: S401CD

Participants Jorge A. Soto, MD, Boston, MA (*Presenter*) Royalties, Reed Elsevier

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LEARNING OBJECTIVES

1) Review key direct and indirect CT findings of blunt pancreatic trauma. 2) Highlight potential pitfalls in diagnosis of pancreatic trauma. 3) Understand proper utilization of MR in patients with suspected pancreatic injuries.







ERS-THA

Emergency Radiology Thursday Poster Discussions

Thursday, Dec. 5 12:15PM - 12:45PM Room: ER Community, Learning Center

ER

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants

Michael N. Patlas, MD, FRCPC, Hamilton, ON (Moderator) Speaker, Springer Nature

Sub-Events

ER221-SD- The Accuracy and Feasibility of Automatic Classification and Localization of Rib Fractures from Thorax THA1 CT Using Convolutional Neural Networks

Station #1

Participants Qing-Qing Zhou, MS, Nanjing, China (*Presenter*) Nothing to Disclose Yu-Sheng Yu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose Jiashuo Wang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose Qian Gao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose Rongguo Zhang, Beijing, China (*Abstract Co-Author*) Employee, Infervision Inc Zi-Yi Xia, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose Zhang-Chun Hu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose Xue-Song Li, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose Hong Zhang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Rib fractures are the most frequently observed injury in thoracic blunt trauma. However, it is time-consuming to detect rib fractures and the subtle buckled fracture was often missed. This study aims to analyze the accuracy and feasibility of automatic classification and localization of rib fractures on CT images using convolutional neural networks (CNNs), and test the robustness by three hospitals.

METHOD AND MATERIALS

Institutional review board approval was obtained with waiver of informed consent for this retrospective study. A total of 1087 rib CT images, 7,696 annotations, from our hospitals were divided into training (n = 978) and validation (n = 109) sets. CNN model was applied in current work. Images were labeled by 4 certified radiologists and one orthopedics specialist according to patient's clinical trauma history, radiologic characteristic and callus formation or fracture healing is in follow-up period. Four classifications (fresh complete fracture, fresh incomplete fracture, old fracture, and fracture healing period) combined with precise fracture location were detected automatically. We analyze the accuracy of different classification models and compared the detection time, diagnostic accuracy, omission diagnostic rate (ODR) with different seniorities of radiologists, and multi-task loss evolution and the AUC was calculated as an index for statistical analysis. Four hundred of images from two other different hospitals were used to verify the robustness of the model.

RESULTS

The time of diagnosis made by doctors was 6.7 minutes on average, compared with an average of 2.3 seconds in AI software. The accuracy of CNN model was greater compared with that of primary radiologist (AUC, 92.4% and 88.3%, P < 0.05) and had a similar accuracy with attending radiologist and above (AUC, 92.4% and 93.8%, P > 0.05). ODR of CNN model was less than all radiologists (mean ODR, 0.83% and 5.7%, P = 0.0024). Similar diagnostic performance was obtained from two other hospitals.

CONCLUSION

The classification and location of ribs fracture can be detected by CNNs with high accuracy and can reduce miss rate. The results would help emergency patients to obtain accurate CT findings quickly and reduce the eye strain and workload of radiologists.

CLINICAL RELEVANCE/APPLICATION

(dealing with ribs fractures) CNN can detect the classification and location of ribs fracture automatically with high accuracy and short time and is recommended in clinical rib diagnosis.

ER222-SD- Segmental Bowel Wall Hypoenhancement on CT Predicts Devascularizing Mesenteric Injury After HA2 Blunt Trauma

Station #2

Participants Alexis R. Boscak, MD, Baltimore, MD (*Presenter*) Nothing to Disclose Uttam Bodanapally, MD, Owings Mills, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Travel support, Siemens AG Kathirkamanathan Shanmuganathan, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

PURPOSE

To demonstrate the utility of segmental bowel hypoenhancement on contrast-enhanced CT as a predictor of devasularizing mesenteric injury after blunt trauma to the abdomen.

