

**Texas Children's
Hospital®**

Pediatric Surgical Emergencies

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Objectives

1. Define Pediatric Surgical conditions that may require emergent surgical intervention
2. Identify appropriate management in a Pediatric Surgical Emergency
3. Identify surgical conditions that commonly affect pediatric patients and how they present.

No disclosures.

The Surgical Patient

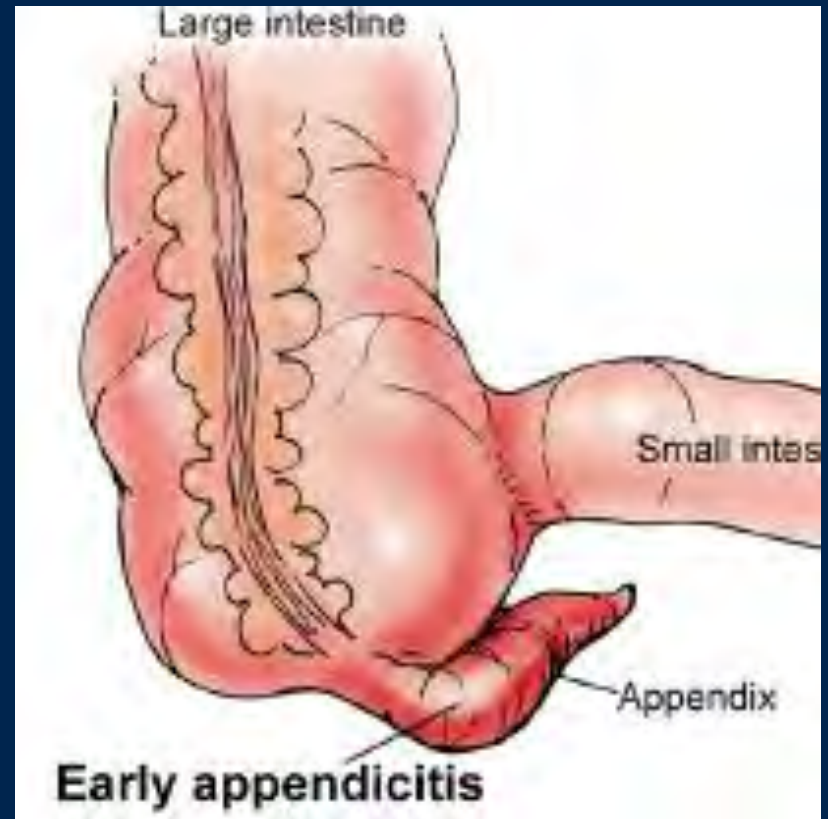
- Emergent
- Urgent
- Non-urgent

- Our Job:
 - Appropriately manage expectations
 - Communicate - convey meaningful information

