



Practical Radiology: Pediatric Abdominal Emergencies

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Financial Disclosures

- I do not have any relationships to report with ACCME defined ineligible companies.
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Objectives

After this presentation, the participant will be able to:

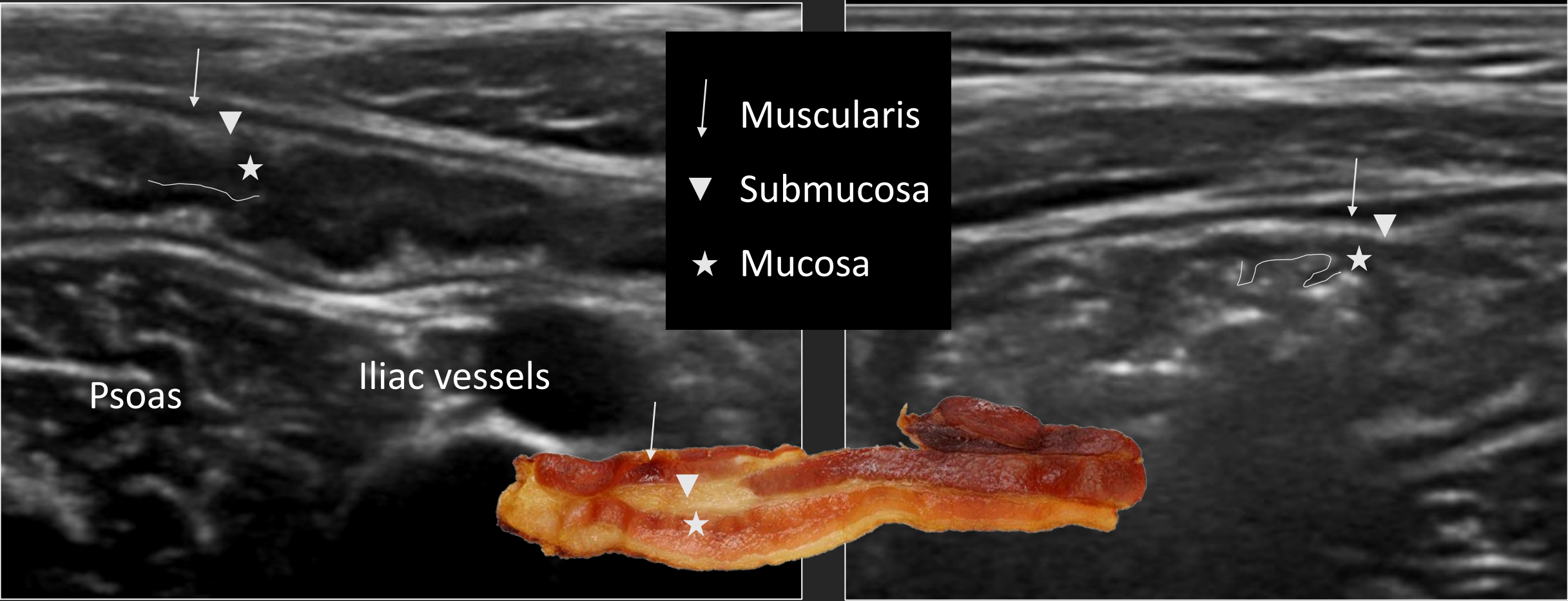
1. Describe imaging findings of pediatric GI emergencies
 2. Describe imaging findings of intra-abdominal pediatric GU emergencies
 3. List ways to reduce radiation and optimize image quality in pediatric abdominal imaging
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Imaging of Pediatric Acute Abdomen

- Radiographs
 - Support devices
 - Bowel gas distribution
 - Mass effect
 - Stool burden
 - Obstruction
 - Pneumoperitoneum
 - Pneumatosis (Inpatients)
 - Foreign body (Emergency Dept.)
- Ultrasound is typical 2nd line modality
- CT rarely used



Pediatric Bowel Ultrasound



Psoas

Iliac vessels

- ↓ Muscularis
- ▼ Submucosa
- ★ Mucosa

Terminal Ileum

Cecum



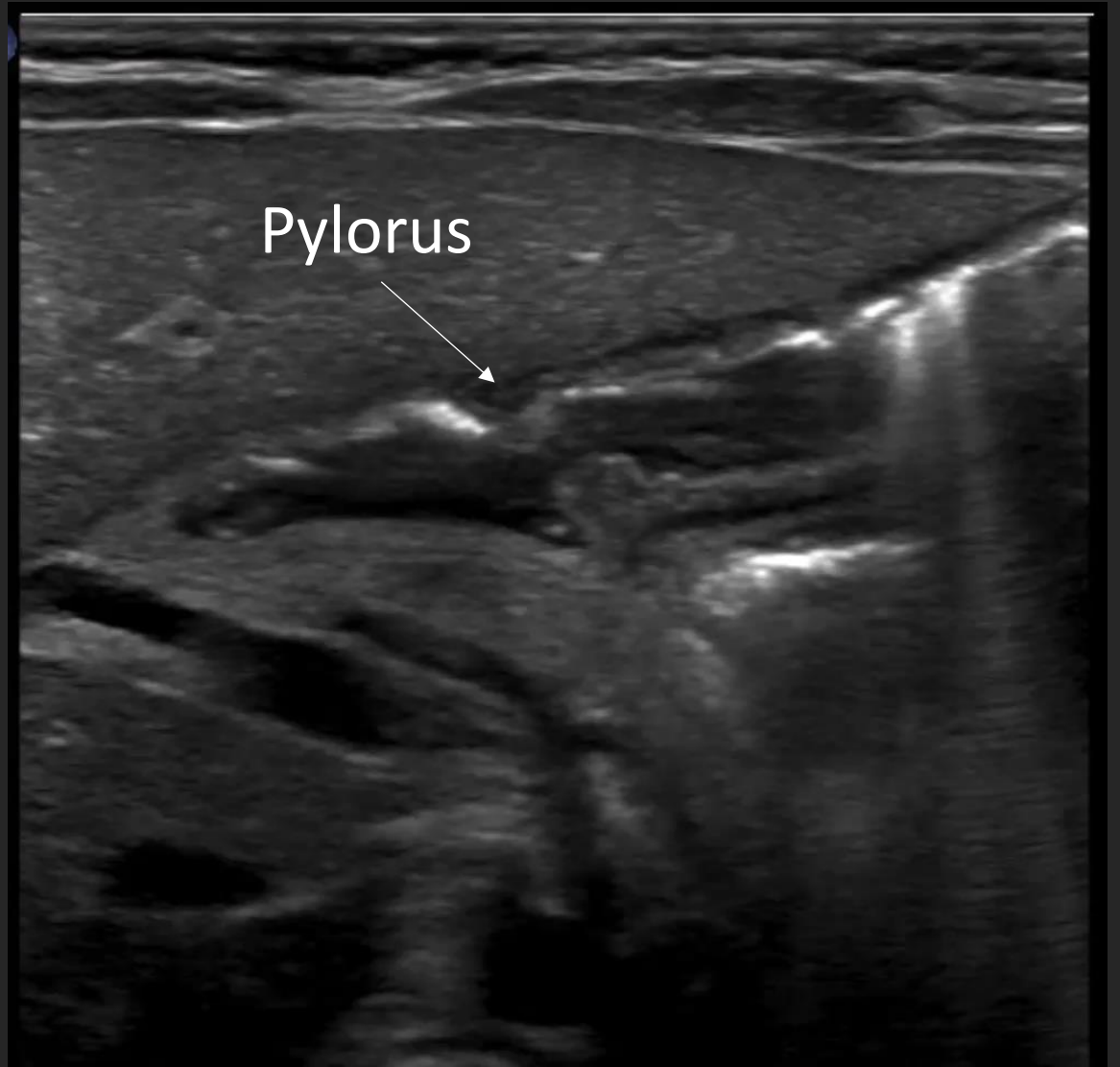
6-month old w/ bilious vomiting

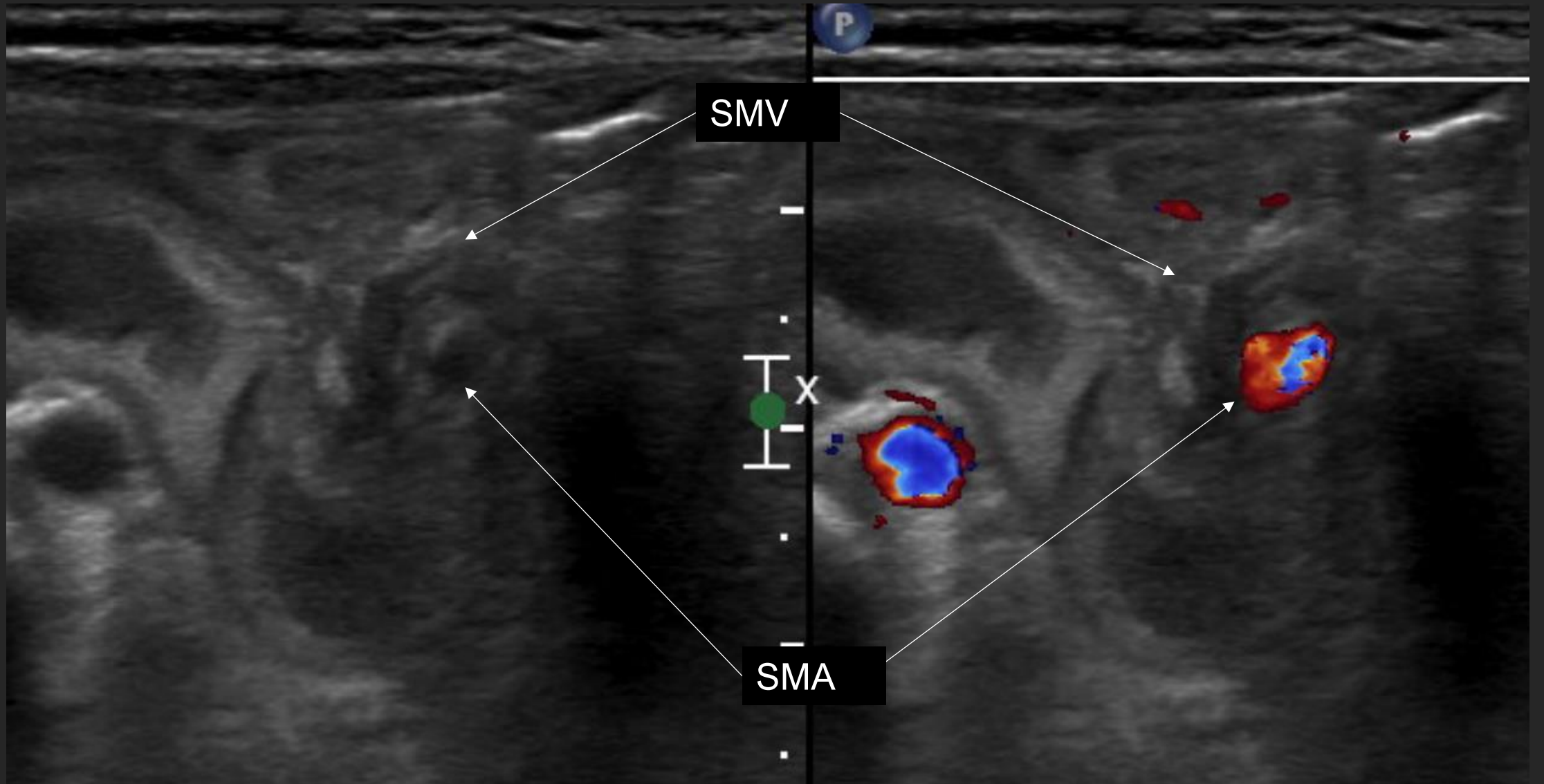
Differential diagnosis bilious vomiting

- Post-pyloric obstruction
 - Midgut volvulus
 - Duodenal stenosis
 - Annular pancreas
- Enteritis
- Feeding intolerance
 - Gastro-esophageal reflux
 - Milk protein allergy



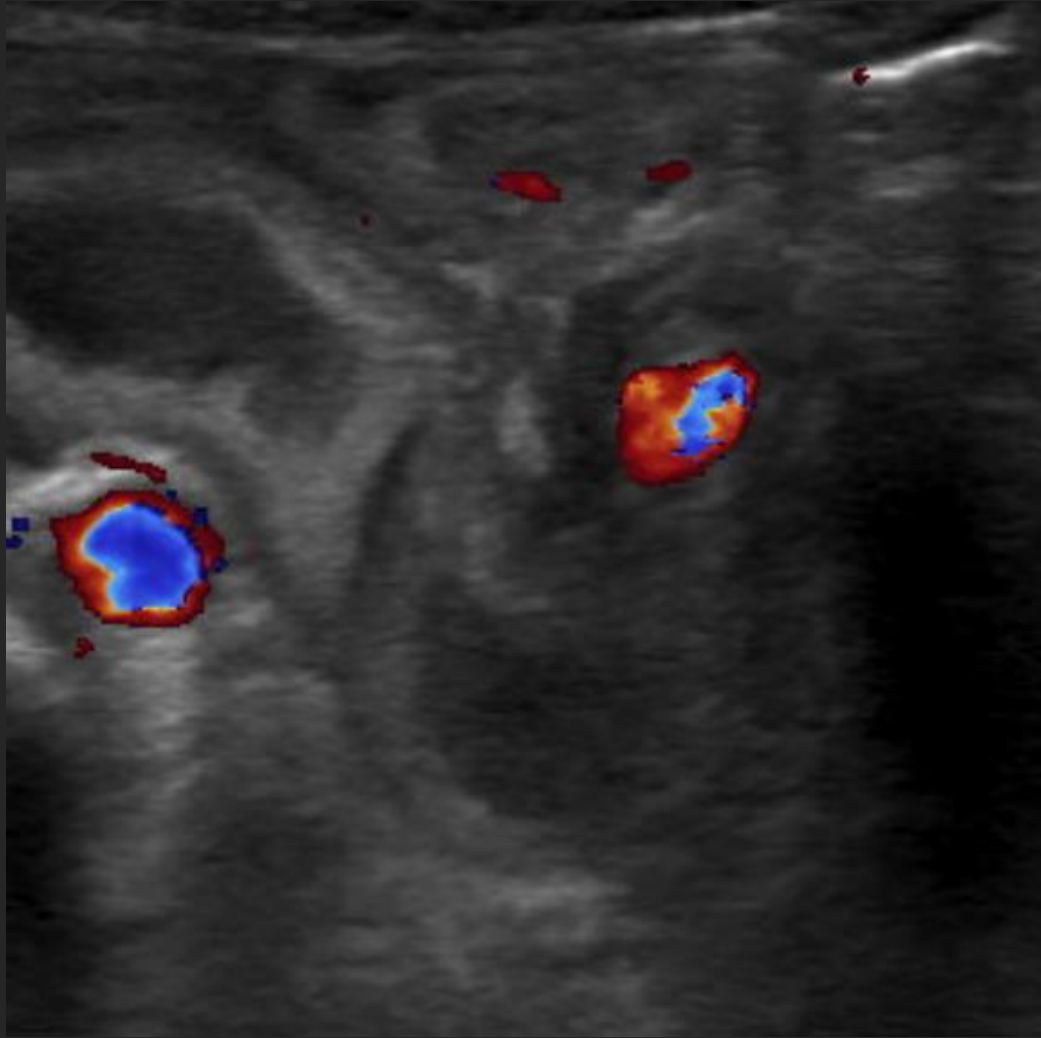
6-month old w/ bilious vomiting





6-month old w/ bilious vomiting

Midgut Volvulus



6-month old w/ bilious vomiting

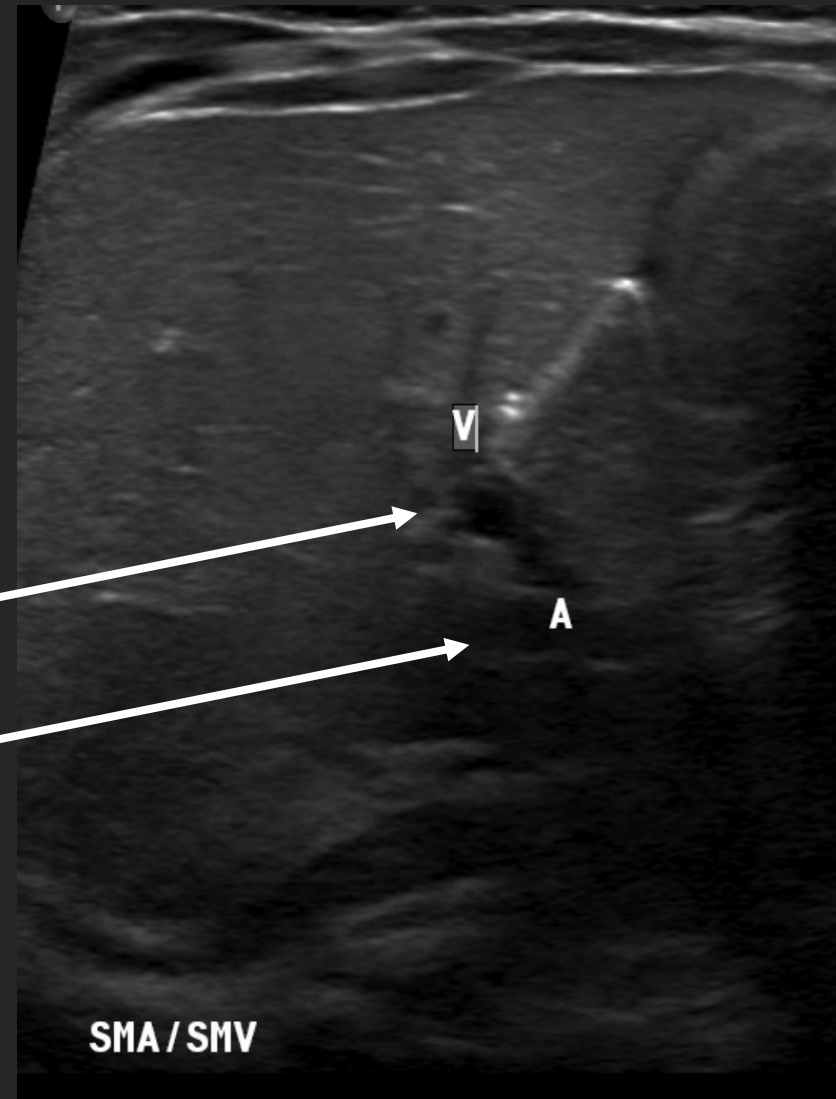
- SMA should be *left* of SMV
- Ultrasound diagnosis
 - Linear probe, baby head probe
 - Sensitivity 83 – 96%
 - Specificity 89 – 100%
 - Clockwise whirlpool sign
 - Obstructed duodenum
- Fluoroscopy may confirm atypical cases