METHOD AND MATERIALS

Informed consent was waived by the institutional review board for this HIPAA-compliant study. Retrospective record review identified 122 adult patients (age range 18 - 80 years; 80 male [65%] and 42 female [34%]) who had undergone contrastenhanced CT of the abdomen and pelvis after blunt trauma, including 30 with surgically proven mesenteric injury resulting in devascularization of bowel. Two radiologists each performed blinded review of all 122 cases, evaluating bowel wall enhancement as well as other signs of injury including body wall disruption, mesenteric hematoma, active bleeding, hemoperitoneum, extraluminal gas, bowel wall edema and bowel wall discontinuity. Discordant interpretations underwent subsequent consensus review. Data analysis included calculation of diagnostic performance measures with confidence intervals, areas under the receiver operating characteristic curves, and interobserver agreement/variability.

RESULTS

In 30 cases of surgically proven mesenteric injury resulting in devascularization of bowel after blunt trauma, contrast enhanced CT demonstrated anatomically concordant segmental bowel hypoenhancement in 80.0% (24 of 30) patients, with 20.0% (6 of 30) false negative. This finding was 98.9% specific and 94.3% accurate, with a positive predictive value of 96.0% and a negative predictive value of 93.8%. False positive bowel hypoenhancement was identified in only 2.4% (1 of 92) casesconsidered negative for devascularizing bowel injury based on surgical exploration and/or clinical course.

CONCLUSION

Segmental hypoenhancement of bowel on contrast-ehanced CT is an accurate signifier of devascularizing mesenteric injury after blunt trauma, with moderate sensitivity and high specificity.

CLINICAL RELEVANCE/APPLICATION

Segmental bowel hypoenhancement predicts the presence of devasularizing mesenteric injury requiring emergent surgical intervention after blunt trauma, and should be carefully evaluated for on contrast-enhanced CT examinations performed in this clinical setting.

ER232-SD- Virtual Monochromatic Reconstructions of Dual-Energy CT in Abdominal Trauma: Optimization of THA4 Energy Level Improves Pancreas Laceration Conspicuity and Diagnostic Confidence

Station #4 Participants

Gavin M. Sugrue, MBBCh, Vancouver, BC (*Presenter*) Nothing to Disclose John P. Walsh, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Bonnie Niu, BSC, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Yilin Zhang, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Francesco Macri, MD, PhD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Elina Khasanova, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Omar Metwally, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Nicolas Murray, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Pancreatic injury is associated with significant morbidity and mortality. Pancreatic lacerations can be challenging to identify as the pancreas is not scanned at peak enhancement in most trauma CT protocols. This study qualitatively and quantitively assessed pancreatic lacerations with virtual monoenergetic dual-energy CT (DE CT) to establish an optimal energy level for visualization of pancreatic lacerations.

METHOD AND MATERIALS

Institutional review board approval was obtained. We retrospectively examined 17 contrast-enhanced CT studies in patients presenting with blunt trauma with MRCP, ERCP or intraoperatively proven pancreatic lacerations. All studies were performed in our Emergency Department from 2014-2019 with a 128 slice dual-source DE CT scanner. Evaluation was performed using the portal venous phase acquired simultaneously at low (80 or 100 kVp) and high (140 kVp with tin filtration) energy levels. Images were reconstructed at VMI energy levels from 40 to 100 keV in 10 keV increments and analysed quantitatively and qualitatively. Pancreatic laceration attenuation, background parenchymal attenuation and noise were measured for all VMI datasets and compared to conventional mixed polychromatic images (PCI) at 120 kVp. Subjective analysis was performed by two independent readers. Qualitative parameters included diagnostic acceptability, subjective noise, contrast resolution, diagnostic confidence and laceration conspicuity. Differences between the CNR of the VMI monoenergetic series and mixed images were assessed using a one-way ANOVA. Qualitative parameters were compared using a Paired T Test.