Pediatric Surgical Emergencies

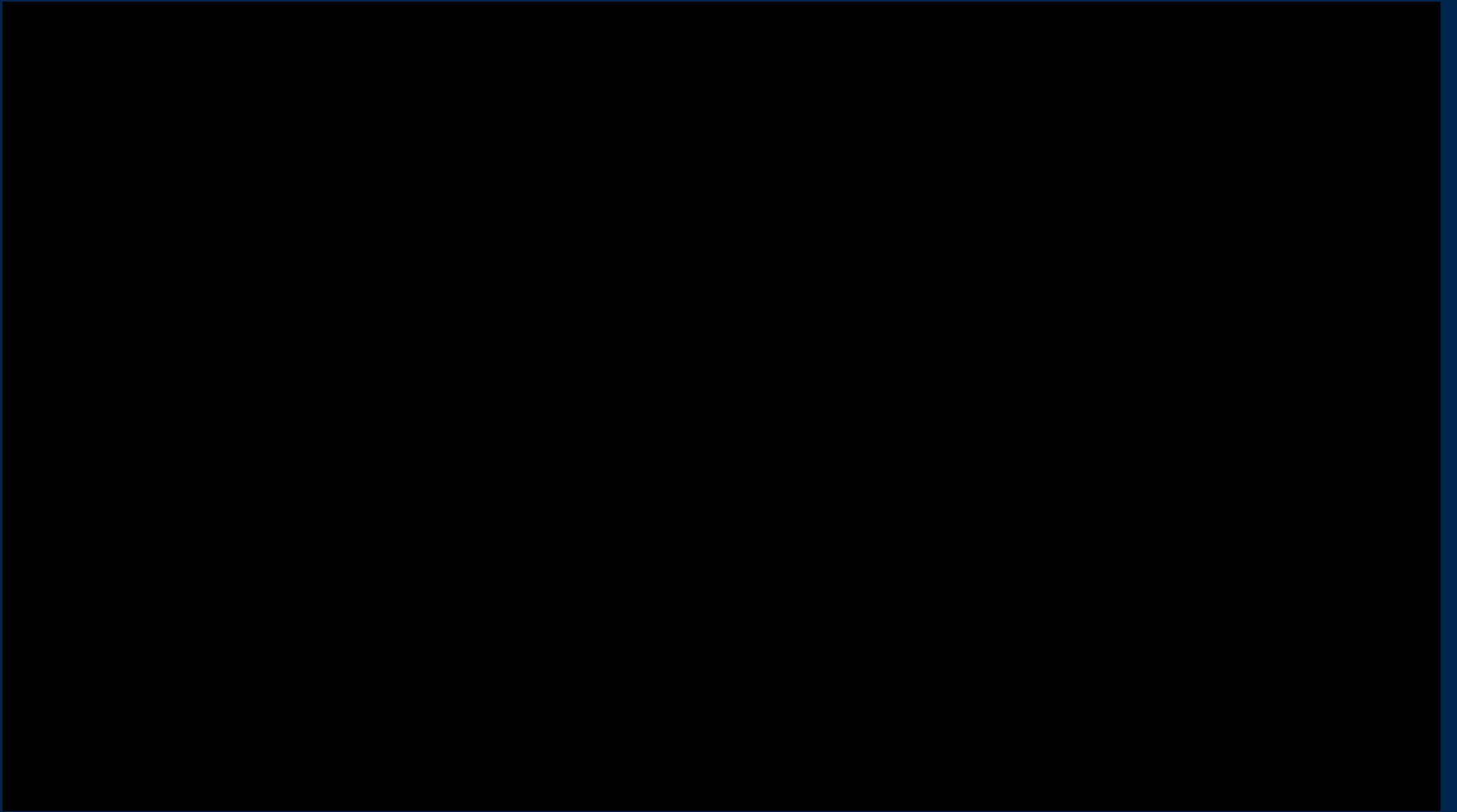
- Appendicitis
- Pyloric Stenosis
- Intussusception
- Intestinal malrotation
- Spontaneous Pneumothorax

Appendicitis



Appendicitis

- Inflammation of the vermiform appendix
- Exact cause is unknown
 - obstruction of the appendiceal lumen
- Prevents the escape of secretions → a rise in intraluminal pressure → mucosal ischemia with stasis → bacterial overgrowth
- Fecolith, parasites, calculi, foreign body, neoplasm, stricture of worms, lymphoid hyperplasia secondary to Crohn's disease,
- Carcinoid syndrome (rare)

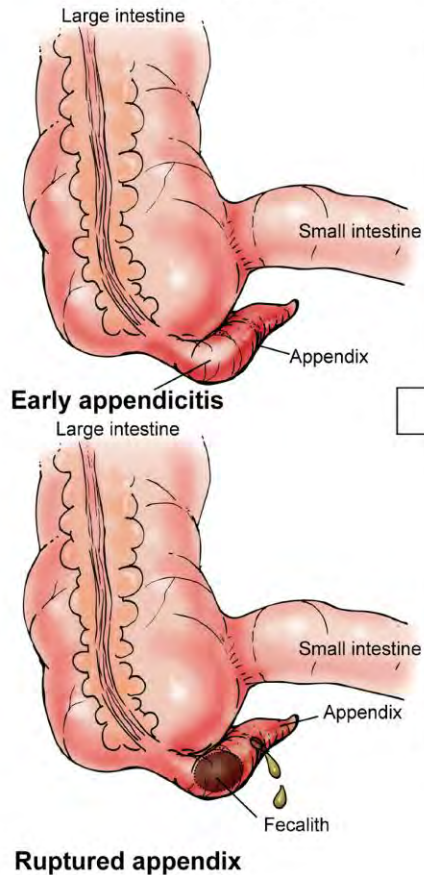


Appendicitis

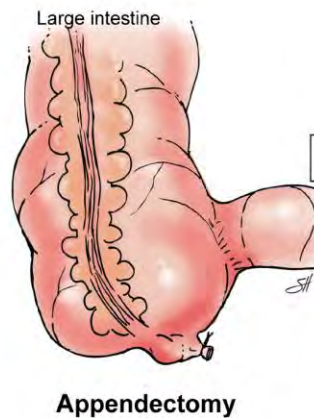
- Acute appendicitis is the most common abdominal condition requiring surgery in children
- > 320,000 operations in the United States annually.
- > 1200 cases at Texas Children's annually
- 1/3 of all childhood admissions for abdominal pain
- 60% are “simple” or uncomplicated
- 40% are advanced or complicated
 - Includes gangrenous without perforation or perforated
 - Abscess without visible perforation, assume perforated

