Outline

1. Definitions
2. Diagnoses
3. Modalities with Normals
4. Cases!
5. Resources
6. Sim Lab Cases! Think Pair Share

References:
1. UNC Health Care Administrative Manual Critical Tests and Values/Findings
   http://guides.lib.unc.edu/Radclerks
Critical Tests are those tests that will always require rapid communication of the results, even if normal.

2 Critical Tests
- Radiology CT Scan for s/s of stroke in ED or inpatient unit
- Radiology CXR s/s of stroke in ED or inpatient unit

Turnaround time on Critical Tests at UNCH < 45 min
A critical value/result is defined as any value/result or interpretation where a delay in reporting may result in a serious adverse outcome for the patient.

All critical values/results will be reported to the appropriate LIP or responsible licensed caregiver within one hour of the generating area determining the final value/result.
Critical Results Diagnoses Radiology

- Aortic Dissection, Acute
- Ectopic Pregnancy
- Pulmonary Embolism, Acute
- Aneurysm Rupture
- Acute or unexpected Bowel perforation
- Cervical fracture with significant displacement
- Acute Epiglottitis
- Tension Pneumothorax
- Brain or Cord tumor with significant Mass effect
- Intracranial Hemorrhage
- Ovarian or Testicular Torsion
- Life Threatening misplaced tube or line

These diagnoses must be communicated directly to the patient’s licensed independent practitioner or licensed caregiver. ie CALL THE DOC!
Modalities: AAS

Acute abdominal series (AAS) - 3 views
   AP supine abdomen
   AP upright abdomen
   PA upright chest

Common indications:
   Bowel perforation/free air
   Obstruction

Effective radiation dose: 0.1-1 mSv
Modalities: Normal AAS

- AP supine abdomen
- AP upright abdomen
- PA chest

Common indications:
- Bowel perforation/free air
- Obstruction
Ionizing radiation (x-rays)

Basically CT is an x-ray tube that rotates around the patient with detectors on opposite side

Multidetector
  8, 16, 64, 128, 320 rows of detectors
  Faster scans than single row
  more detectors helpful for breath hold, non cooperative, cardiac imaging

Pros: Fast and High detail
Cons: Radiation, Contrast reactions, and Expensive
Modalities: Normal CT

Colon
descending
Small Bowel
hepatic flexure
IVC
Aorta
Liver
inferior tip
Splenic vein
R Kidney
L Kidney
Colo
Modalities: Normal CT

- Falx
- Lat Vent
- Frontal Horn
- Occipital Horn
- Uncus
- Tentorium
Uses sound waves (rather than ionizing radiation)

Indications:
RUQ pain: gallstones/cholecystitis/bile duct stones
Appendicitis in kids/pregnancy
Kidney stones
Pelvis US for torsion/adnexal pain
Modalities: Ultrasound

- Bladder
- Seminal vesicles
Outline

1. Definitions
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4. Cases ! Illustrative cases are organized by organ system
5. Resources
6. Sim Lab Cases ! Think Pair Share
Ptx air in the pleural space may occur as result of: **Trauma** penetrating, blunt, or barotrauma; **iatrogenic** biopsy, surgery, line placement, thoracentesis, mechanical ventil, bronchoscopy

**Tension pneumothorax** mass effect from ball valve mechanism may yield displaced mediastinum with poor venous return to the heart -> cardiovascular collapse and death

Case 1: Tension Pneumothorax

mediastinal shift to left
Case 2: Life Threatening Malposition

IABP balloon too high -> risk for cerebral ischemia (occlusion of left common carotid or left vertebral art) and left arm ischemia (occl of left subclavian art)
Case 3: Bowel Perforation

Massive pneumoperitoneum implies bowel perf unless recent surgery

Pneumoperitoneum

Free air within the peritoneal cavity

Abdominal pain, peritonitis symptoms

Plain radiographs often utilized -> lucency beneath the diaphragm. To improve sensitivity, assure the central ray of the x-ray beam is at highest level of the peritoneal cavity. On supine films: Rigler’s, falciform, football, inverted V signs. CT more sensitive!
Case 4: Displaced Cervical Fracture

On sagittal and axial cervical spine CT, grade II-III anterolisthesis of C6 on C7, posterior elements fractures (C6), bilateral jumped and locked facets with fractures = Traumatic C6-7 spondylolisthesis with bilateral locked facets

Bilateral Locked Facets as example of Unstable Cervical Fracture

Anterior dislocation of vertebral body

Jumping of inferior articular process over the superior articular process of vertebral body below – locked in this position

Can be uni- or bilateral

Extreme flexion type injury of head/neck

High risk of cord damage

UNSTABLE
Case 5: Acute Epiglottitis

Acute Epiglottitis

Now uncommon in pediatric population due to childhood H. influenzae immunization, may be seen in non-immunized children and also adult population.