RESULTS

The optimal CNR for the assessment of pancreatic lacerations was observed at 40 keV (p=0.0002). Diagnostic acceptability and subjective noise were improved on conventional PCI (p=0.0006 and p=0.001 respectively), however both readers reported improved contrast resolution, diagnostic confidence and laceration conspicuity at VMI at 40 keV (p=0.0156, p=0.0002 and p=0.0012 respectively).

CONCLUSION

Contrast-enhanced dual source dual energy CT with VMI reconstruction at 40 keV maximizes the CNR of a pancreatic laceration

with increased contrast resolution, diagnostic confidence and laceration conspicuity.

CLINICAL RELEVANCE/APPLICATION

Virtual monoenergetic imaging at lower keVs improves diagnostic confidence and conspicuity of pancreatic lacerations and may allow for more accurate grading of pancreatic injuries.

ER173-ED- Imaging Evaluation of Abdominopelvic Gunshot Trauma: What the Radiologist Needs to Know THA5

Station #5

Identified for RadioGraphics

Participants

Awards

Faezeh Sodagari, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Margarita V. Revzin, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Mariam Moshiri, MD, Bellevue, WA (*Abstract Co-Author*) Nothing to Disclose
John S. Pellerito, MD, Manhasset, NY (*Abstract Co-Author*) Research Grant, General Electric Company
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TEACHING POINTS

1. To review major types of the commonly used firearms in the urban setting 2. Most commonly used imaging modalities and protocols in the evaluation of gunshot wounds and their immediate complications 3. To discuss the range of imaging appearances in main abdominopelvic gunshot injuries, and the role of the radiologists in clinical management

TABLE OF CONTENTS/OUTLINE

1. Types of firearms: small arms (revolver and pistol); long guns (rifles, shotguns, machine, and submachine guns) 2. Radiological imaging and protocols: a. Ultrasound FAST b. CECT/CTA and modifications to the protocols and technique (artifact reduction techniques) c. Emergent and urgent fluoroscopic examinations 3. Direct abdominopelvic injury: a. visceral organs (renal, hepatic, adrenal, pancreatic, and splenic lacerations) b. hollow organs (bowel, urinary bladder, ureters, and gallbladder penetrating trauma) c. musculoskeletal systems (spinal/pelvic and muscle/ligamentous injuries) d. vascular systems (arteriovenous and lymphatic injury) 1. Indirect imaging findings and predictors related to bullet trajectory injury 2. Flow chart outlining emergent Management, and role of the radiologist





ERS-THB

Emergency Radiology Thursday Poster Discussions

Thursday, Dec. 5 12:45PM - 1:15PM Room: ER Community, Learning Center

ER

AMA PRA Category 1 Credit ™: .50

Participants

Felipe Munera, MD, Key Biscayne, FL (Moderator) Nothing to Disclose

Sub-Events

ER224-SD- Adrenal Hematomas and Associated Injuries in the Chest, Abdomen and Pelvis: A Level 1 Trauma THB1 Center Experience

Station #1

Participants Alaa A. Al-Taie, MBChB, Doha, Qatar (*Presenter*) Nothing to Disclose Ahmed Awad, MBBS, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose Dalal M. Sibira, MBBS, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose Elmoaiad M. Elsafi, MD, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose Shatha Al Hilli, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose Zeyad Jaleel, MD, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

- Identify the commonly associated thoracic, abdominal, pelvic and osseous injuries. - Investigate the side/sides of commonly injured adrenal, (right, left or bilateral) and identify which of the aforementioned has the most common associated injury. - Investigate the side of the adrenal hematoma and its relation to the ipsilateral and contralateral organ injury.