Pitfall: SMA/SMV location

- Bowel gas frequently obscures SMA/SMV
- Look inferior to pancreatic head
- **Not at hepatic hilum**

Portal vein

Superior
mesenteric
artery



Midgut Volvulus

FLUOROSCOPY

Duodenojejunal junction *should* be:

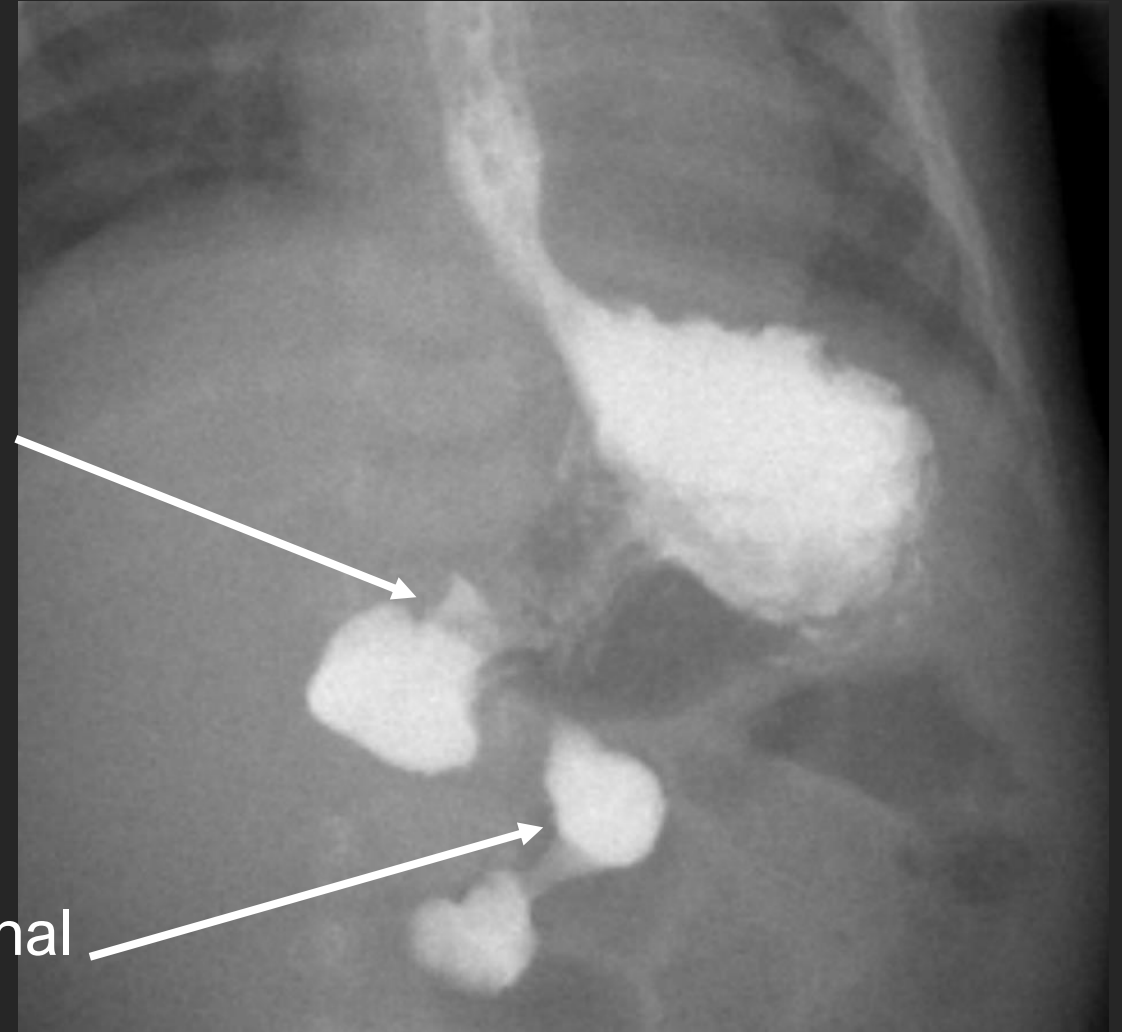
- Left upper quadrant
- Level of pylorus

Fluoroscopic signs

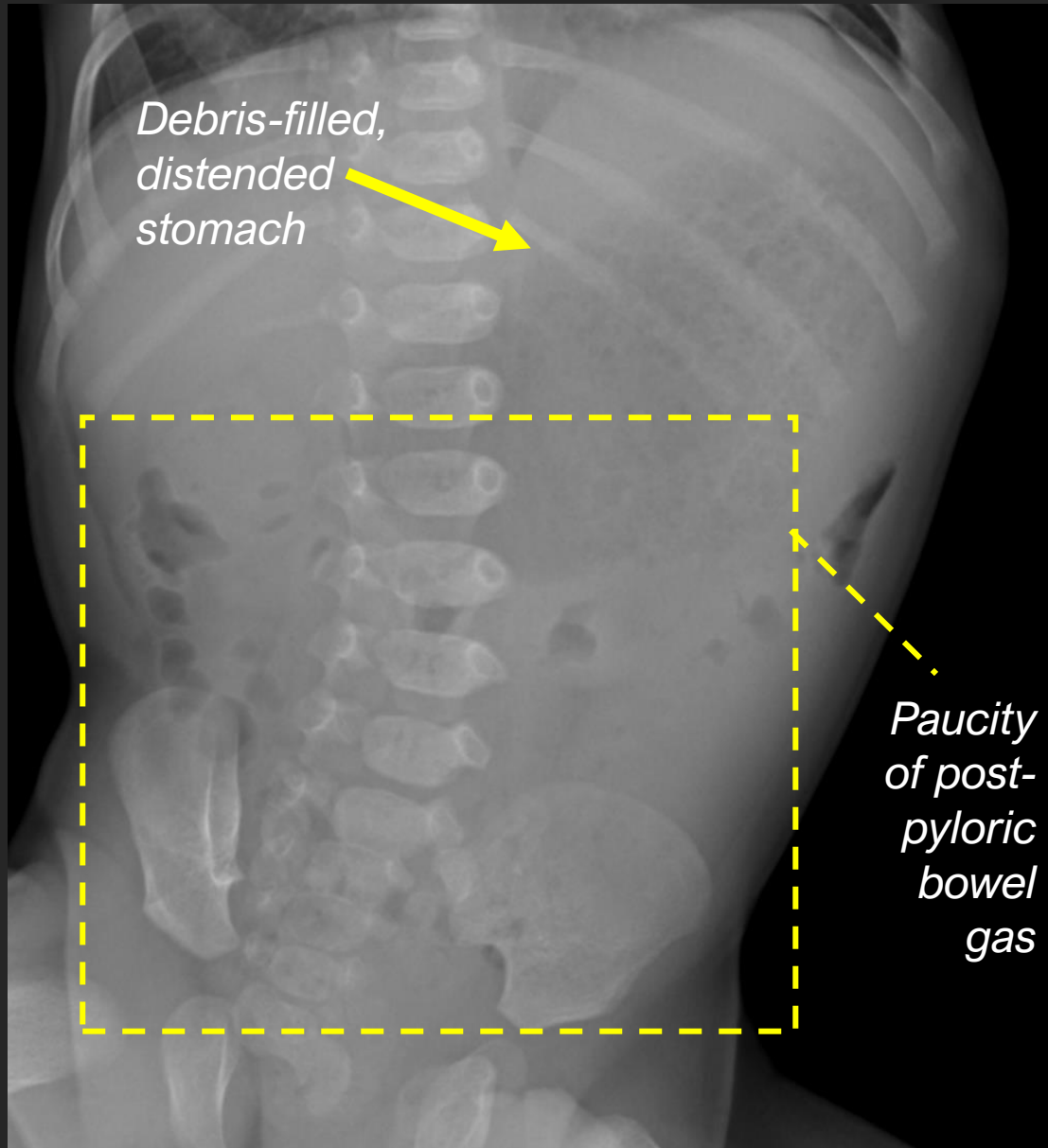
- “Bird beak”
- “Corkscrew”

Duodenojejunal
junction

Pylorus

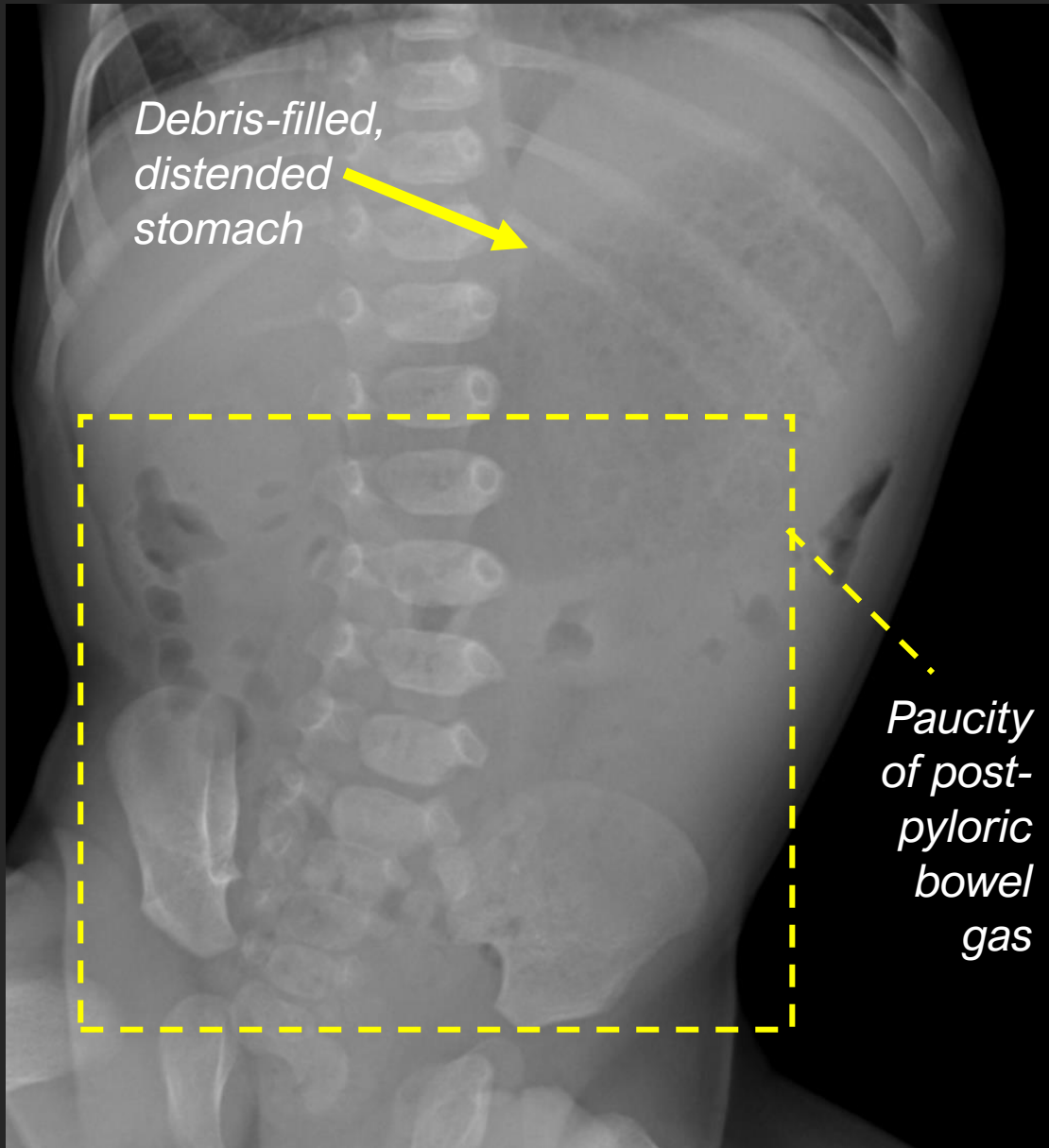


Differential diagnosis

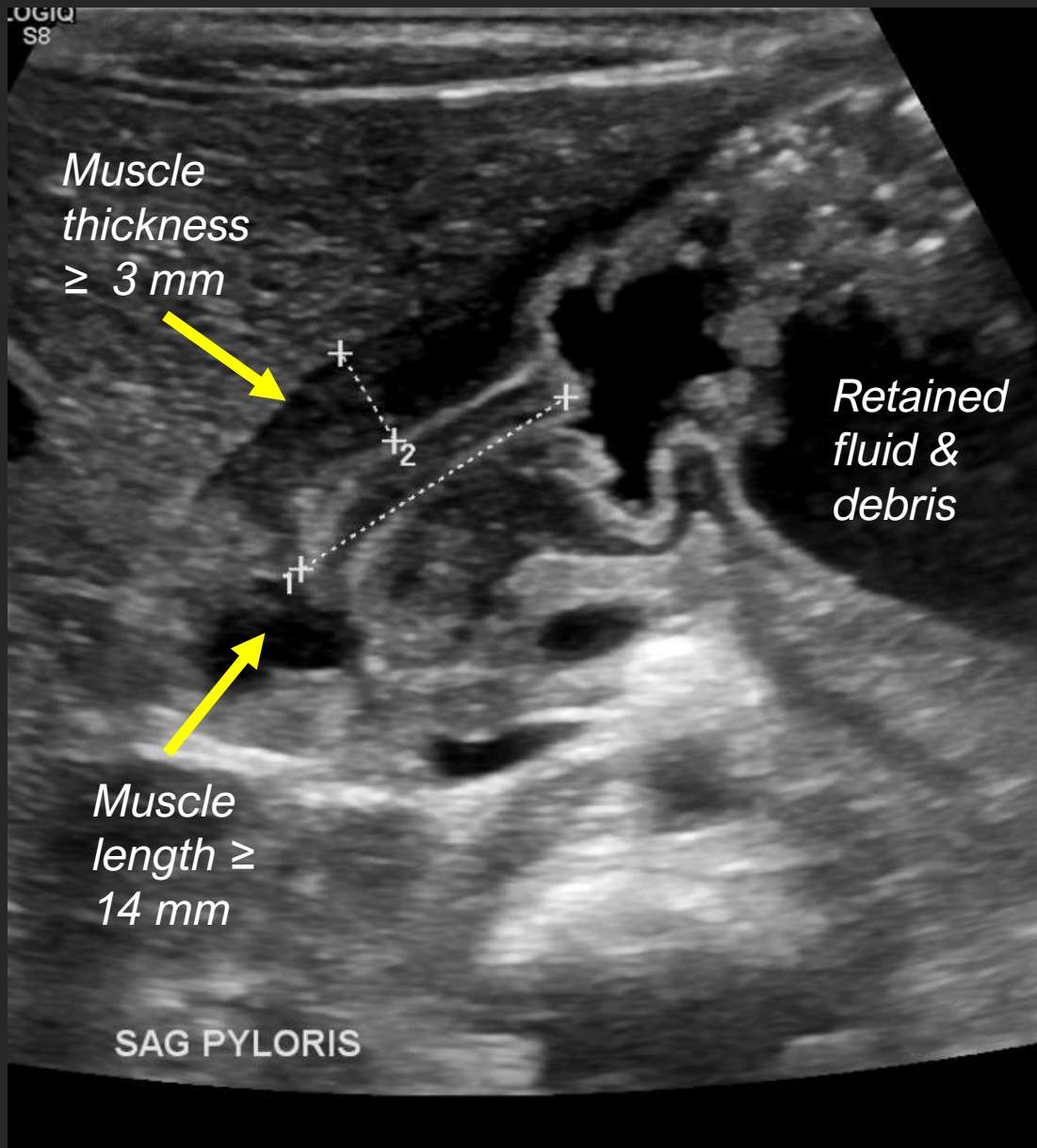


2-month old, vomiting and failure to thrive

- Gastric outlet obstruction
 - Hypertrophic pyloric stenosis
 - Mass
- Retained debris in stomach
 - Lactobezoar