Lateral film -> inflamed thickened epiglottis. Clinical and radiographic findings classic and CT not typically needed

Lateral neck soft tissue radiograph with thumb = thumbprint sign of inflamed epiglottis
Case 6: Acute Pulmonary Embolism

CTPA (CT Pulmonary Angiography) have high sensitivity and specificity for dx of PE. Acute Dx: a. Arterial occlusion by thrombus with lack of enhancement of lumen, +/- vessel enlrg, b. Partial filling of vessel surrounded by contrast, c. peripheral intraluminal filling defect that forms acute angle with arterial wall. Can also see peripheral wedge-shaped lung infarct and linear bands.

Saddle embolus in both R and L main pulm arteries as well as visible clot (filling defects) branch arteries
Case 7: Acute Aortic Dissection

Aortic Dissection

Stanford classification
Type A: proximal to left subclavian: surgery
Type B: distal to left subclavian: medical management

Imaging findings:
Dissection flap
+/− aneurysmal dilatation of aorta
Differential opacification of true/false lumen
Thrombosed false lumen
+/− aortic rupture

CTA, axial, chest. Linear hypodense structure in the lumen of the ascending, transverse, and descending aorta. Both true and false lumens opacified = Aortic Dissection
Case 8: Aneurysm Rupture

AAA fusiform or saccular dilatation of the abdominal aorta. Rupture is a catastrophic complication with mortality up to 90%. Usually posterolateral aspect of the aorta results in retroperitoneal hemorrhage. May also rupture anterolateral aspect of the aorta resulting in peritoneal exsanguination. Grey-Turner sign indicates ecchymosis of the flanks. Lifetime risk of rupture if AAA > 5 cm = 20%, > 6 cm = 40%, > 7 cm = 50%+.

Axial CT without contrast: aortic aneurysm with active retroperitoneal extravasation = ruptured AAA. Call Surgery!
Case 9: Ectopic Pregnancy

Ectopic Pregnancy

Responsible for up to 15% of maternal deaths

Usu pelvic pain, vaginal bleeding, positive pregnancy test, empty uterus

To exclude ectopic, demonstrate an appropriately positioned IUP (intrauterine gestational sac)

Most specific sign is live embryo outside uterus, usu in the adnexa but only seen in 20-25% of cases

Look for complex free fluid

Note empty uterus, normal left ovary, echogenic trophoblastic tissue + gestational sac and yolk sac in left adnexa
Case 10: Testicular Torsion

Testicular Torsion

Acute scrotal pain
Testicular salvage rates are greatest when surgery performed within 6 hrs of sx onset. Can not be salvaged after 24 hrs.
Gray scale findings may be normal or there may be a small hydrocele, scrotal wall thickening, epididymal and testis enlargement and hypoechoic. Color Doppler crucial! Lack of demonstrable flow to affected testis

Color Doppler views of the left testicle and paired views of both testicles. Heterogeneous swollen left testis without internal vascularity = TORSION. Right testis has normal flow and size
Cases 11 & 12: Intracranial Hemorrhage
Subdural Hemorrhage

Subdural hemorrhage (SDH) collects in the potential space between the inner dura and the arachnoid layer.

Result from bridging vein tear in a MVA or fall.

On CT: hyperdense crescentic shape when acute, then isodense to hypodense when subacute and chronic. Mass effect -> altered mental status.
Epidural Hemorrhage

Epidural hemorrhage forms between inner table of calvarium and outer layer of the dura, results from middle meningeal arterial tear.

>90% are assoc with skull fx usu temporoparietal bones, also frontal and parieto-occipital regions.

On CT: hyperdense biconvex lens shape, mass effect. Early identification critical to guide evacuation vs early reevaluation.
Cases 11 & 12: Intracranial Hemorrhage
Case 13: Subarachnoid Hemorrhage

Subarachnoid hemorrhage that collects in the space between the pia and the arachnoid membrane

Think trauma, aneurysm, HTN, AVM

On CT: hyperdensity outlining the sulci and basilar cisterns, usu does not cause mass effect or edema
Brain Herniation

Complication of increased intracranial pressure. Brain tumor joins intracranial hemorrhage and cerebral edema from stroke/anoxia as most common cause. Shift of brain from one compartment to the other = herniation places parenchyma, brainstem, intracranial vessels and cranial nerves at risk. Types are subfalcine, transtentorial, tonsillar, and extracranial.

Case 14: Brain Tumor with Mass Effect

A. Right GBM with subfalcine herniation Rt->Lt
B. Right ATRT with uncal herniation Rt->Lt

Glioblastoma Multiforme

Atypical Teratoid Rhabdoid Tumor
Any questions?

http://guides.lib.unc.edu/Radclerks

Video shorts:
ICU Portable CXR
https://heelstream.med.unc.edu/Playlist/r5PRe7y3 - Dr Renner’s Cervical Spine video