METHOD AND MATERIALS

Non-randomized retrospective study. Inclusion criteria: Patients (18-60 years) from both genders who had CT scan of the chest, abdomen, and pelvis in a trauma settings and found to have adrenal injury. Exclusion criteria: Patients with known adrenal lesions or incidental adrenal hematomas without history of trauma were excluded from the study. Concomitant injuries are evaluated and graded: Solid organs injury to the kidneys, liver, pancreas and spleen are graded according to AAST (American association for surgery of the trauma) grading and severity score. Hemoperitoneum is evaluated. Hemothorax, pneumothorax and lung parenchymal injuries are evaluated. Pelvic fractures are graded based on Tile hip fracture classification. Rib, scapula, spine and other included bones in the CT scan images are investigated. With regards to better characterization of the adrenal lesions in order to r/o incidentiloma, we used the CT density measurements (Hounsfield units) to exclude patients with fat containing adrenal lesions i.e incidental adenomas.

RESULTS

37 cases of adrenal hematomas were detected: Injuries were unilateral in 35 patients (31 cases involved the right-gland, 4 in the left-gland, and 2 with bilateral involvement). The hematomas had a mean maximum diameter of 2.7 cm and a mean attenuation of 66 HU.

CONCLUSION

The right adrenal gland is more commonly affected than the left. Adrenal gland hematoma on either side is noted to be associated with ipsilateral and/or contralateral organ injury. The bigger the hematoma the more concomitant injuries are present. Adrenal gland injury is noted to be associated with various severity of other organ involvement.

CLINICAL RELEVANCE/APPLICATION

Familiarity of the radiologist with the different patterns of adrenal gland and concomitant injuries are paramount for patient evaluation in trauma setting.

ER225-SD- Cervical Spine Fracture Prevalence Using Machine Learning THB2

Station #2 Participants Ryan King, MD,MS, Boston, MA (*Presenter*) Nothing to Disclose Jayashri P. Pawar, DMRD,MBBS, Natick, MA (*Abstract Co-Author*) Nothing to Disclose

Bradley Wright, Boston, MA (*Abstract Co-Author*) Nothing to Disclose Bharti Khurana, MD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose Mitchel B. Harris, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Using machine learning for the evaluation of vertebral fracture prevalence in non-contrast CT scans of the cervical spine and

classification of fracture by vertebral level.

METHOD AND MATERIALS

This is an IRB approved research project. Retrospective analysis of radiology reports for non-contrast CT scans of the cervical spine at a level 1 trauma center was performed over a period of ten years (2008-2018). By querying exam codes, 36,559 non-contrast CT scans of the cervical spine were identified as having been performed on 30,049 unique patients during this ten-year interval. Rather than manually reviewing each report, machine learning was applied to facilitate the identification of fractures. Using a combination of bootstrapping and natural language processing, the cohort was stratified by likelihood of containing pathology. Specifically, a classifier was iteratively trained to predict the presence of vertebral fracture in the radiology report. The most likely pathologic studies were reviewed in batches (batch size: 100) to confirm the presence or absence of fracture, and the classifier was retrained with the results to improve the predictive power of the model.

RESULTS

The trained classifier ultimately yielded 1,980 studies positive for cervical spine fracture. The median age of presentation is 67 years (min 4, max 110). Of the 1,980 cases, 1,140 patients (57.57%) are male and 840 (42.42%) are female. As per the radiology report, there are 3,060 individually fractured cervical vertebrae. The study-level percentage of fractures by vertebral level was found to be: 22.2% C1, 44.9% C2, 8.03% C3, 11.2% C4, 15.4% C5, 22.4% C6, and 30.4% C7.

CONCLUSION

This fracture-positive cohort represents an average annual incidence rate of 5.41% (5.05% min - 6.47% max). The demographics are 4:3 male: female with a median age of 67. There are 3,060 individually fractured vertebrae, yielding a range of 1 to 7 fractures (median 1) per study. 60.5% of the studies have a single cervical fracture. The distribution of fracture is bimodal with 55.2% occurring in the upper cervical vertebrae (C1 and C2) and 44.8% subaxial. The most common concurrent fractures are C1 and C2, representing 11.9% of the cohort. Concurrent C6, C7 fractures are the most common (11.3%) subaxial injury.