2-month old, vomiting and failure to thrive

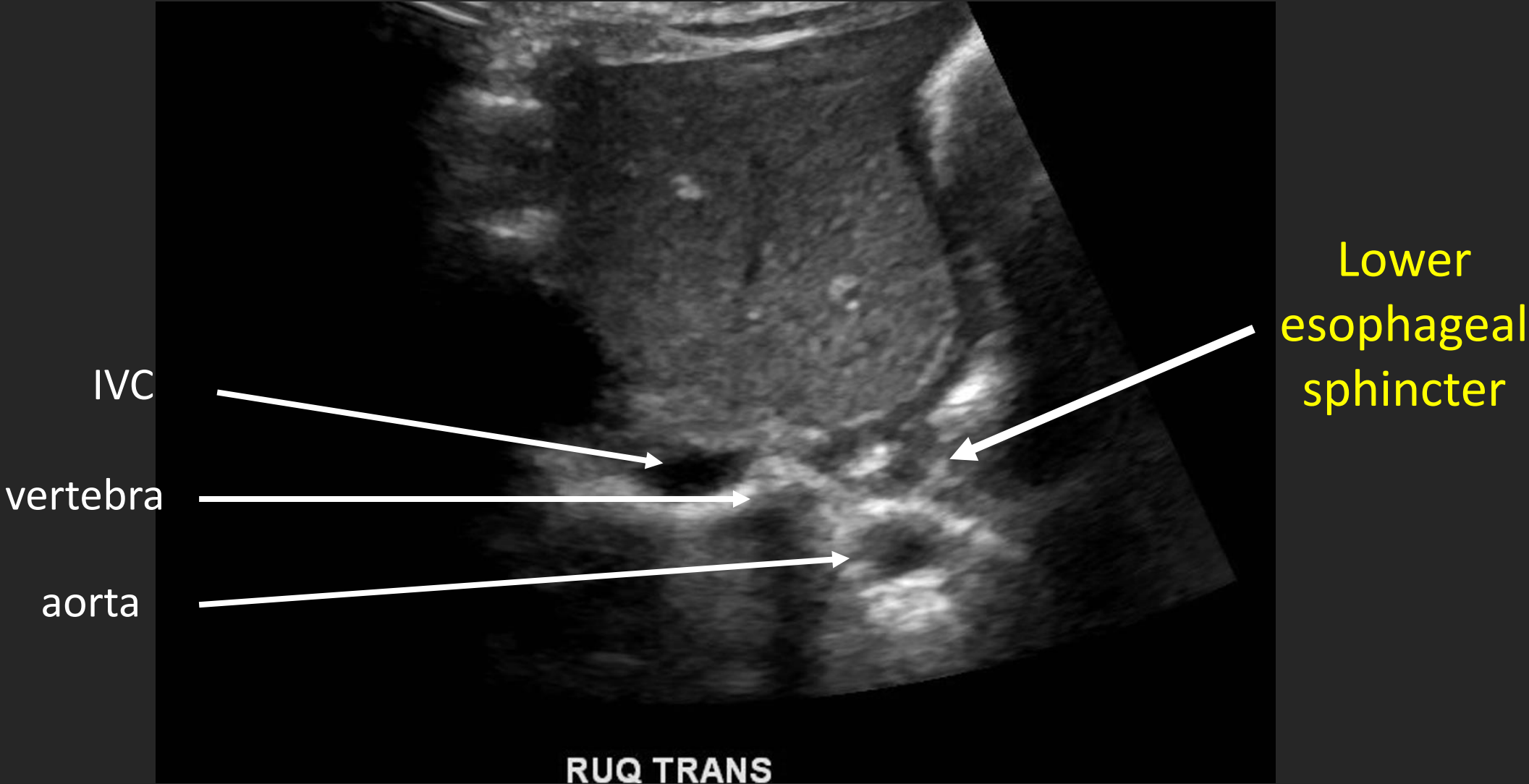


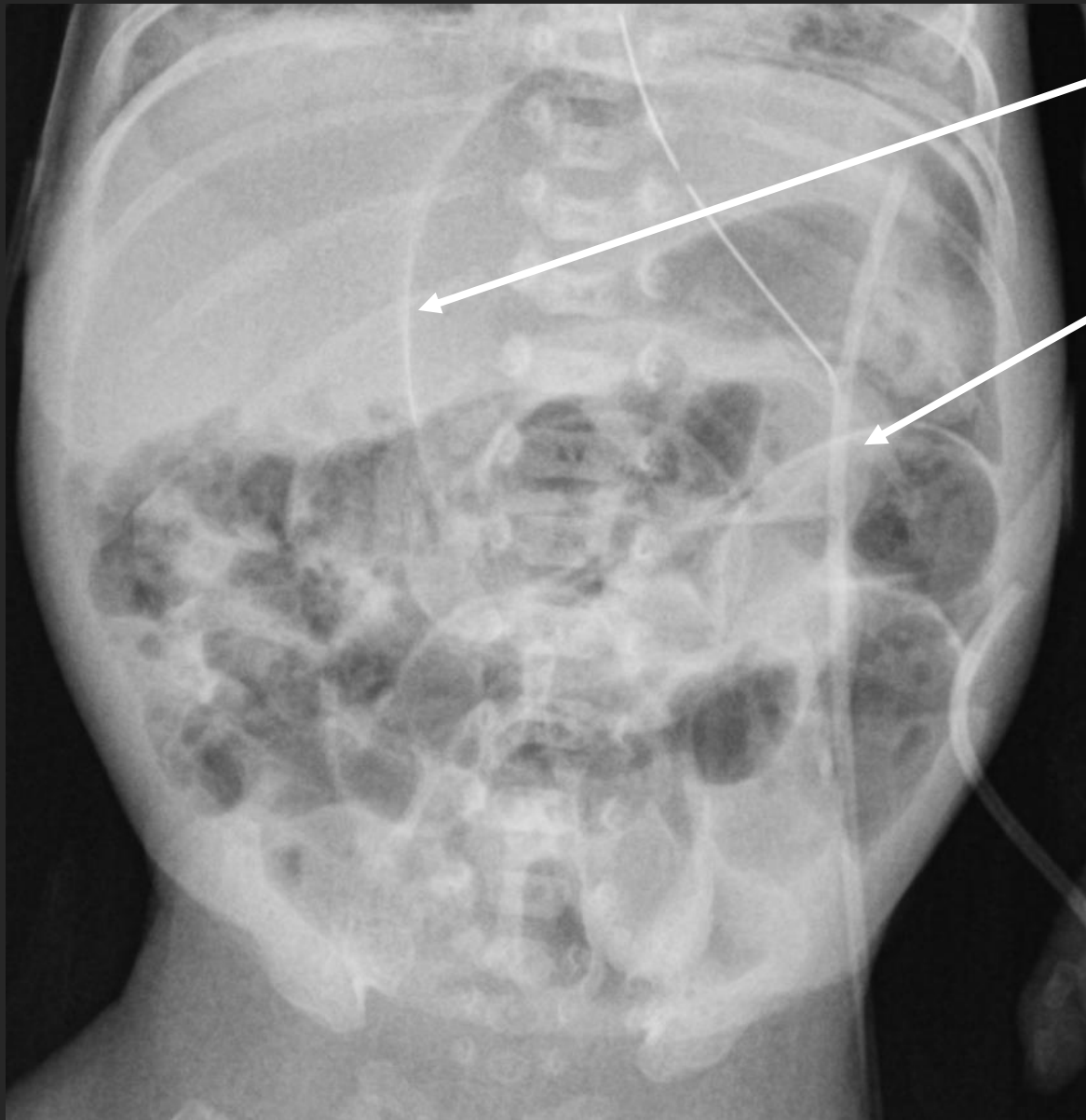
Pyloric Stenosis

- Infants 3 weeks – 14 weeks
- Males:Females 4:1
- Muscular layer (dark)
 - ≥ 3 mm thick
 - ≥ 14 mm long
- Retained fluid and debris in stomach
- Failure pylorus to open

2-month old, vomiting and failure to thrive

Pitfall: Lower Esophageal Sphincter





- Falciform ligament
 - “football sign”
- Air outlining bowel wall
 - “Rigler sign”
- Mottled lucencies in bowel
- Ileus

12-day old w/ abdominal distention

Necrotizing Enterocolitis



12-day old w/ abdominal distention

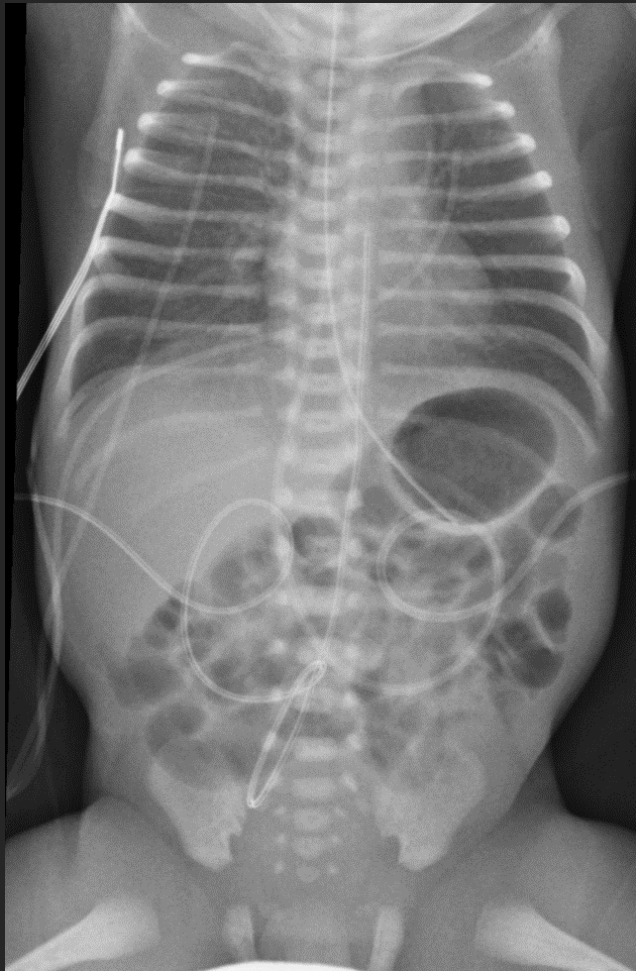
Premature infants

- Approx 32-week equivalent gestational age
- Advancing feeding

Complex congenital heart disease

- Single ventricle physiology
 - “Steal” phenomenon
 - Low cardiac output
-

Necrotizing Enterocolitis



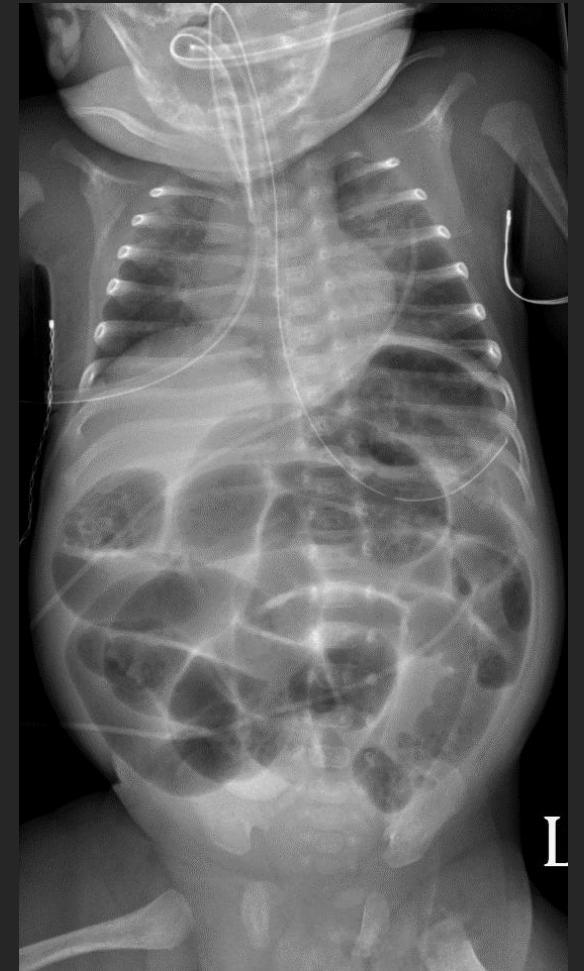
0-day old, 30-week gestation



4-weeks old, abdominal distention



1 hour later



5 hours later

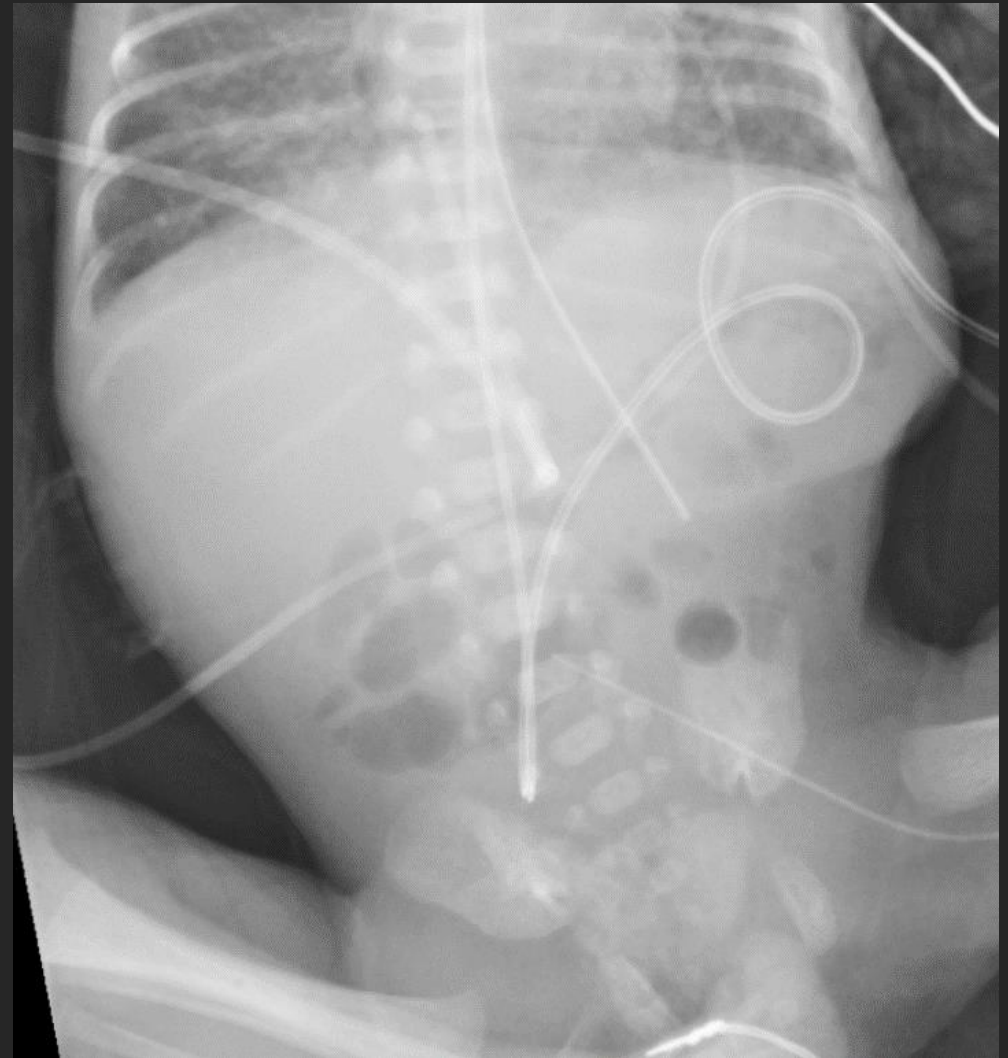
Pitfall: Umbilical venous catheter hides “football”



Umbilical venous catheter



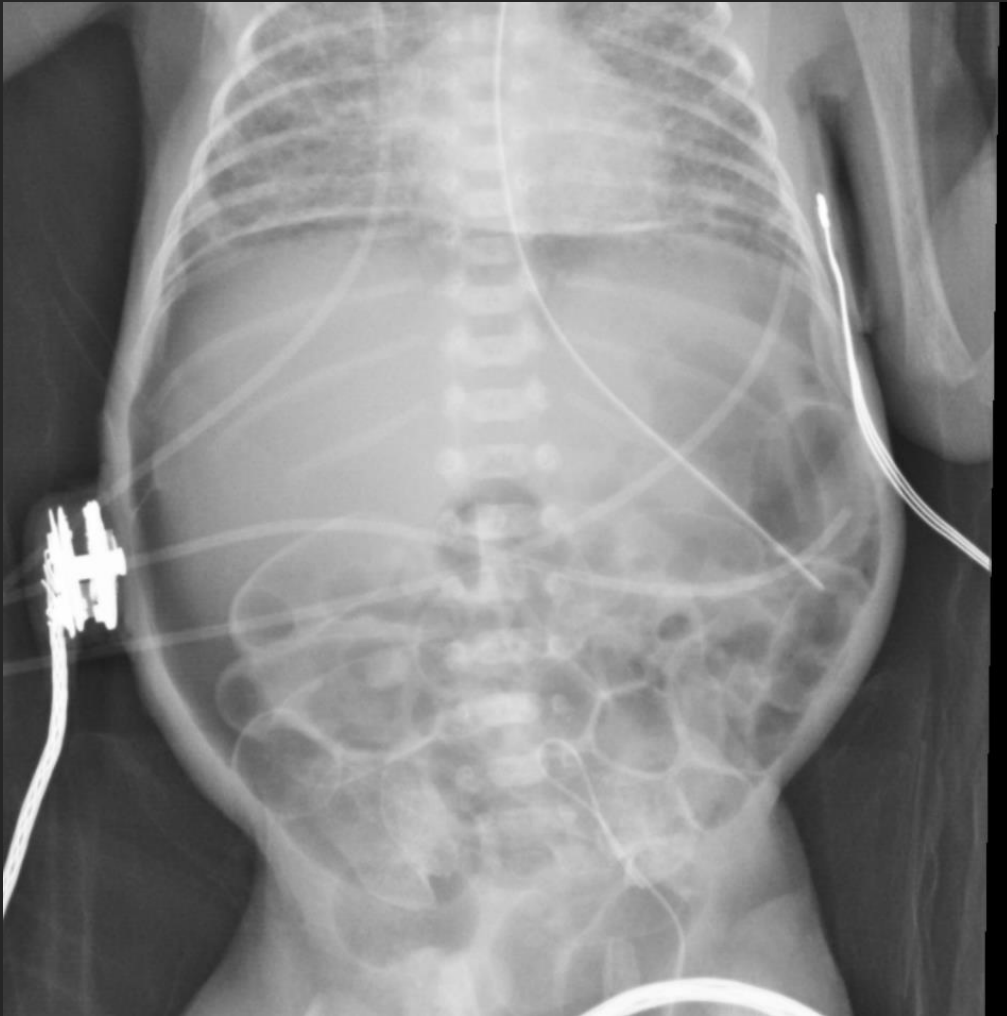
14-day old 26-weeks gestation w/ abdominal distention



