

"DON'T MISS" PEDIATRIC PATHOLOGIES: PICTORIAL REVIEW OF COMMON CRITICAL RADIOGRAPHIC AND SONOGRAPHIC FINDINGS THAT SHOULD NOT BE MISSED BY ON-CALL RADIOLOGY RESIDENTS



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Abstract

This presentation reviews a spectrum of common, but critical radiographic and ultrasound findings in the newborn ICU and pediatric emergency department. On-call radiology residents should be familiar with these imaging findings and make a prompt diagnosis. When some findings are equivocal, the on-call resident should be able to recommend an appropriate next step for follow-up.

Foreign bodies

Children from age of 6 months to 4 years are high risk for foreign body ingestion/aspiration. Foreign bodies are more commonly lodged in the GI tract than the airways. A classic teaching is foreign bodies typically lodge in profile in the trachea and en face in the esophagus. Top figure: an ingested coin migrated to the rectum. Middle figure: ingested button (Bottom figure) lodged in esophagus).



Epiglottitis / Croup

Epiglottitis is a life-threatening bacterial infection with edema of the epiglottis (red arrow, thumb print sign) and aryepiglottic folds (green arrow). (This patient also has prevertebral swelling, due to cellulitis.)

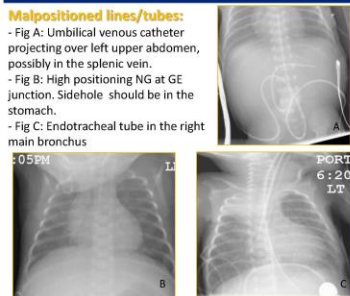
Croup, aka laryngotracheobronchitis -- Inflammation with subglottic and laryngeal narrowing due to viral infection. Classic steple sign (black arrow). (This sign can also be seen in other conditions, such as epiglottitis, bacterial tracheitis, and angioneurotic edema.)



Neonatal ICU Chest & Abdomen

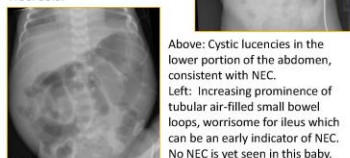
Malpositioned lines/tubes:

- Fig A: Umbilical venous catheter projecting over left upper abdomen, possibly in the splenic vein.
- Fig B: High positioning NG at GE junction. Sidehole should be in the stomach.
- Fig C: Endotracheal tube in the right main bronchus



Necrotizing Enterocolitis

Necrotizing enterocolitis (NEC) primary affects preterm newborns, and is related to bowel ischemia resulting in intestinal wall necrosis.



Above: Cystic lucencies in the lower portion of the abdomen, consistent with NEC.
Left: Increasing prominence of tubular air-filled small bowel loops, worrisome for ileus which can be an early indicator of NEC. No NEC is yet seen in this baby.

Pneumothorax/PIE

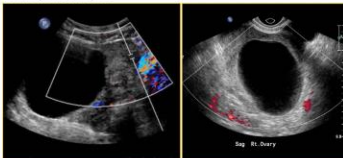
Preterm newborns on a ventilator are at high risk for pneumothorax and pulmonary interstitial emphysema (PIE). Left sided tension pneumothorax with mediastinal shift. Also note air bronchogram in the left chest, esp at the base, indicative of PIE.



Ovarian Torsion

Most ovarian torsions occur in teenagers. Large ovarian cysts (>5cm) and benign tumors are risk factors. Pelvic ultrasound is the primary modality for diagnosis. Typical ultrasound findings are enlarged and edematous ovaries, which may have lack of flow, especially arterial flow. However, Doppler study is neither sensitive or specific. A normal ovary may have absence of flow.

Left: Enlarged and edematous left ovary, which was surgically proved to be torsion.
Right: Surgically proven ovarian torsion due to a 7cm benign non-epithelial cyst.

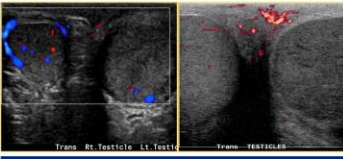


Testicular Torsion

Testicular torsion most commonly occurs in teenagers. Scrotal ultrasound is the primary and effective diagnostic modality. Key findings are lack of vascular flow or asymmetrically decreased flow. Emergent surgical detorsion in 6 hours is critical to salvage the testis.