CLINICAL RELEVANCE/APPLICATION

Analysis will be extended to include an in-depth examination of mechanism of injury and anatomical description of fracture location on the vertebrae.

ER226-SD- Small Bowel Obstruction (SBO) Predictors of Urgent Surgical Treatment and Bowel Resection

Station #3

Participants

Carlos Vilches Catalan, Madrid, Spain (*Presenter*) Nothing to Disclose Milagros Marti de Gracia, MD,PhD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Aurea Diez Tascon, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Alberto Jimenez, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose Irene Miguelsanz, MD, Tres Cantos, Spain (*Abstract Co-Author*) Nothing to Disclose Manuel Varo Alonso, MD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine which computed tomography (CT) findings can predict the need for urgent surgical treatment and bowel resection in patients with small bowel obstruction (SBO).

METHOD AND MATERIALS

Retrospective observational analysis of patients requesting attention in hospital emergencies due to SBO. Period 2015-2017. All patients are examined with CT after intravenous contrast administration. Two groups are established: (G1) conservative therapeutic management and (G2) urgent surgical treatment that is subsequently divided into two subgroups according to the need for bowel resection. Secondary variables: demographic, clinical (surgical history) radiological (reduced bowel wall enhancement, parietal thickening, local mesenteric haziness, mesenteric fluid, feces sign, free peritoneal gas, pneumatosis or venous gas, closed - loop mechanism, whirl sign and the cause of obstruction). The IBM SPSS Statistics was used to obtain results and statistical analysis (univariate and multivariate).

RESULTS

Initially, 98 patients were selected in the study, of which 15 were excluded (8 due to the dismissal of treatment due to low life expectancy, and 7 to undergo deferred surgery due to poor evolution after conservative treatment). Reduced bowel wall enhancement, parietal thickening, mesenteric fluid, closed loop mechanism and adhesive SBO were significantly associated with the need for urgent surgical treatment in the univariate analysis. In the logistic regression only reduced bowel wall enhancement and closed loop mechanism allow us to predict the need for urgent surgery.

CONCLUSION

All CT findings studied except mesenteric fluid allow us to predict the need for urgent surgery but do not have good sensitivity to determine the need for bowel resection.

CLINICAL RELEVANCE/APPLICATION

There are several radiological findings that predict the need for urgent surgery and bowel resection in the context of SBO

ER233-SD- The Utility of Iodine Based Dual-Energy CT (DECT) in Triaging Patients with Blunt Bowel Injury

Station #4

Participants Cristian Salgado, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose Krystal Archer-Arroyo, MD, Decatur, GA (*Presenter*) Nothing to Disclose Uttam Bodanapally, MD, Owings Mills, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Travel support, Siemens AG Thorsten R. Fleiter, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose Matthew P. Dattwyler, MD, Chevy Chase, MD (*Abstract Co-Author*) Nothing to Disclose Kathirkamanathan Shanmuganathan, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess the performance of DECT in triaging patients with blunt bowel injury

METHOD AND MATERIALS

IRB approved HIPPA compliant retrospective single institutional study was performed over a twelve month period. Using postprocessed DECT data, iodine concentrations were measured, both during arterial and portal venous phase in each segment of small and large bowel. Primary outcome measures were surgical findings and clinical follow-up. Association between iodine concentrations was examined using t-test or Wilcoxon Rank-sum test