1 day earlier



Spontaneous Intestinal Perforation



14-day old 26-weeks GA w/abdominal distention

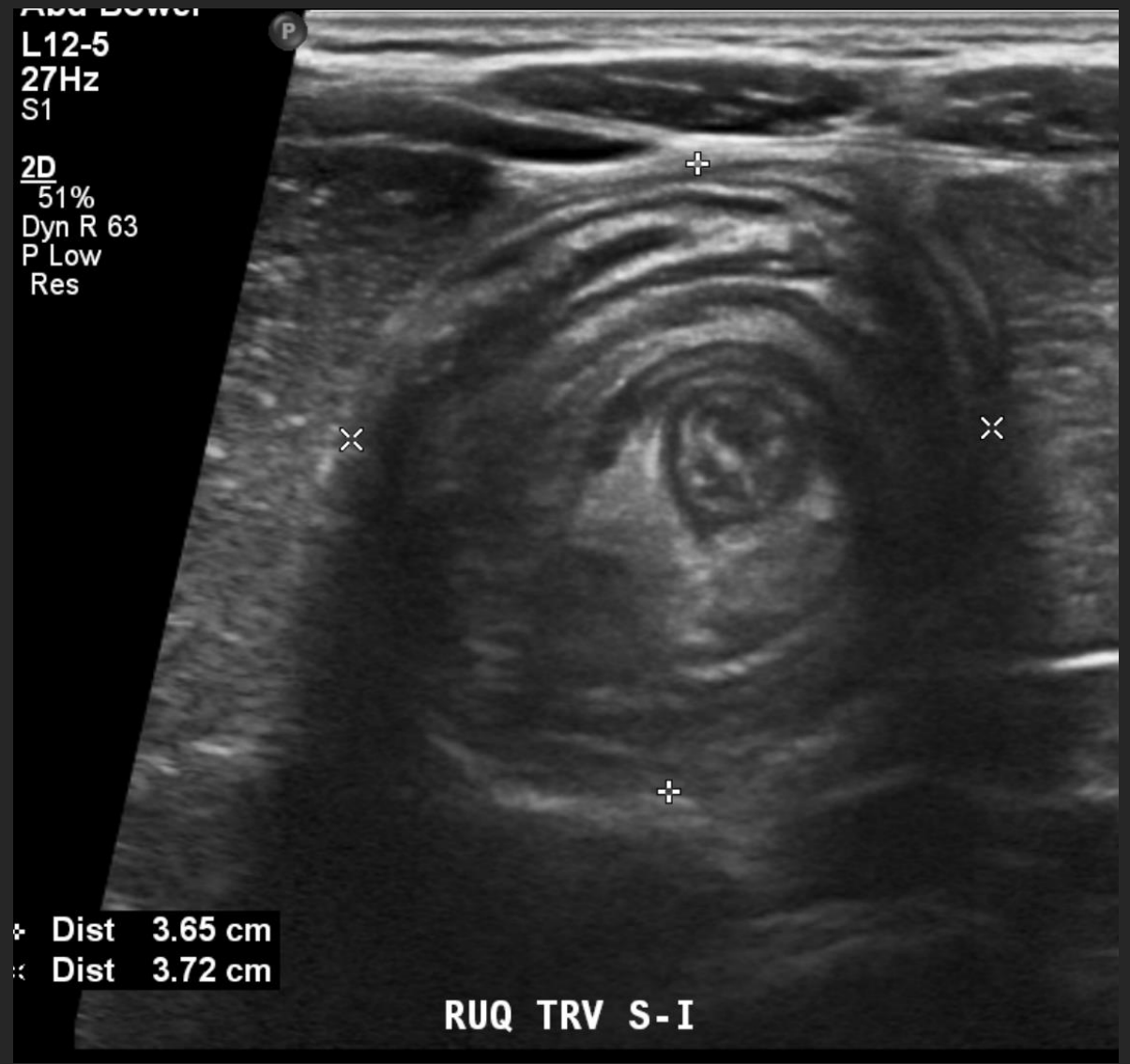
- Affects very low birth weight infants
- Typically perforates at terminal ileum >> jejunum, colon
 - Infection, ischemia
- Risk factor: early post-natal steroids, indomethacin
- Medical and surgical treatment options



6-month old w/ dark stools

Differential diagnosis,
infant with dark stools:

- Ileocolic intussusception
 - Polyps
 - Meckel complication
 - Milk protein allergy
-



6-month old w/ dark stools

Ileocolic Intussusception



6-month old w/ dark stools

- “Target sign”
- “Pseudokidney sign” in long axis
- > 2.5 cm diameter
- Intussusceptum
 - Small bowel
 - Fat
 - Lymph nodes
 - May contain appendix

Intussusception Reduction

Fluoro: Contrast



Fluoro: Air



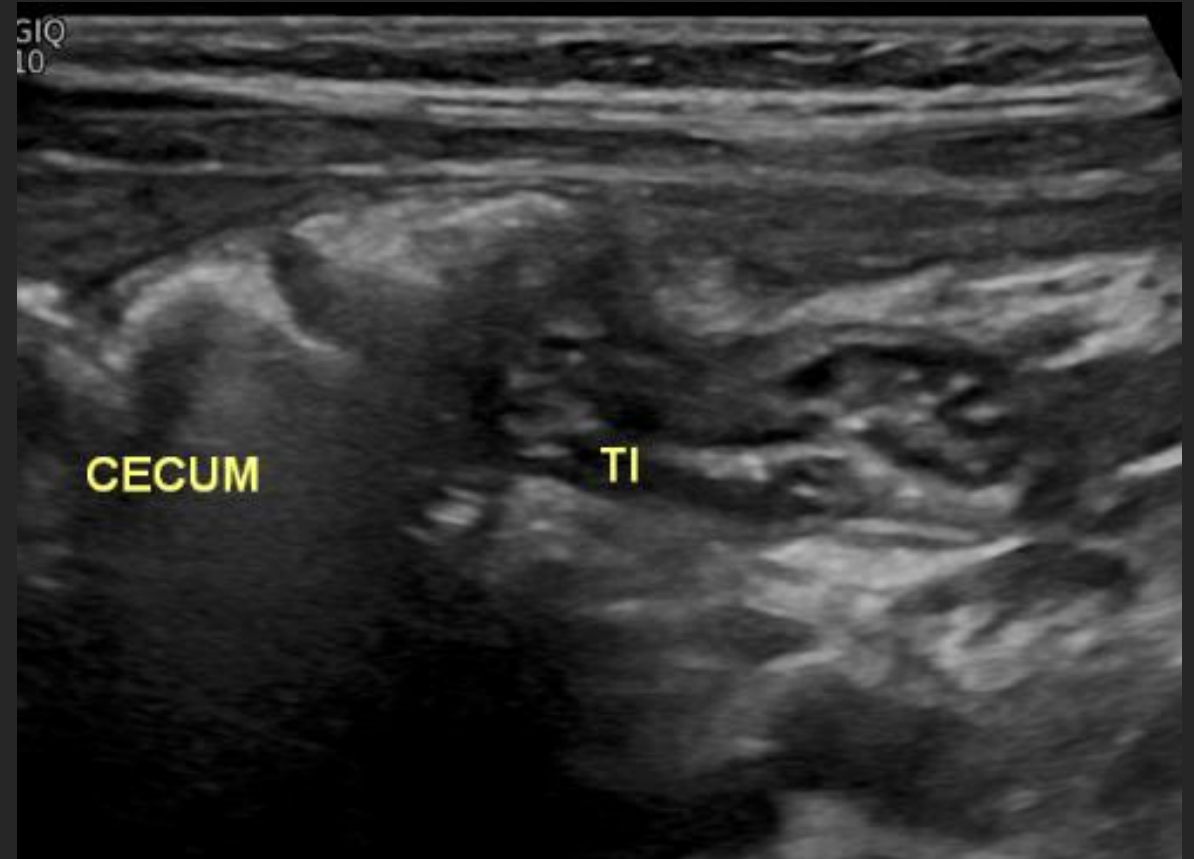
Ultrasound

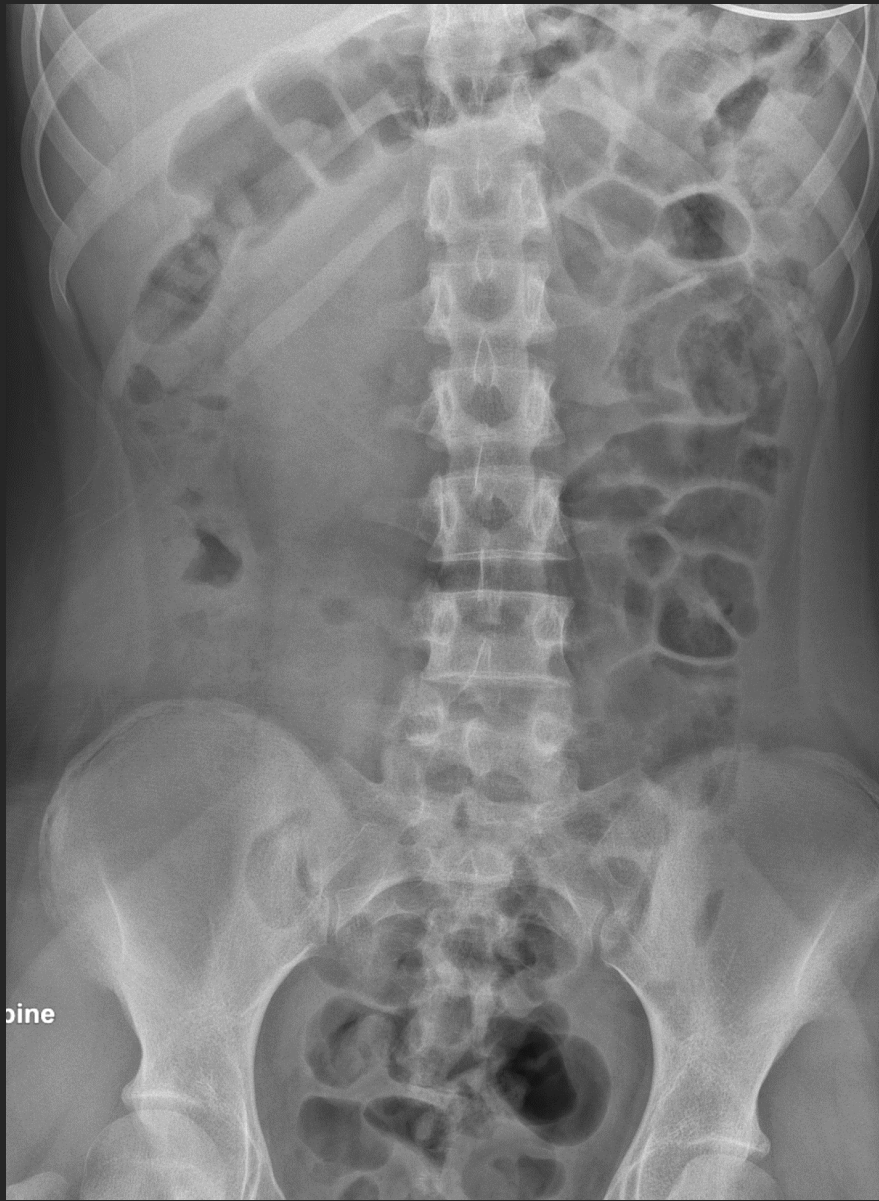


Pitfall: Small bowel intussusception

- < 2.5 cm diameter
- Intussusceptum no fat or nodes

Look for normal ileocecal valve

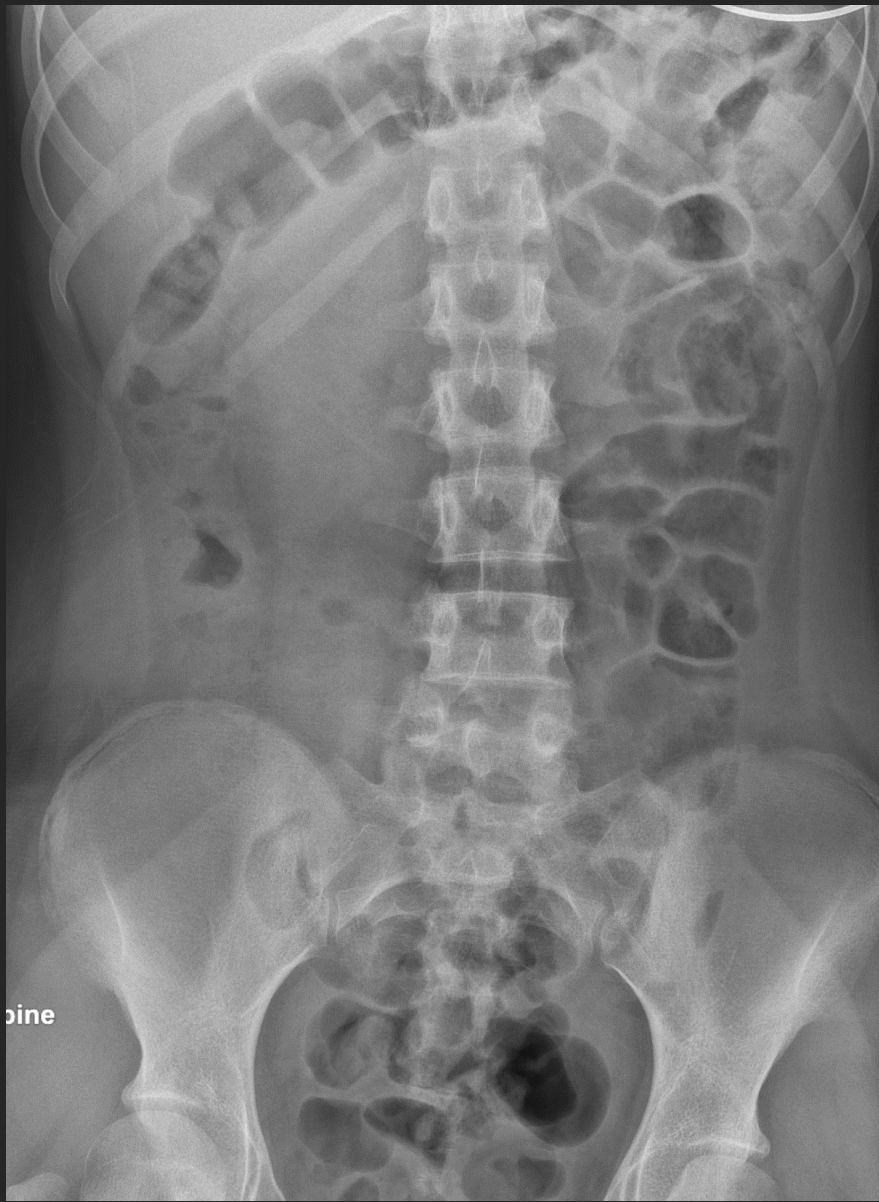




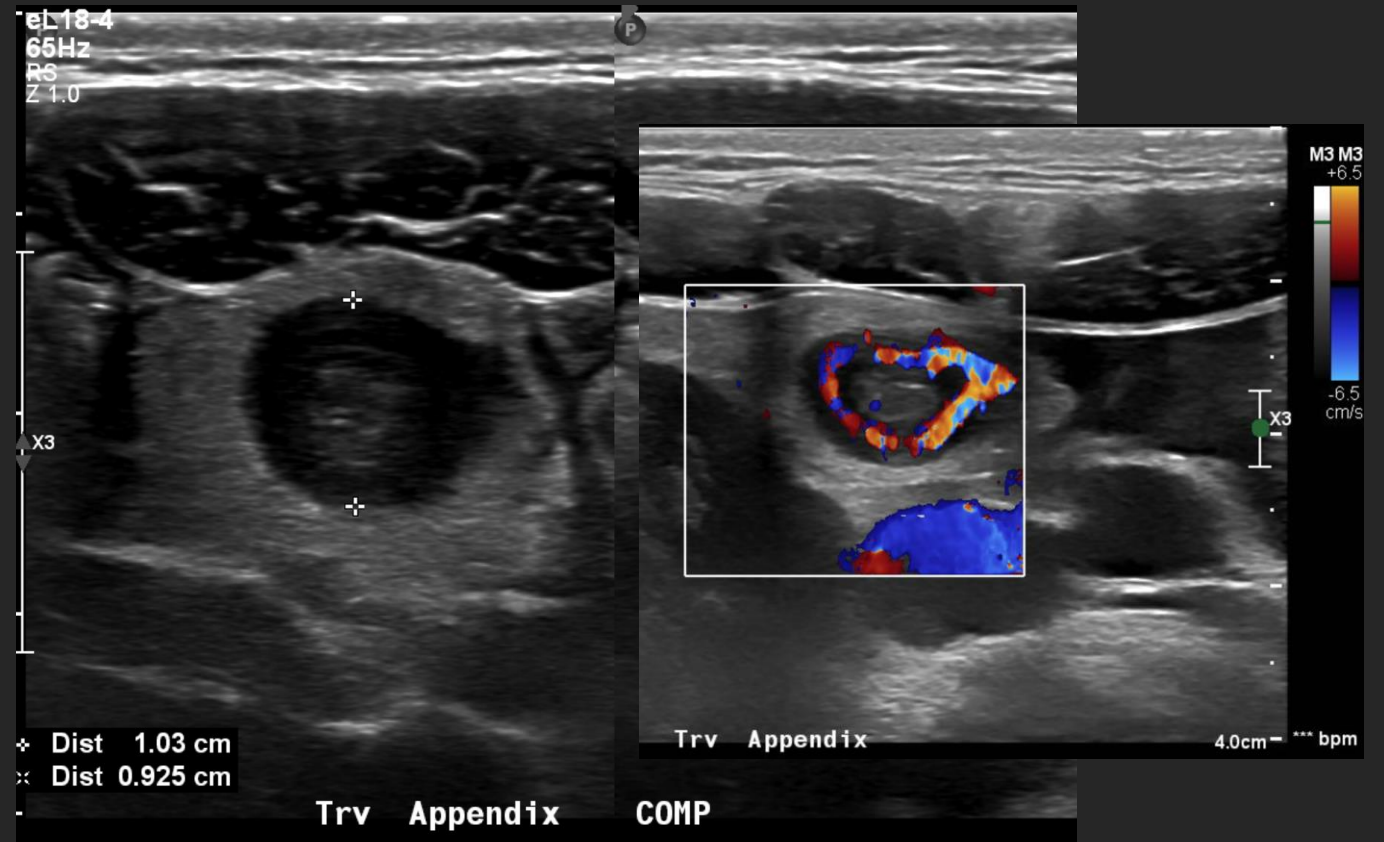
13-year old w/ right lower quadrant pain

Differential diagnosis RLQ pain:

- Appendicitis
 - Inflammatory bowel disease
 - Mesenteric adenitis / enteritis
 - Meckel complication
 - Intussusception with pathology
-