Appendicitis

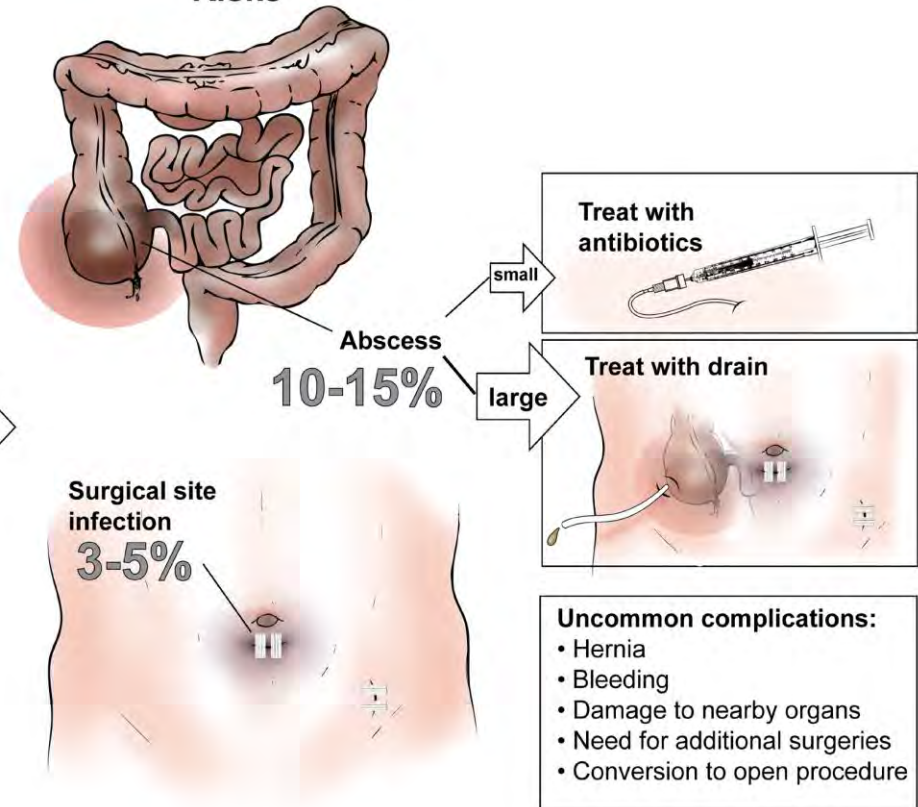
What You Have



The Operation



Risks



Question

- Which of the following signs will not lead to a suspicion of acute appendicitis?
 - A. + Blumberg's sign
 - B. + Rosving's sign
 - C. + Tinel's sign
 - D. + Psoas sign

- Answer:
- C. + Tinel's sign

Appendicitis

- Physical Exam Findings:
- Pain over McBurney's point
- Rovsing's sign: palpation of the left lower quadrant causes pain in the right lower quadrant
- Blumberg's sign = rebound tenderness
- Psoas sign
- Obturator sign
- Painful ambulation/jumping in place

Differential Dx

- Mesenteric adenitis (Gastro)
- Omental torsion
- Strep pharyngitis
- Meckel's diverticulum
- Intussusception
- PID
- Ectopic pregnancy
- **Mittelsmerz**

Appendicitis

- Uncomplicated v. Complicated
 - Simple
 - Gangrenous
 - Perforated
 - With or without abscess
- PAS score
- US results
 - Skilled US technician
 - >95% of patients at TCH receive US as part of dx

Appendicitis

TCH Appy scoring system

- 1 = Normal completely visualized appendix
- 2 = Partially visualized appendix - no findings to suggest appendicitis
- 3 = Non-visualized appendix - no findings to suggest appendicitis
- 4 = Equivocal study - e.g. peri-appendiceal inflammation or borderline
- appendiceal enlargement but otherwise normal appendix
- 5 = Appendicitis
 - -5a = Not perforated
 - -5b = Perforated

Appendicitis

Is it perforated??