Left: Significantly decreased vascular flow on the left due to torsion/detorsion mechanism. The testis was not torsed at time of surgery.

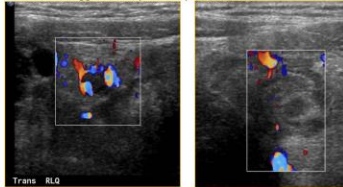
Right: Enlarged, hypoechoic and heterogeneous testicle without vascular flow on the left -- surgical proven testicular torsion with infarction.



Acute Appendicitis

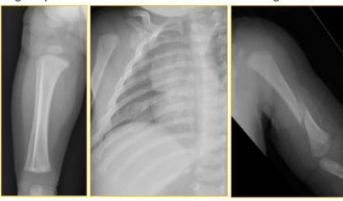
Ultrasound is the primary modality to evaluate acute appendicitis. Classic finding is a blind-ending, non-compressible and hyperemic tubular structure in right lower quadrant. Appendicolith may or may not be seen. If appendix is not identified on ultrasound, the exam is indeterminate.

Top right: Mild appendicitis with echogenic appendicolith.
Left: Classic hyperemic and inflamed appendix -- "ring of fire".
Bottom right: Hyperemic appendix with poor margination of bowel wall, suggestive of possible perforation.



Non-Accidental Trauma/Fracture

Musculoskeletal injuries from child abuse is common in nonambulatory infants. Some fracture patterns are specific and correlate to the injury mechanism that is unique to this population. Below are some examples.
Left: Infant with bucket handle fracture of proximal tibia.
Middle: Two month old with subacute right rib fractures, can result from squeezing the chest between the fingers
Right: Spiral fracture of left humerus due to twisting force.



Intussusception

A segment of bowel (intussusceptum) invaginated into the adjacent distal segment (intussuscipiens), causing bowel obstruction and ischemia. Plain film can be diagnostic with a "crescent sign" -- crescent of intraluminal air surrounding the rounded mass (top left). Ultrasound is very sensitive, and shows the "target" sign of intussusception on transverse images, and telescoping on sagittal images (right column). Air enema can demonstrate and reduce the intussusception (bottom left).

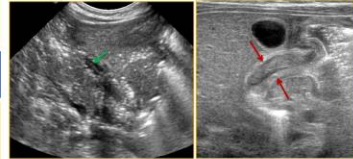


Hypertrophic Pyloric Stenosis

Abnormal thickening/elongation of the pylorus leads to gastric outlet obstruction. This entity presents 4-6 weeks after birth. Ultrasound can be diagnostic.

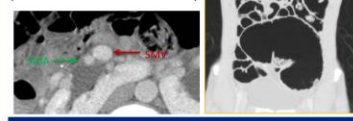
Top right: Normal pylorus.
Bottom right: Thickened and elongated pylorus.

Bottom left: Complication - portal venous gas - Diffuse patchy echogenic areas in the liver, consistent with air. String of air bubbles (green arrow) seen traversing in the portal veins.



Midgut Volvulus

Twisting of the entire midgut about the axis of the superior mesenteric artery, and is related to malrotation, in which the small bowel is in the right abdomen, and the colon in the left. In this case of cecal volvulus, the plain film is not obvious (top). CT is revealing and demonstrates the SMA abnormally positioned to the left of SMA. This patient also has a horseshoe kidney.



Conclusion

This is a succinct pictorial review of critical and important findings in plain films and ultrasound. Some of them are life-threatening or surgical emergencies. Radiology residents on call should be familiar with the above mentioned entities. Prompt notification should be made to the ordering provider. Appropriate follow-up should be recommended and performed in a timely manner to ensure optimal care. The authors would like to extend our sincere thanks to Gerald Raucci for helping locate the relevant cases.

References

1. Donnelly, L, Pediatric Radiology: The Fundamentals. Saunders 2008
2. Reid, J. et al, Pediatric Radiology (Rotations in Radiology). Oxford University Press 2013
3. Herring, W., <http://learningradiology.com>
4. Parker, B. et al, Pediatric Radiology: The Requisites. Mosby Elsevier 2009.