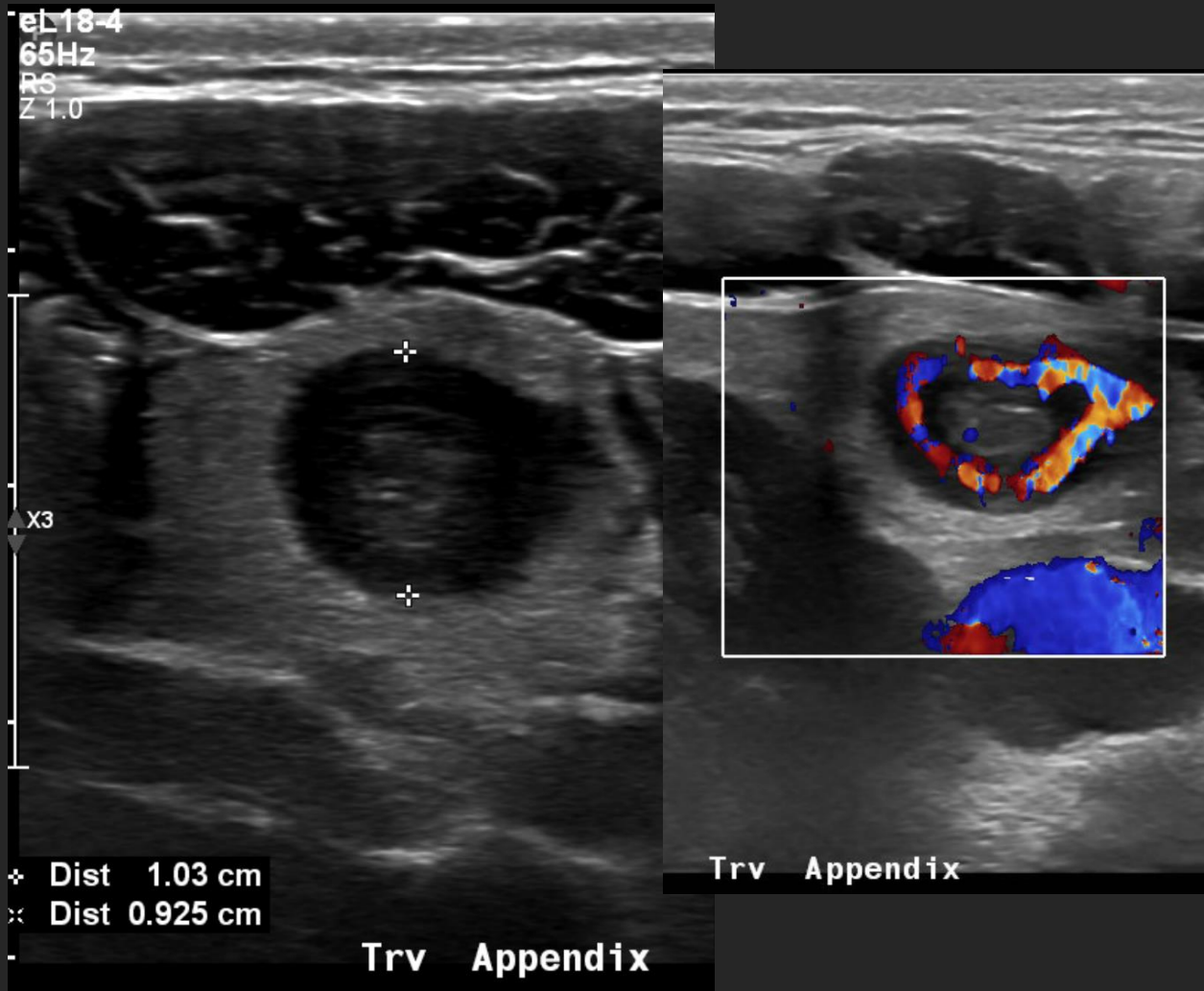


pine



13-year old w/ right lower quadrant pain

Appendicitis



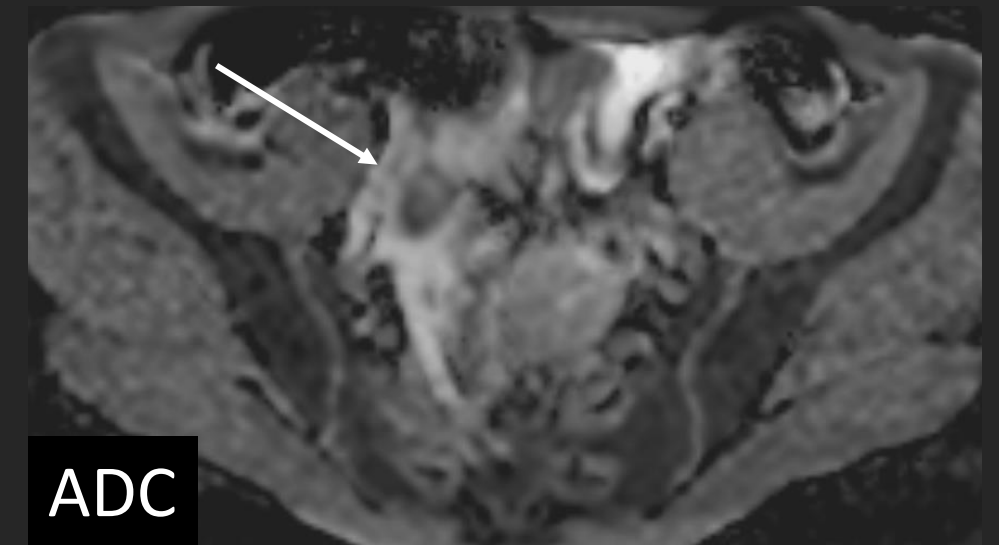
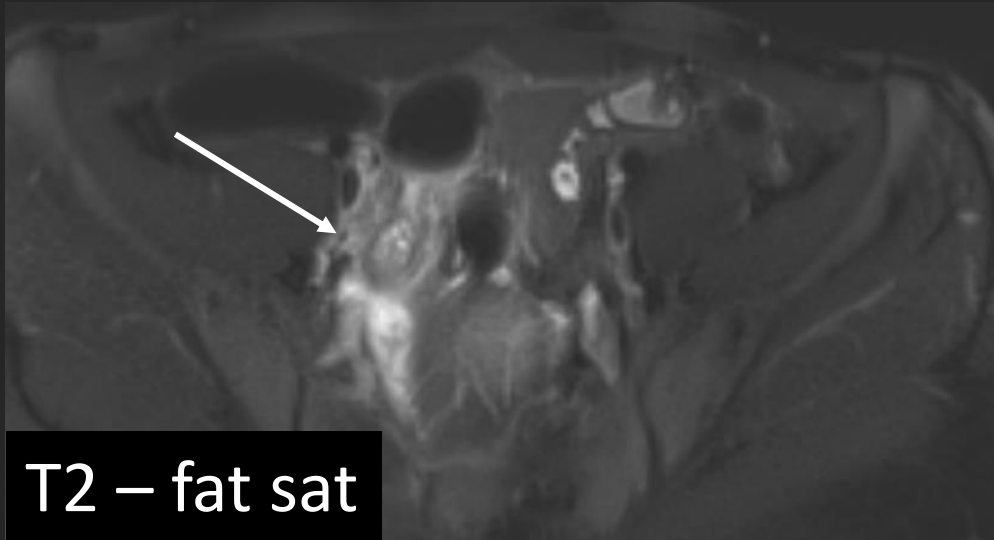
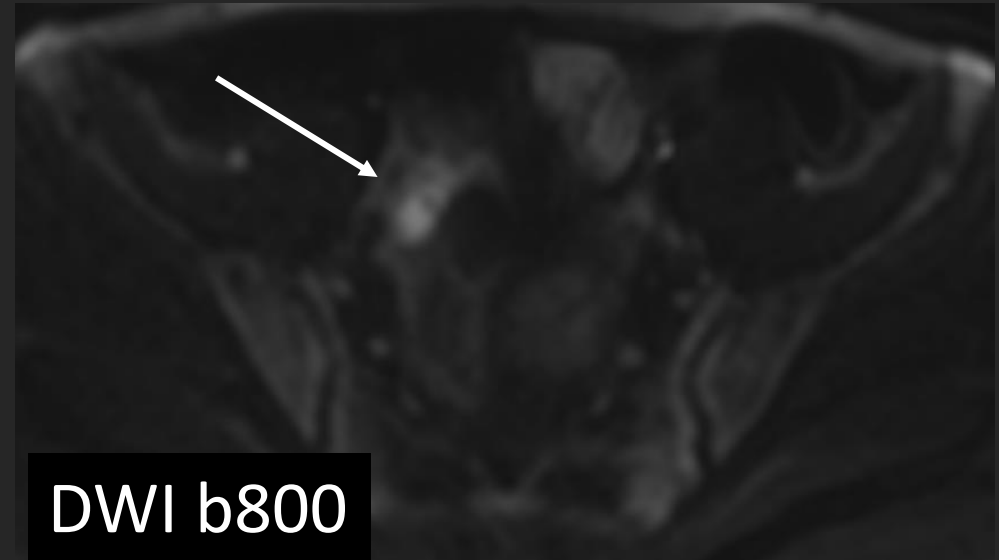
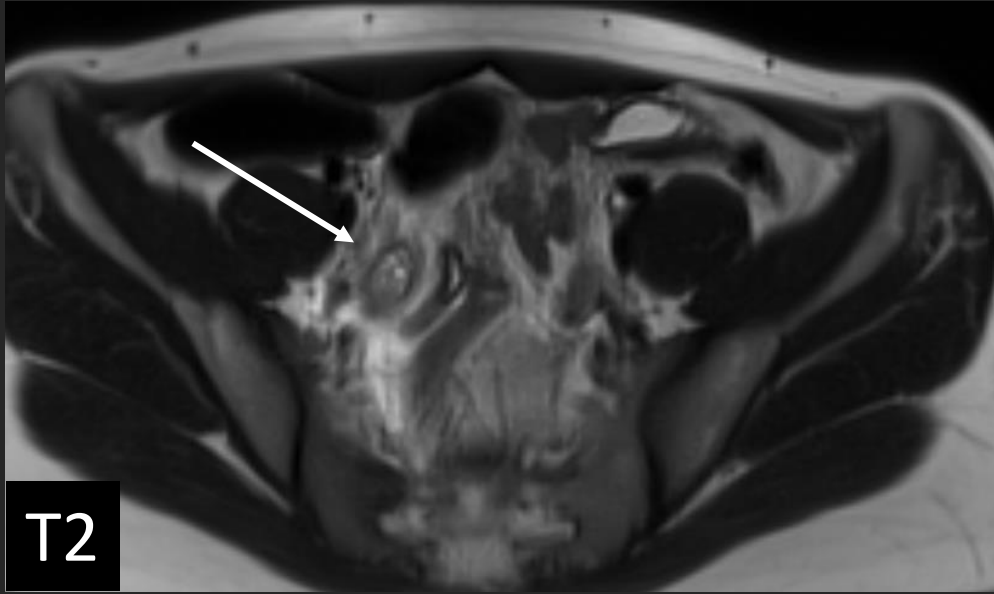
- Typically > 7-years old
- Febrile, leukocytosis

Ultrasound

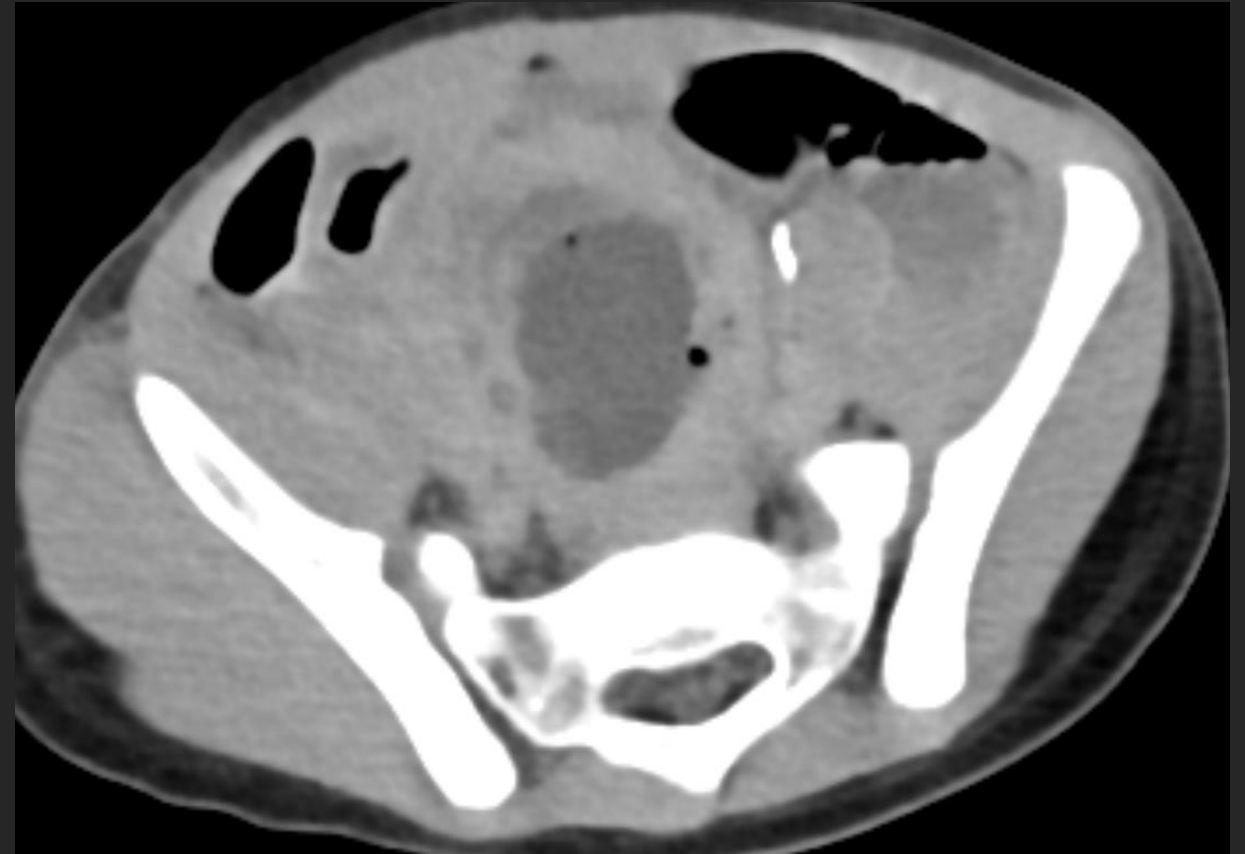
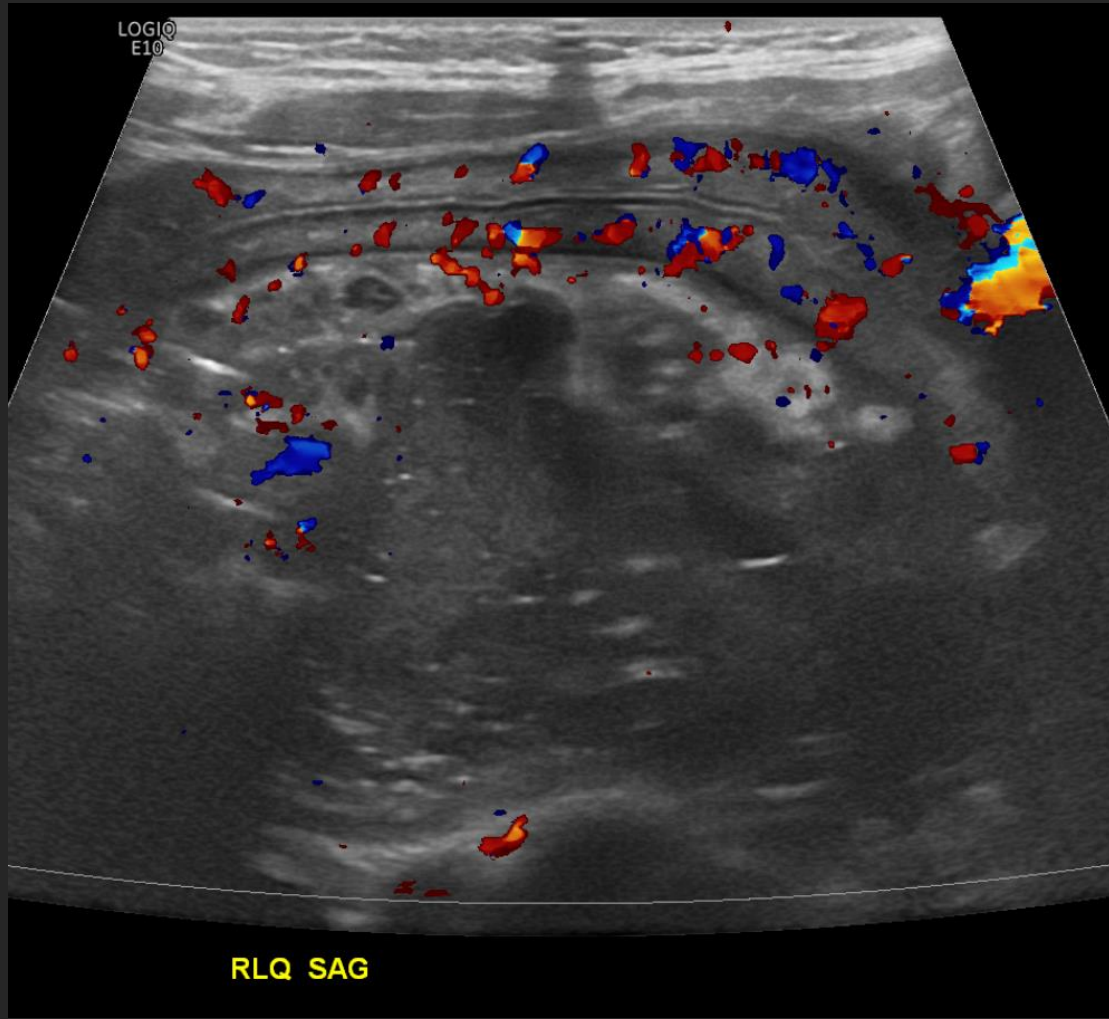
- > 6 mm diameter
- Non-compressible
- Mesenteric fat echogenic
- Hyperemic