- Infants – higher chance of perforation
- 70% - 95% of children < 1 year old
- 70% - 90% of children 1-4 years old
- 10% - 20% of adolescents with acute appendicitis have a perforated appendix.
- The reported median perforation rate in children is 38.7%.

Appendicitis PAS Score

- **Pediatric Appendicitis Score (PAS) [point value] (8-11)**
- ☐ Migration of pain [1]
- ☐ Anorexia [1]
- ☐ Nausea/Vomiting [1]
- ☐ RLQ tenderness [2]
- ☐ Cough/Hopping/Percussion tenderness in RLQ [2]
- ☐ Elevation of temperature [1]
- ☐ Leukocytosis ($\geq 10,000$) [1]
- ☐ Differential WBC with left shift [1]

Appendicitis PAS Score

- *The PAS is the cumulative point total from all clinical findings
- **PAS ≤ 4 : low suspicion for appendicitis**
- NOTE: sensitivity of 97.6%, with a negative predictive value of 97.7%
- **PAS 5-7: equivocal for appendicitis**
- **PAS ≥ 8 : high suspicion for appendicitis**

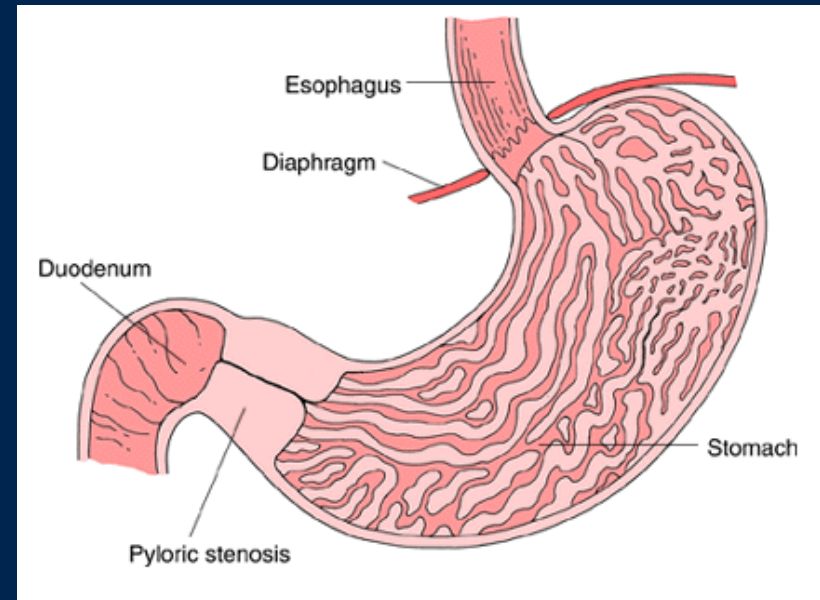
Appendicitis Treatment

- Antimicrobial stewardship
 - All patients diagnosed with appendicitis will be started on appropriate antibiotic therapy
- Surgery
 - Laparoscopic approach
 - Delayed appendectomy for interval approach
- Interval Appendectomy
 - >7 days symptoms + well defined walled off abscess
 - Localized pain
 - Interventional Radiology consult for drain placement
 - IV antibiotics

Pyloric Stenosis

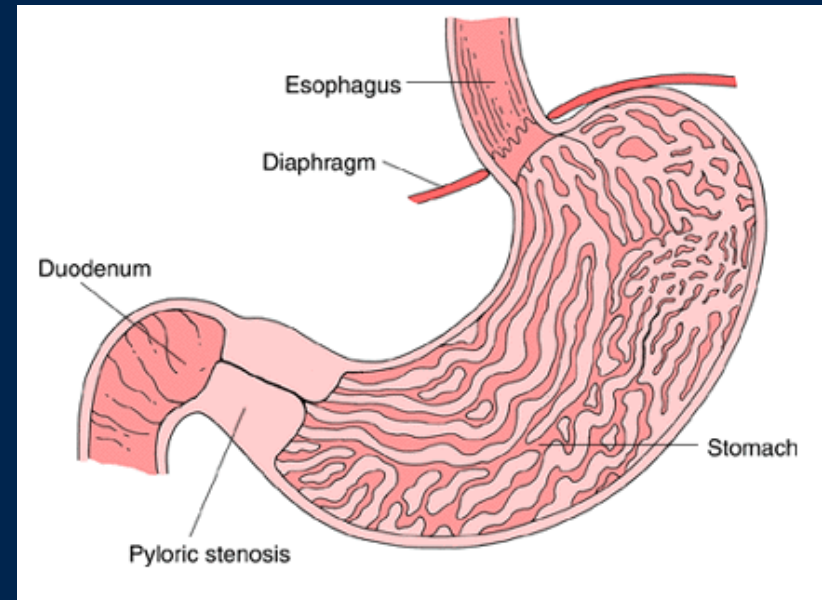
Pyloric Stenosis

- Hypertrophy of pyloric muscle
- Can lead to complete gastric outlet obstruction
- “Cervix sign”
- “String sign” on US