RESULTS

Study group consisted of 54 patients (mean age 44 years, males 32) with potential bowel injury. 64 patients aged matched (males 50, abdominal AIS =0) formed the control group for normal values of iodine concentration in each bowel segment. In the study group 25 patients underwent laparotomy, 16 patients were managed non-operatively had bowel wall thickening considered injury on CT, and 13 patients with isolated free intraperitoneal fluid. 10 patients had surgically proven bowel injury at least at one site. Iodine concentration at the injury site in this group was lower on arterial phase when the injury involved the jejunum (median [Q1, Q3]:1.1[0.5, 1.9] vs 2.45 [1.9, 3.05]; p=0.01) and ileum (median [Q1, Q3]:1[1.4, 1.97]; p=0.01). In the 16 patients with bowel wall thickenig there was no significant difference in iodine concentration, except in 3 patients with ascending colon injury the iodine concentrations were low: arterial phase (Mean SD: 0.43[0.5] vs 1.24[0.46]p=0.04); portal venous (Median [Q1, Q3]:0.2 [0.1,0.9] vs 0.9 [0.62, 1.2]p=0.04). No difference in iodine concentration in all bowel segments were observed in the 13 patient with isolated free fluid and control group.

CONCLUSION

Iodine concentraions measured at injury site on DECT is a potential biomarker for surgical small bowel injury.

CLINICAL RELEVANCE/APPLICATION

Iodine meaurements made at injury site on processed DECT data is a potential biomarker to triage patients with small bowel injury for surgery.

ER174-ED- Vascular Injuries by Gunshot Wound: Pearls and Pitfalls THB5

Station #5

Participants

Gretchen A. Otero-Soto, MD, Carolina, PR (*Presenter*) Nothing to Disclose Erick G. Rodriguez Cruz, BS,MD, Caguas, PR (*Abstract Co-Author*) Nothing to Disclose Laura Bimbela-Nieves, PhD, San Juan, PR (*Abstract Co-Author*) Nothing to Disclose Amanda P. Marrero-Gonzalez, MD, San Juan, PR (*Abstract Co-Author*) Nothing to Disclose Edrick G. Lugo-Millan, MD, San Juan, PR (*Abstract Co-Author*) Nothing to Disclose Luis E. Garcia-Irizarry, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Review CT imaging characteristics of the typical sequelae of vascular injury and its distinguishing characteristics. 2. Describe possible pitfalls and ways to overcome them to avoid missing critical findings. 3. Provide correlation with interesting cases from our institution.

TABLE OF CONTENTS/OUTLINE

Vascular injuries are frequently encountered in the emergency setting and the pattern depends greatly on the causative agent. While many times they can occur as a result of blunt trauma or iatrogenic in nature, the incidence of vascular injuries secondary to penetrating or blast injury by gunshot wounds has increased. Radiologists must be familiar with these potentially life-threatening injuries in order to provide an adequate diagnosis. Also, optimal imaging acquisition is essential when diagnosing injury to the blood vessels due to its dependence on adequate technical factors. Through this pictorial review, we aim to discuss the common different patterns of vascular injury, critical findings, pitfalls in vascular imaging, and what to look for when reviewing these images in the emergency setting.A) ObjectivesB) IntroductionC) Pathophysiology of Gunshot WoundsD) Common Radiologic FindingsE) Sample Cases of CT angiography and DSAF) Pitfalls in Imaging Acquisition

ER245-SD- The Role of Dual Source DECT to Detect Post-traumatic Bone Marrow Lesions in Emergency: A THB6 Preliminary Study

. . Station #6

Participants Igino Simonetti, MD, Naples, Italy (*Presenter*) Nothing to Disclose Francesco Di Pietto, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose Stefania Romano, MD, Pozzuoli, Italy (*Abstract Co-Author*) Nothing to Disclose Giovanni Rusconi, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose Vito Chianca, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose Marta Puglia, Pozzuoli, Italy (*Abstract Co-Author*) Nothing to Disclose Mariano Scaglione, MD, Castel Volturno, Italy (*Abstract Co-Author*) Nothing to Disclose Alfonso Ragozzino, Pozzuoli, Italy (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the performance in Emergency of dual-energy computed tomography (DECT) with dedicated protocol in detecting posttraumatic bone marrow lesions (BMLs) in patients with acute musculoskeletal trauma with doubtful x-ray examination and positive clinical examination, in comparison with magnetic resonance (MR) images.