13-year old w/ right lower quadrant pain

Appendicitis MR: Equivalent to CT

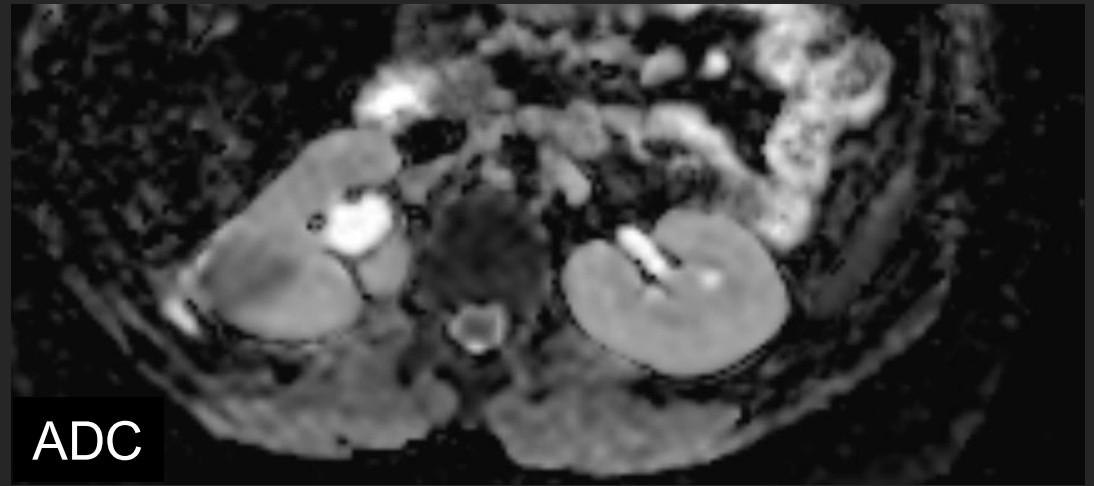
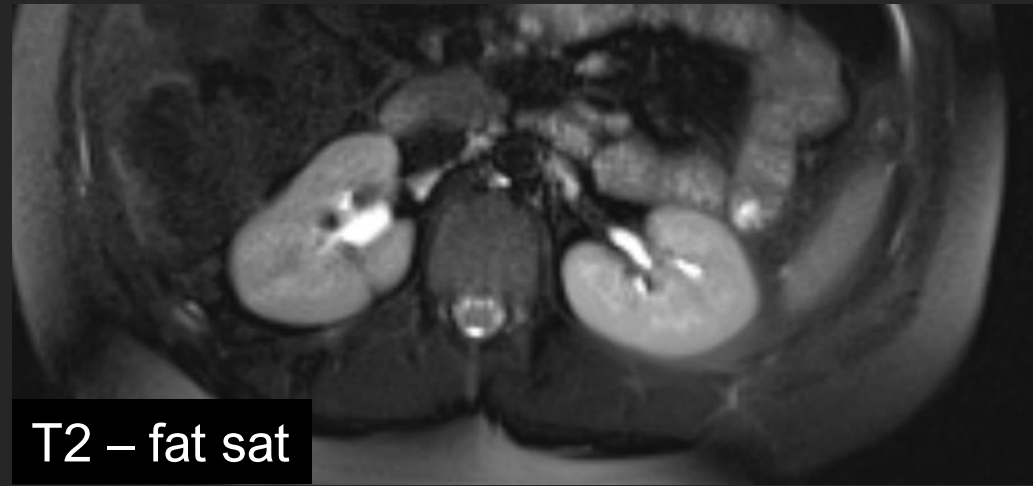
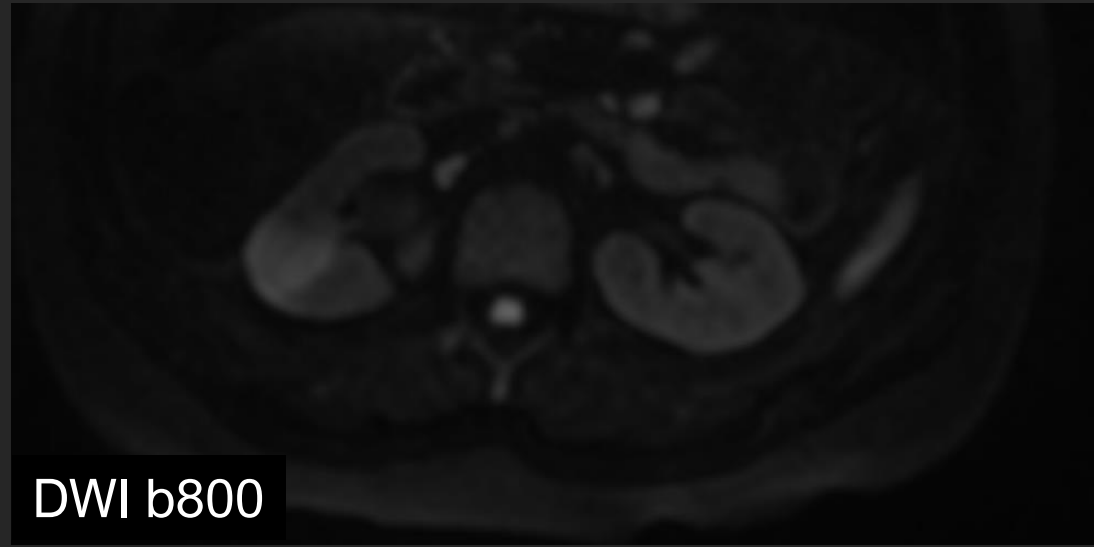


Pitfall: Very young children can present late

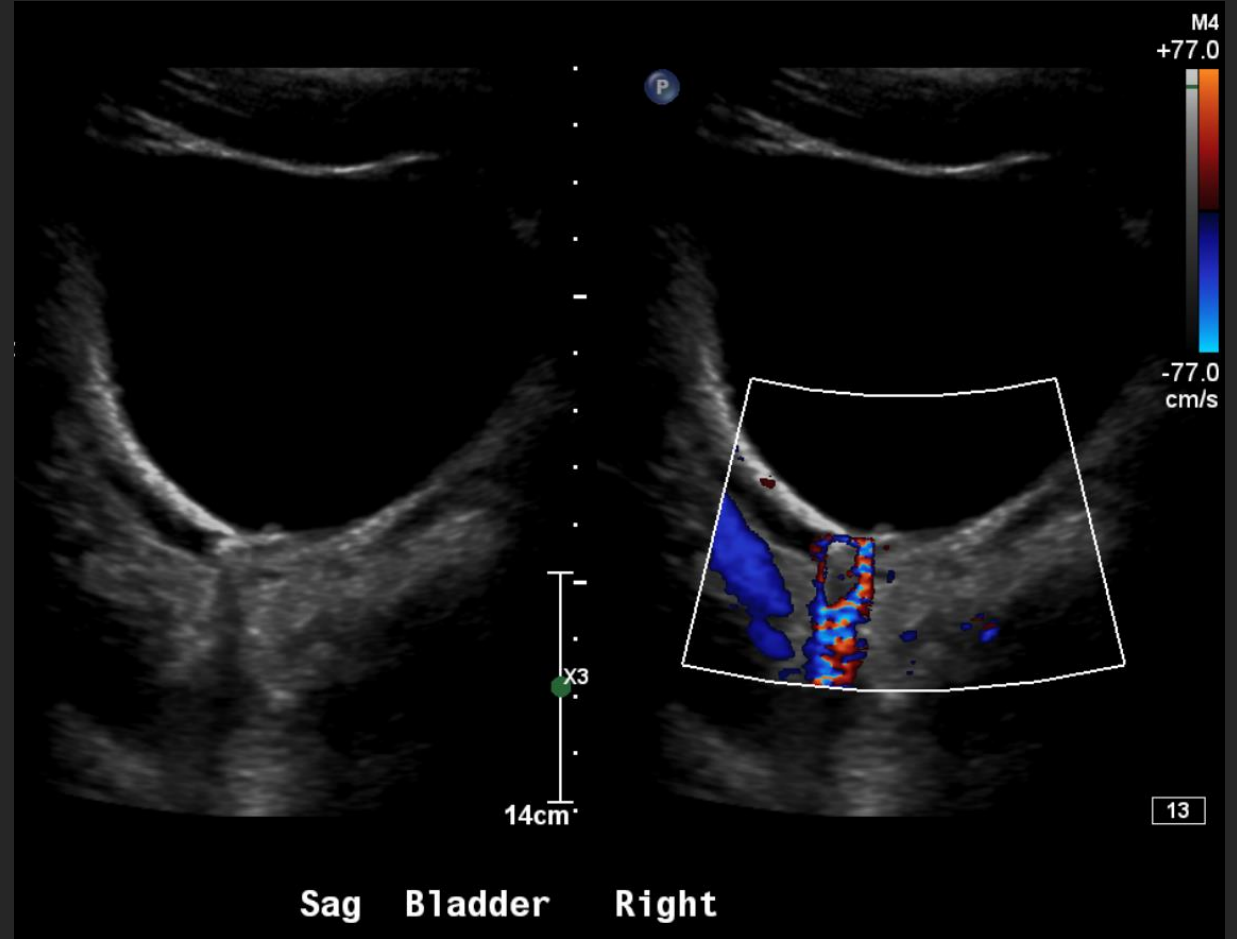


3-year old w/ fever, abdominal pain

MR Appy: Pyelonephritis

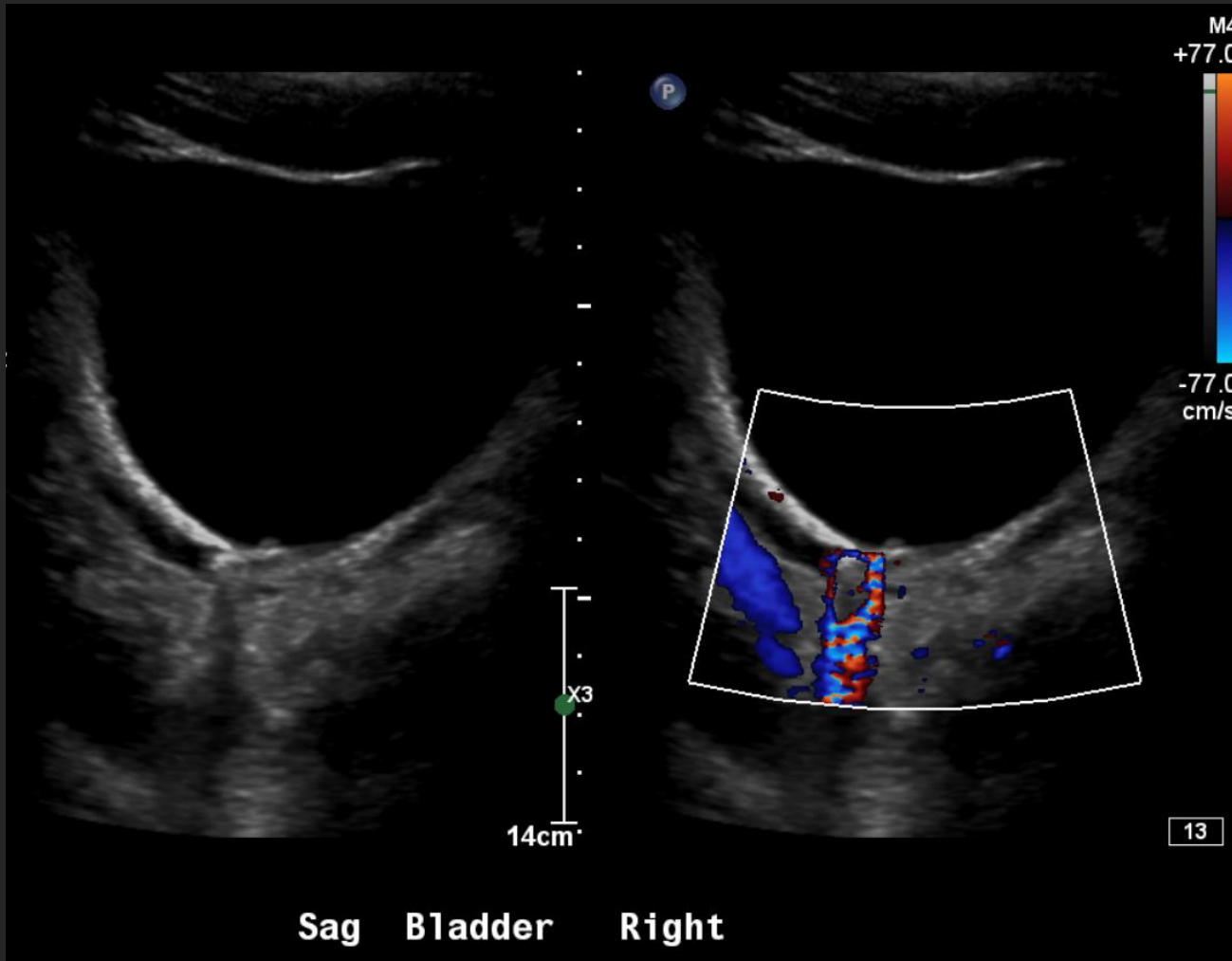


15-year old w/ right abdominal pain



18-year old w/ right lower quadrant pain

Urolithiasis



18-year old w/ right lower quadrant pain

- US Features
 - Echogenic
 - Posterior shadowing
 - Twinkle
- 60% false positive
- All 3 findings
 - 95% specific
 - 31% sensitive

Pediatric Urolithiasis

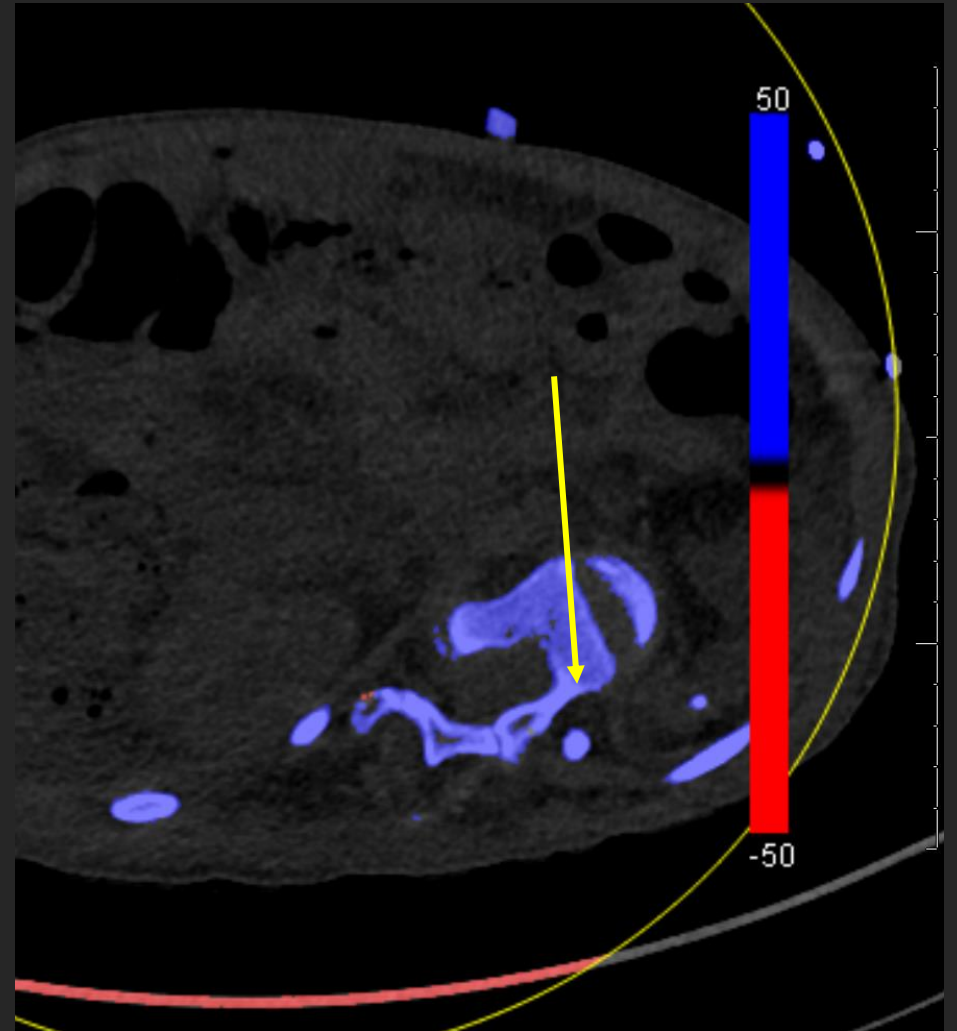
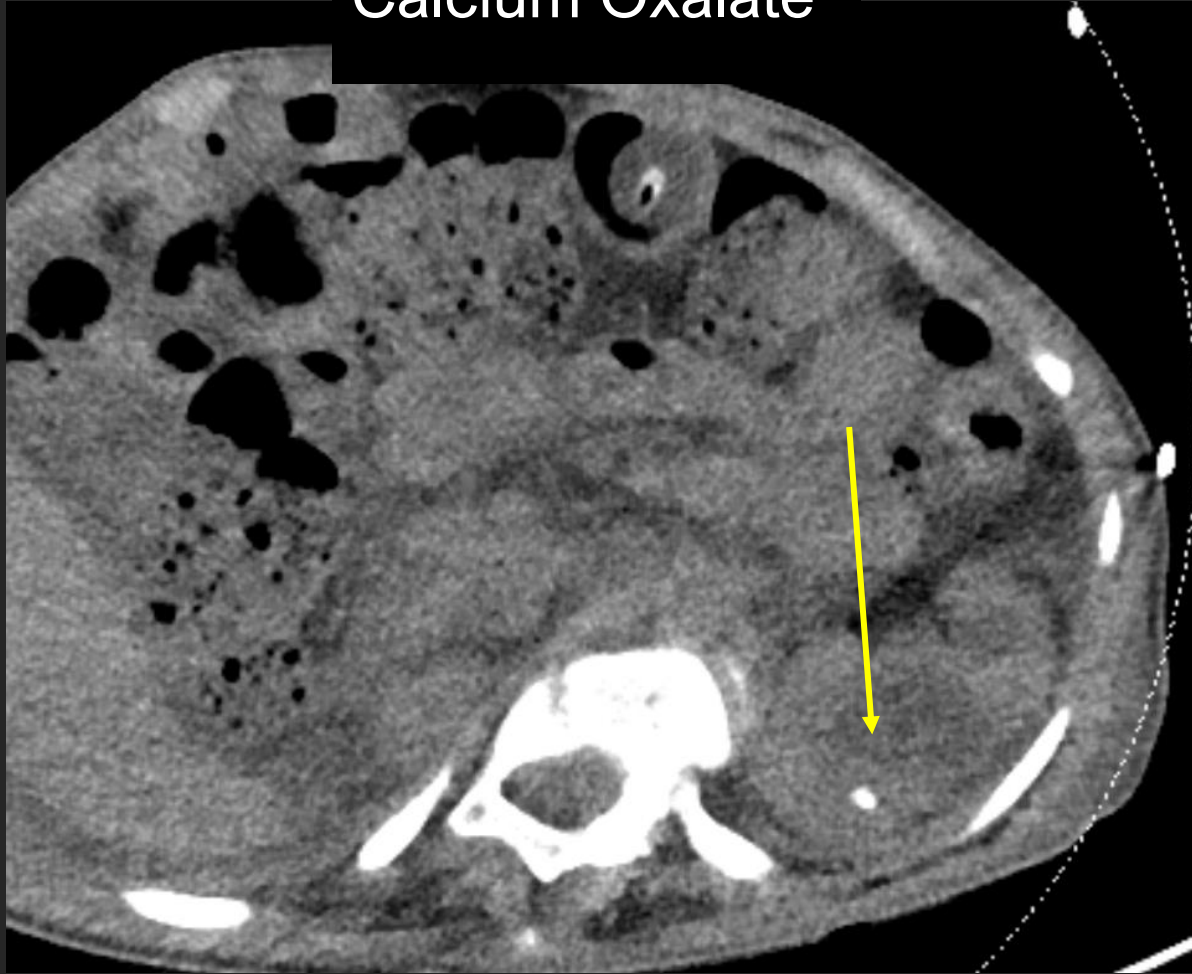
- Positive family history
- Solute excretion abnormality
- Urinary tract malformations
- Inflammatory bowel
- Cystic fibrosis
- Immobility