Pyloric Stenosis

- 2 – 12 weeks of age
- Projectile vomiting
- Weight loss or failure to gain weight
- Progressive
- White/Hispanic
- Primiparity
- Male:female - 4:1
- Very treatable, quick recovery



Question

- Vomiting in an infant with pyloric stenosis is almost always non-bilious.
- A. True
- B. False

- Answer:

- A. True

Pyloric Stenosis

- Severe dehydration/Electrolyte imbalance
 - Check electrolytes
 - Proper and aggressive resuscitation
 - Bolus + 1.5 maintenance fluid on presentation
 - Continue 1.5 maintenance IVF until electrolytes normalize
- Risk of aspiration with multiple episodes of emesis
- Severe malnutrition

Physical Exam

- Metabolic alkalosis
- Sunken fontanel
- Poor skin turgor
- Inadequate UOP
- Small for age

Question

- Does pyloric stenosis require emergent surgical intervention?
 - A. No, “Urgent resuscitation, rather than emergent surgical intervention is the rule”
 - B. No, “Emergent surgical intervention, rather than urgent resuscitation, is the rule
 - C. Yes, these patients must be rushed to the OR
 - D. There are no rules

- Answer:
- A. No, “Urgent resuscitation, rather than emergent surgical intervention is the rule”

Pyloric Stenosis

- US gold standard for dx
- Treat dehydration first!
- Laparoscopic v. open pyloromyotomy
- Most common now is laparoscopic
 - Small scars v old school large incisions

Pyloric Stenosis

- Caution with this surgery
 - Do not disrupt the mucosa
 - What happens if you do?
- Risks of surgery
 - Mucosal perforation 1-3%
 - Incomplete myotomy 1-3%
 - Wound infection 1-3%