METHOD AND MATERIALS

We retrospectively considered the imaging findings of 15 adult patients (range age: 19 - 67 years; 13 males, 2 female) admitted in the Emergency Department of our Institutions for an acute musculoskeletal trauma. All patients were submitted to conventional radiograph with doubtful x-rays findings for bone injury but positive orthopedic clinical examination, with indication to the CT scanning. The traumas of all joints were included in the study, including vertebral traumas. CT examinations have been performed using dual source dual energy scanners (CT SOMATOM Definition Flash and SOMATOM Drive, Siemens) with specific DE protocols. Post processing were made on a dedicated workstation (SyngoVia), using multiplanar and 3D reformats as well as color-coded evaluation of the bone marrow edema. In all patients magnetic resonance images (MR) were acquired in an interval of 5 days following the traumatic event. Blind comparison between DECT and MRI images were performed by two independent readers expert in muscolo-skeletal imaging.

RESULTS

In all patients, our study shown that there was a correspondence between the bone marrow edema shown on the DECT examination and the MRI findings. In particular, it seems that DECT was more accurate in the study of the knee, followed by scaphoid, ankle, femur and shoulder.

CONCLUSION

Our study suggested that DECT could have a high sensitivity and specificity to investigate post-traumatic bone marrow lesions (BMLs) in patients in emergency departments with acute musculoskeletal trauma. Although further studies in prospective with a large number of patients should be required, DECT could be useful in the future in Emergency patients with a doubtful X-ray examination and positive orthopedic clinical examination, for a more effective and immediate diagnosis of traumatic bone lesions.

CLINICAL RELEVANCE/APPLICATION

1. Use of the DECT in Emergency 2. Support in detecting bone marrow lesions in Emergency when xrays findings are inconclusive





SPSH54

Hot Topic Session: Imaging of Traumatic Brain Injury-Present and Future

Thursday, Dec. 5 3:00PM - 4:00PM Room: E451A



AMA PRA Category 1 Credit ™: 1.00 ARRT Category A+ Credit: 1.00

Participants

Donna J. Cross, PhD, Salt Lake City, UT (Moderator) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe new and universal approaches for the visual examination of acute brain injury. 2) Examine novel approaches for the assessment of traumatic brain injury. 3) Describe methods under development to assess traumatic brain injury-related neurodegenerative disorders.

ABSTRACT

This session will highlight molecular imaging of traumatic brain injuries from current clinical work up of acute injury to tracer development for the assessment of chronic brain injury such as Chronic Traumatic Encephalopathy. Topics will include new PET tracers, MRI methodologies and quantitative analyses currently used in research.

Sub-Events

SPSH54A Imaging of Acute TBI

Participants

Yoshimi Anzai, MD, Salt Lake City, UT (Presenter) Nothing to Disclose

For information about this presentation, contact:

yoshimi.anzai@hsc.utah.edu

SPSH54B PET Tracers to Assess TBI and CTE

Participants

Gerard N. Bischof, PhD, Cologne, Germany (Presenter) Nothing to Disclose

SPSH54C Advanced MRI Techniques for TBI Research

Participants

Pratik Mukherjee, MD, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company; Medical Adivisory Board, General Electric Company; Patent Pending USPTO No. 62/269,778





RC708

Emergency Imaging of 'At Risk' Populations

Thursday, Dec. 5 4:30PM - 6:00PM Room: N227B



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Koenraad H. Nieboer, MD, Jette, Belgium (Moderator) Speakers Bureau, General Electric Company

Sub-Events

RC708A Imaging of Nonaccidental Trauma in Children

Participants Steven L. Blumer, MD, MBA, Wilmington, DE (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sblumermd@gmail.com

LEARNING OBJECTIVES

1) To review the incidence of Nonaccidental Trauma in the pediatric population. 2) To review the suggested imaging workup of children with suspected Nonaccidental Trauma. 3) To review the major imaging findings of Nonaccidental Trauma on imaging studies.