Types

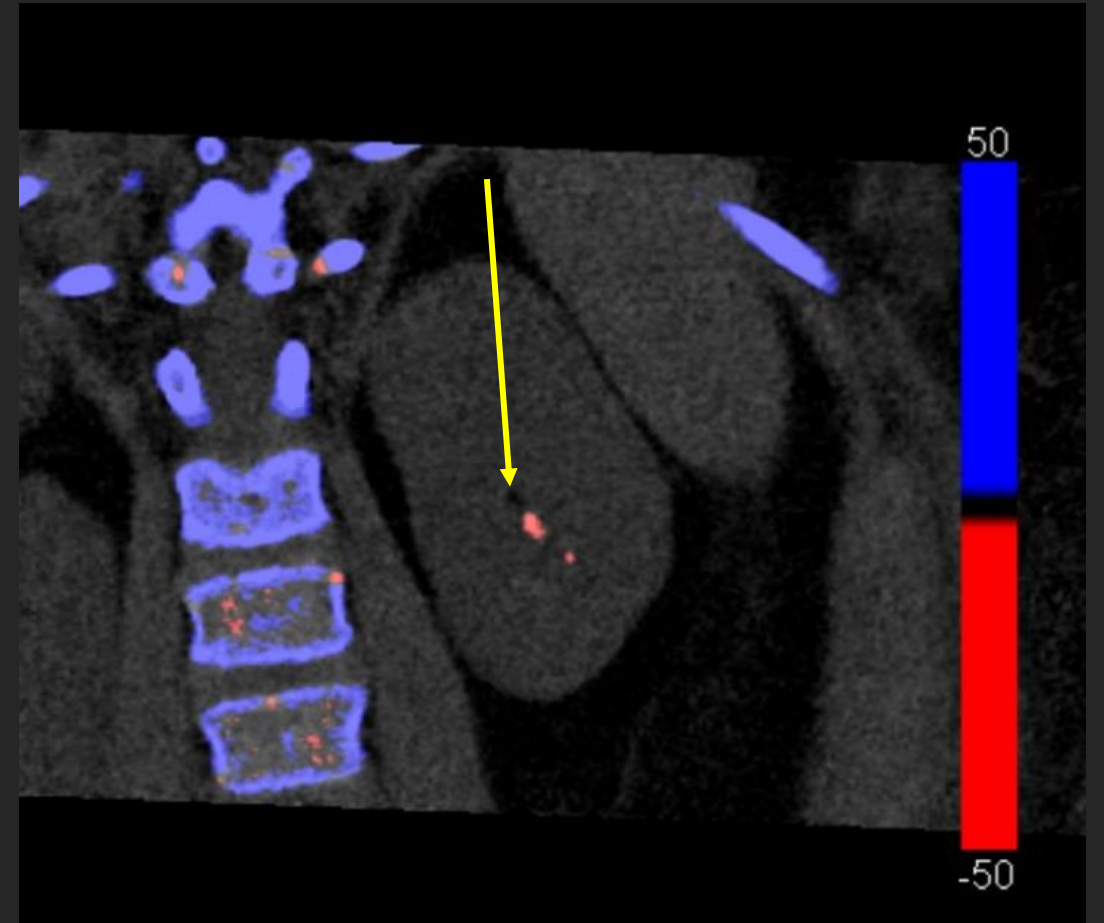
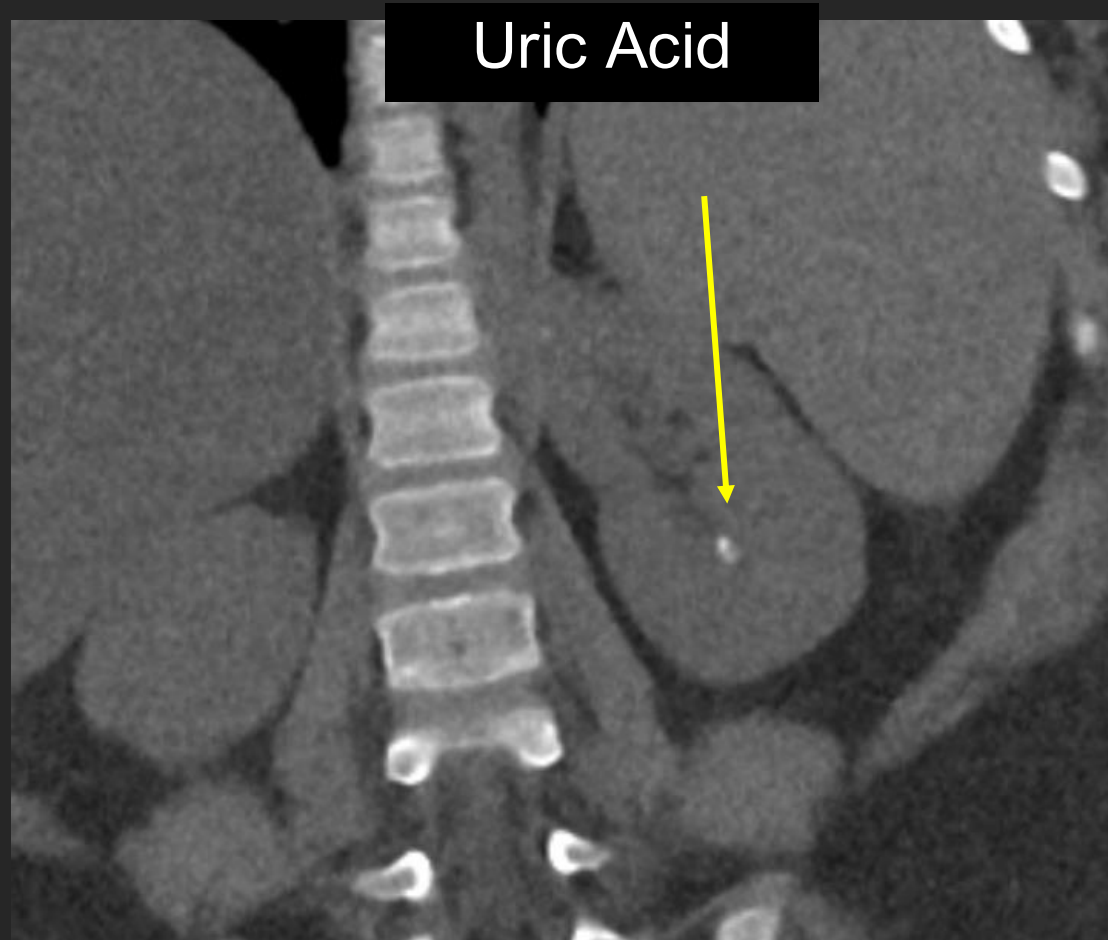
- Calcium oxalate
 - Struvite (infectious)
 - Uric acid
 - Cystine
-

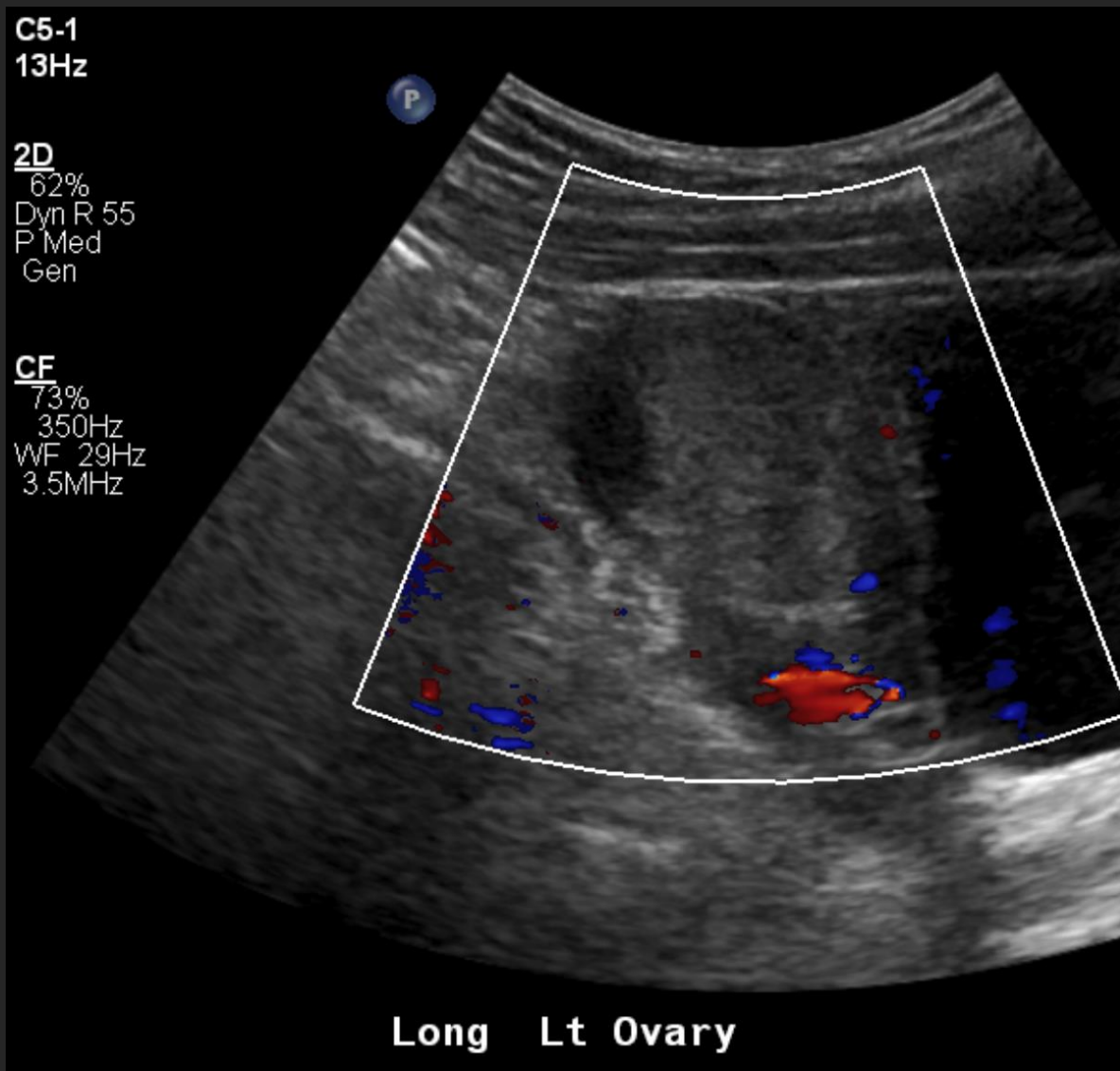
Dual Energy CT - Calcium Map

Calcium Oxalate



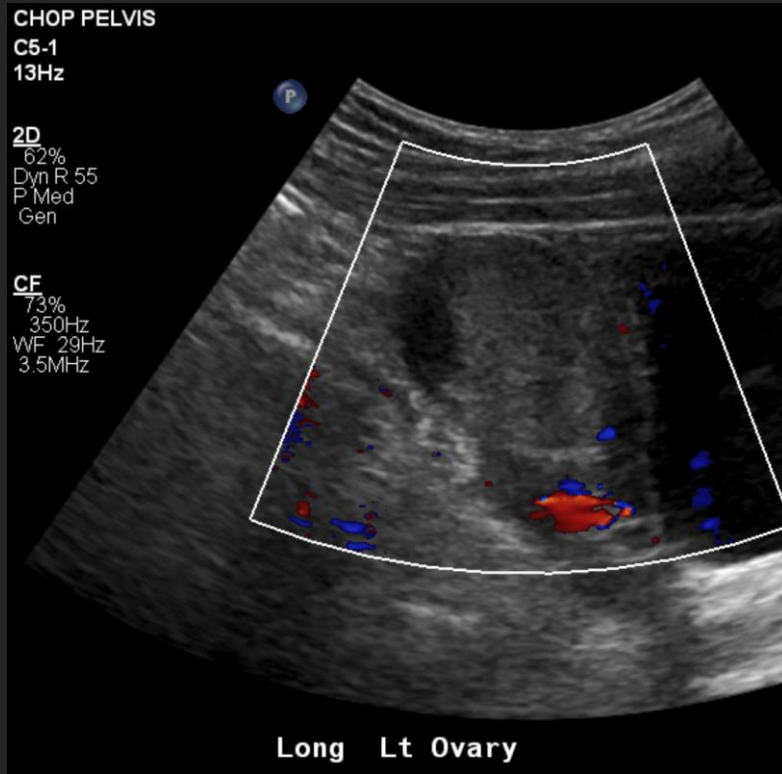
Dual Energy CT - Calcium Map





11-year old w/ left lower quadrant pain

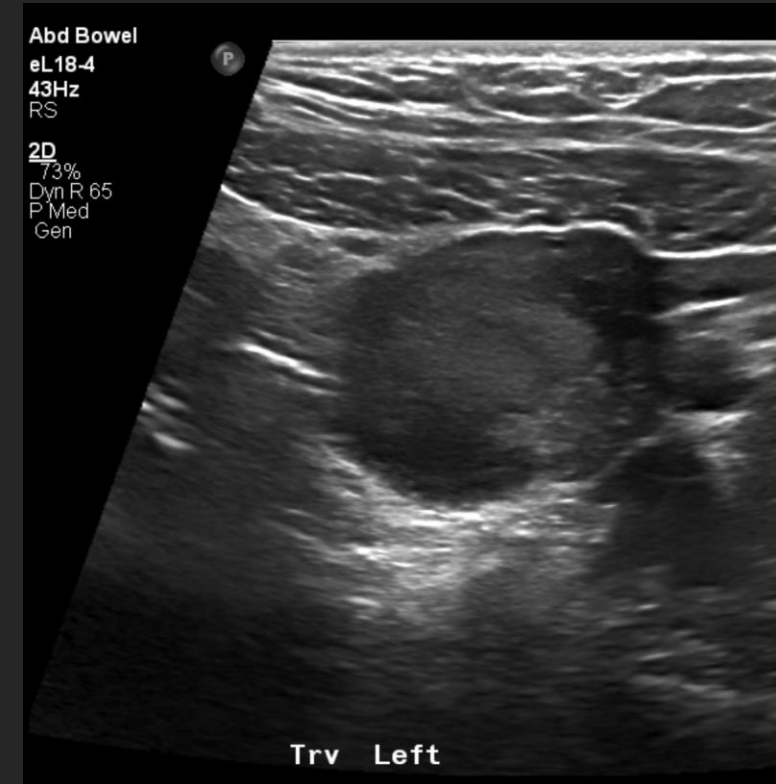
Troubleshooting: Use higher freq



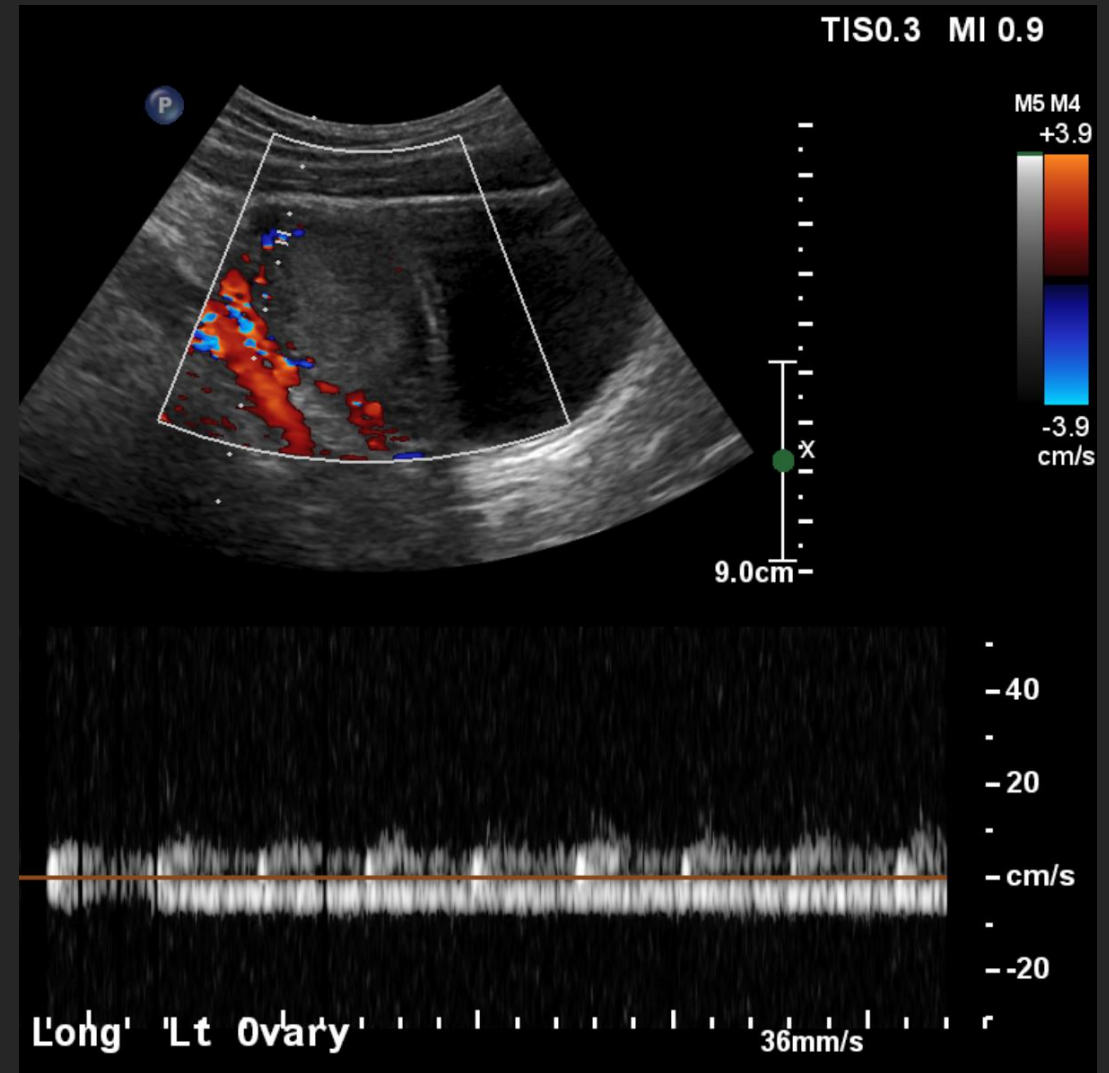
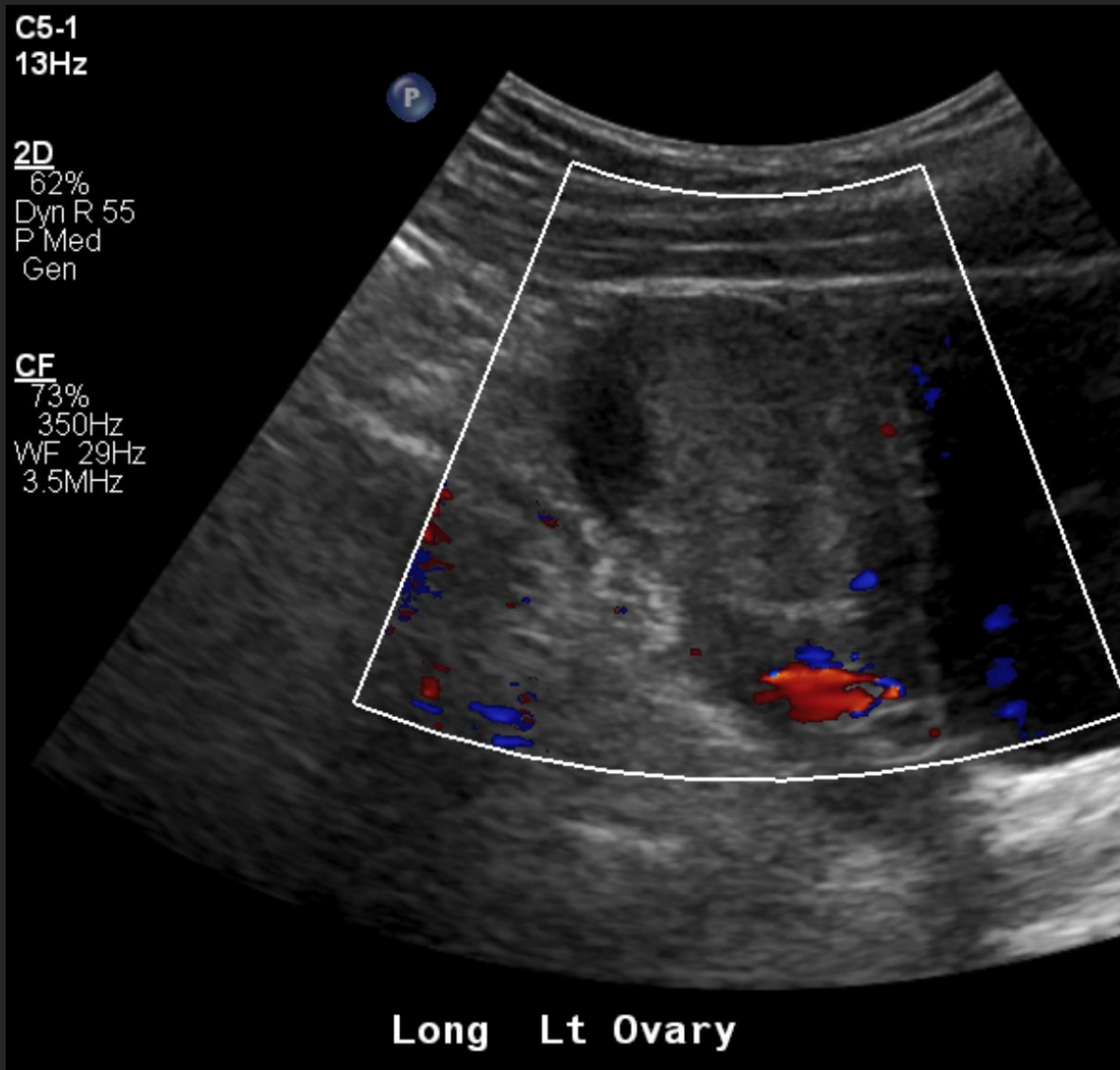
5-1



12-5

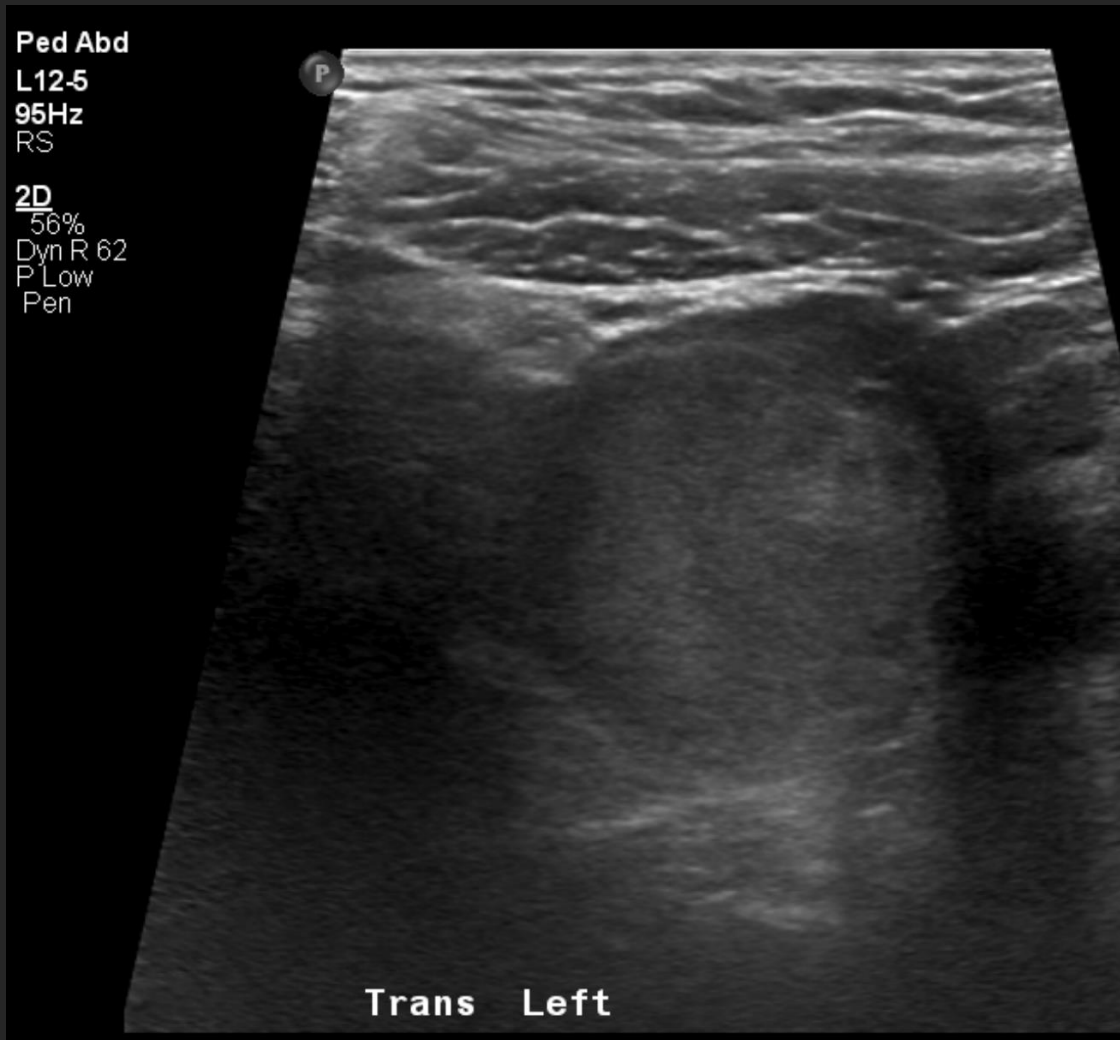


18-4



11-year old w/ left lower quadrant pain

Hemorrhagic Ovarian Cyst



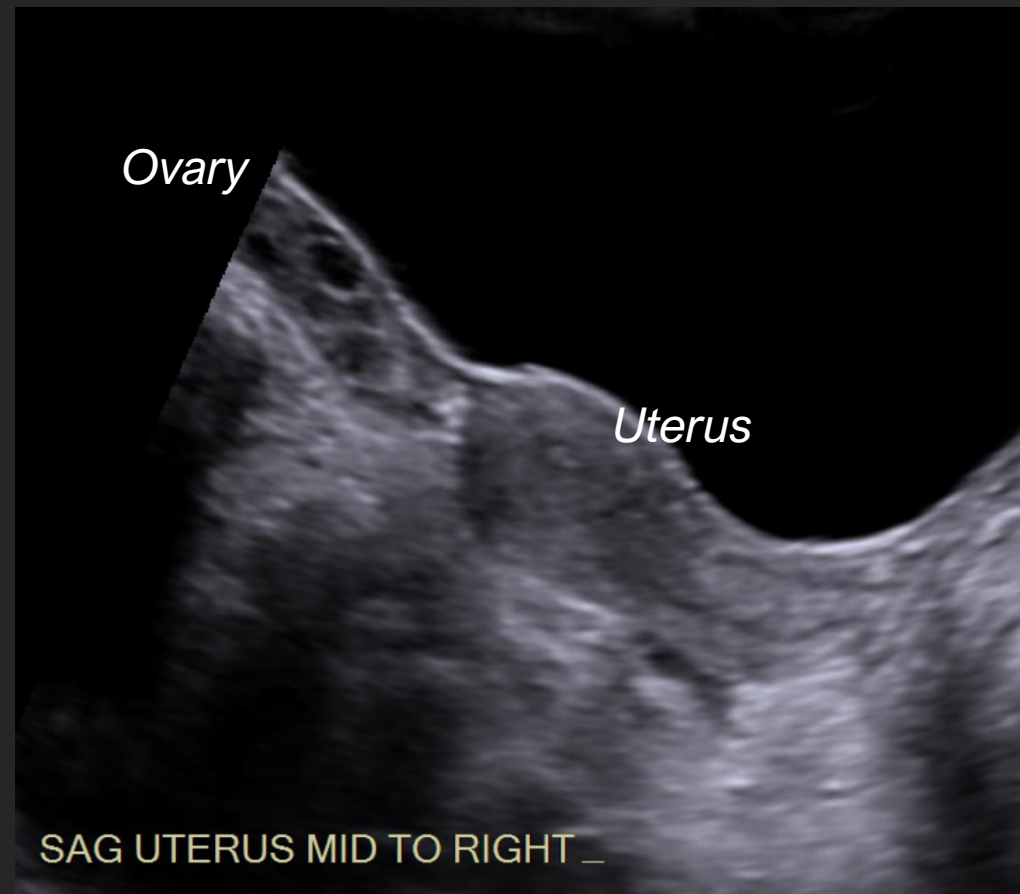
11-year old w/ left lower quadrant pain

Improve evaluation:

- Higher frequency probe
- Full bladder for transabdominal US
 - 75 ml for ≤ 6 -years old
 - 150 ml for 7-years old – menarche
 - 250 ml for post-menarchal



15-year old w/ right lower quadrant pain



Tubal Torsion



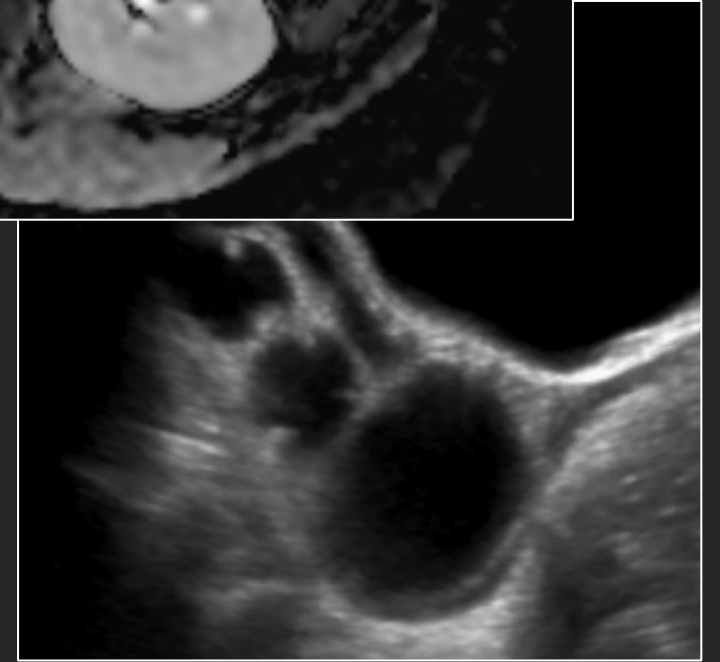
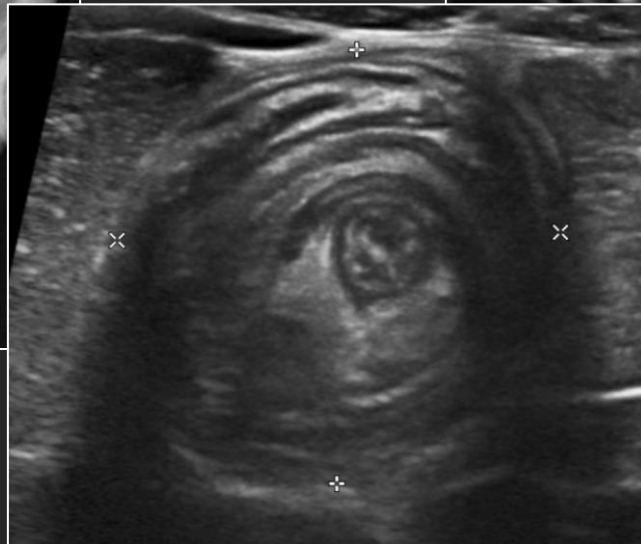
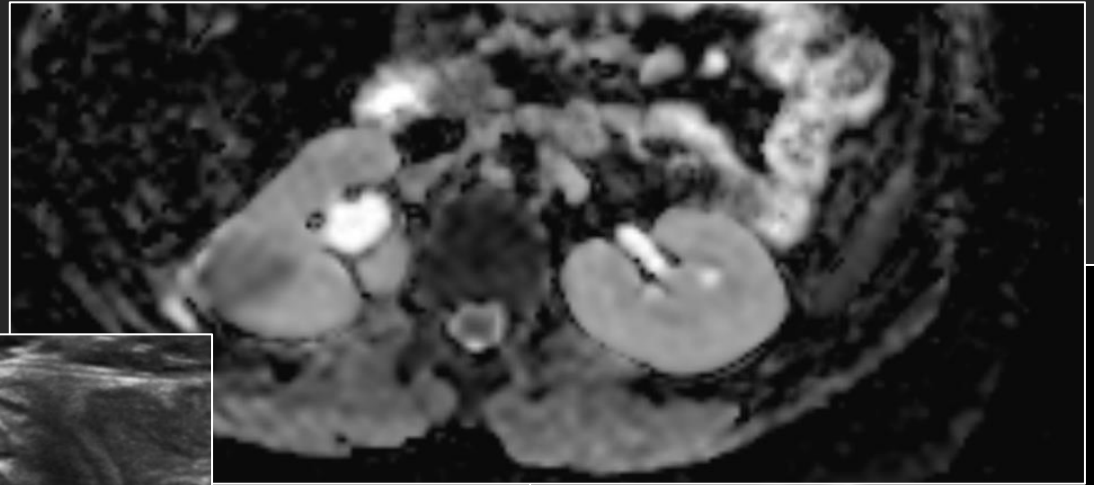
15-year old w/ right lower quadrant pain

- Signs of tubal torsion
 - “spokewheel”
- Often associated with paratubal/adnexal cyst
 - Ovary normal
- **Tubular or fluid-filled cysts in adnexal are tubal torsion until proven otherwise**

Key Points

- Radiographs typically 1st-line imaging modality for pediatric abdominal emergencies
 - Ultrasound 2nd-line
 - Midgut volvulus can be diagnosed with US
 - MR appendicitis diagnostically equivalent to CT and saves radiation
 - US specificity for urolithiasis may be high but sensitivity is low
 - Non-peristalsing tubular fluid in the adnexa considered tubal torsion until proven otherwise
-

Pediatric Abdominal Emergencies



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