RC708B Making the Invisible Visible: Bringing Intimate Partner Violence in Focus

Participants

Bharti Khurana, MD, Brookline, MA (Presenter) Nothing to Disclose

For information about this presentation, contact:

bkhurana@bwh.harvard.edu

LEARNING OBJECTIVES

1) Review the high prevalence of Intimate Partner Violence (IPV) and the barriers linked to underreporting. 2) Understand the key role that radiologist can play in the identification of IPV victims and contribute to multi-dimensional clinical support tool. 3) Recognize the common injury patterns and imaging utilization in IPV victims. 4) Become aware of AI integration in developing multidimensional clinical support tool for IPV detection.

RC708C Imaging of Geriatric Trauma

Participants

Koenraad H. Nieboer, MD, Jette, Belgium (Presenter) Speakers Bureau, General Electric Company

For information about this presentation, contact:

koenraad.nieboer@uzbrussel.be

LEARNING OBJECTIVES

1) Decide whether it is advisable to administer contrast media in elderly patients with an unknown renal function during a polytrauma CT scan. 2) Recognizing typical trauma mechanisms in the elderly. 3) Have knowledge of advanced CT techniques for optimal imaging for trauma in the elderly.







RC804

Avulsion Injuries of the Upper and Lower Extremities

Friday, Dec. 6 8:30AM - 10:00AM Room: E451B



AMA PRA Category 1 Credits ™: 1.50 ARRT Category A+ Credit: 1.75

Participants

Zehava S. Rosenberg, MD, Hoboken, NJ (Director) Nothing to Disclose

Sub-Events

RC804A Upper Extremity

Participants Lee F. Rogers, MD, Tucson, AZ (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lfrogers@comcast.net

LEARNING OBJECTIVES

1) Obtain appropriate radiographs, AP, lateral and obliques; oblique views are essential as certain fractures may be visible only on this projection. 2) Certain fractures and dislocations are notorious for being overlooked; know these injuries and be certain to identify or exclude them. 3) Certain ligamentous avulsion of the digits are associated with characteristic deformities allowing a definitive diagnosis of the underlying abnormality. 4) Be aware of the potential for satisfaction of search and the potential of diagnostic oversights in certain injuries; once such an injury is noted look closely for the commonly associated injury. 5) When the clinical diagnosis is not apparent or uncertain on the initial radiographs, do not hesitate to obtain CT or MRI to confirm or exclude an injury.

RC804B Avulsion Injuries of the Pelvis and Hip

Participants

Omer A. Awan, MD, Baltimore, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Outline the spectrum of avulsive injuries in the pelvis and hip. 2) Delineate imaging characteristics of pelvic and hip avulsive injuries, with emphasis on radiography and MRI. 3) Elucidate practical and clinical applications to pelvic and hip avulsive injuries.

ABSTRACT

n/a

RC804C Knee

Participants Thomas L. Pope, MD, Denver, CO (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

thomaspopemd@gmail.com

LEARNING OBJECTIVES

1) Delineate the most common avulsion injuries in the knee. 2) Outline the most common imaging features of avulsion injuries in the knee. 3) Describe the complimentary role of radiography, CT and MR imaging in the diagnosis of avulsion injuries of the knee. 4) Provide some hints on keys to avoid missing these lesions in your clinical practice.

RC804D Foot and Ankle

Participants

Zehava S. Rosenberg, MD, Hoboken, NJ (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Familiarize the radiologist with radiographic findings of common avulsion injuries of the ankle and foot with emphasis on frequently missed entities. 2) Provide cross sectional imaging correlation for all the described entities. 3) Provide the radiologist with tools for distinguishing radiographic evidence of pathology from mimickers of disease.