Intussusception



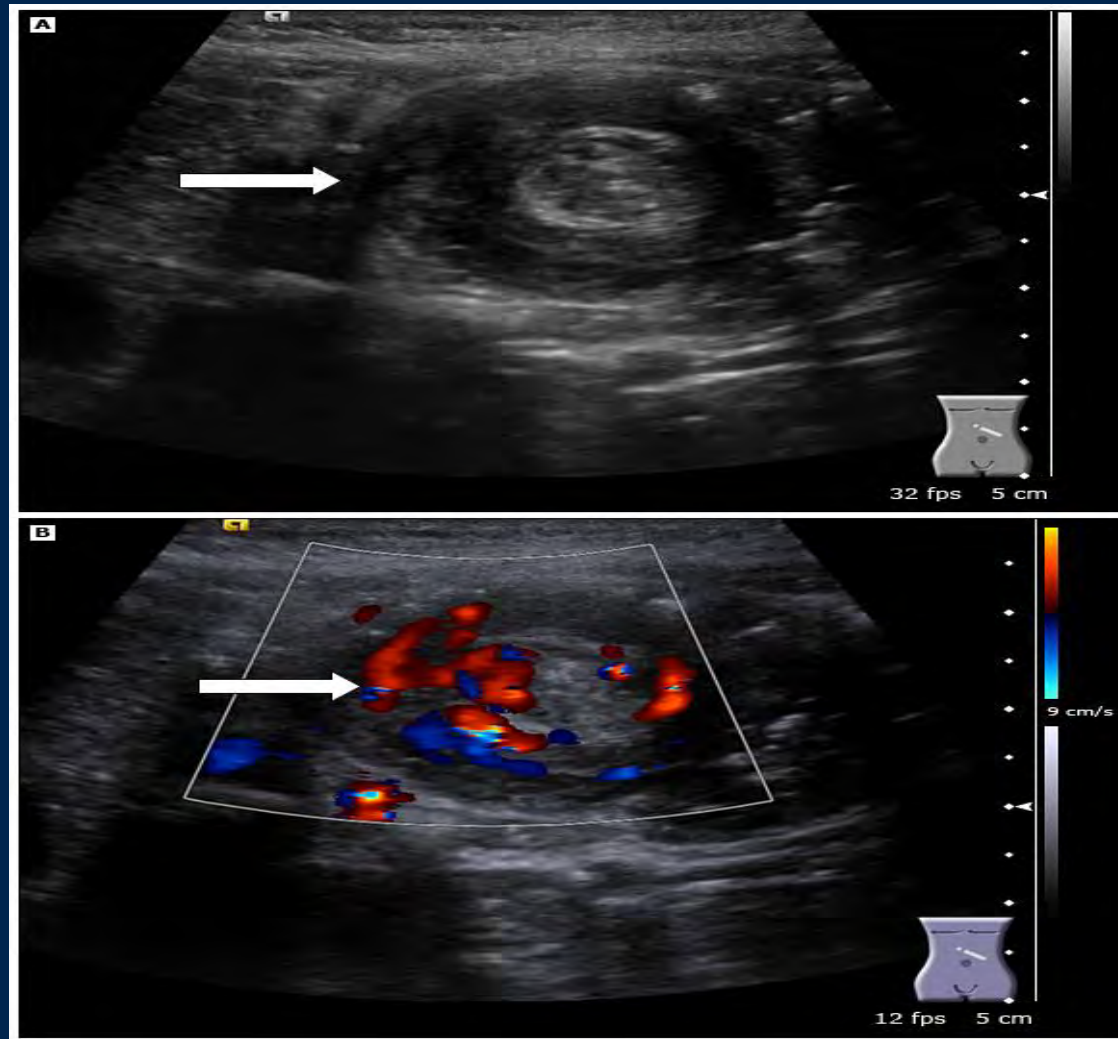
Intussusception

- Invagination or telescoping of intestine onto itself
- Most common in infants and toddlers
- Sudden onset abdominal pain
- Intermittent, severe colicky abdominal pain, may follow recent viral infection, oblong mass in RUQ, vomiting
- Viral illness

Intussusception

- Currant jelly stools
 - May be a latent sign, severe inflammation
- Typically Ileocolic intussusception
- Consider a mass lead-point when older patient or recurrent
- Small bowel – small bowel intussusception
 - Transient, incidental finding

Intussusception



Intussusception

Treatment

- Air contrast enema v barium enema reduction
 - Normal vital signs
 - No evidence of peritonitis
 - Surgery back up in case of perforation during procedure

Intussusception

Treatment

- Surgical intervention
 - Laparoscopic v open reduction
 - Signs of peritonitis = possible perforation
 - Perforation during radiology procedure
 - Surgical emergency

Case Study

- 2 month male no PMH presents with 2 days of emesis that has progressed to bilious emesis. Lethargic. Making wet diapers, non-bloody BM 1 day ago.
- PE: VSS, faint crying, mild pallor, abdomen slightly firm with minimal distention. Grimaces with moderate palpation. Normal bowel sounds.
- Gluc 77 mg/dl, lytes wnl

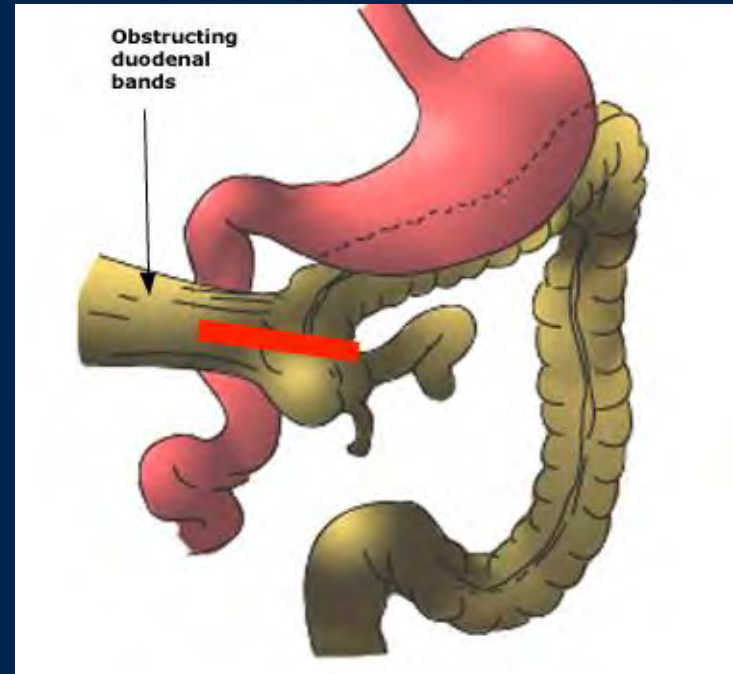
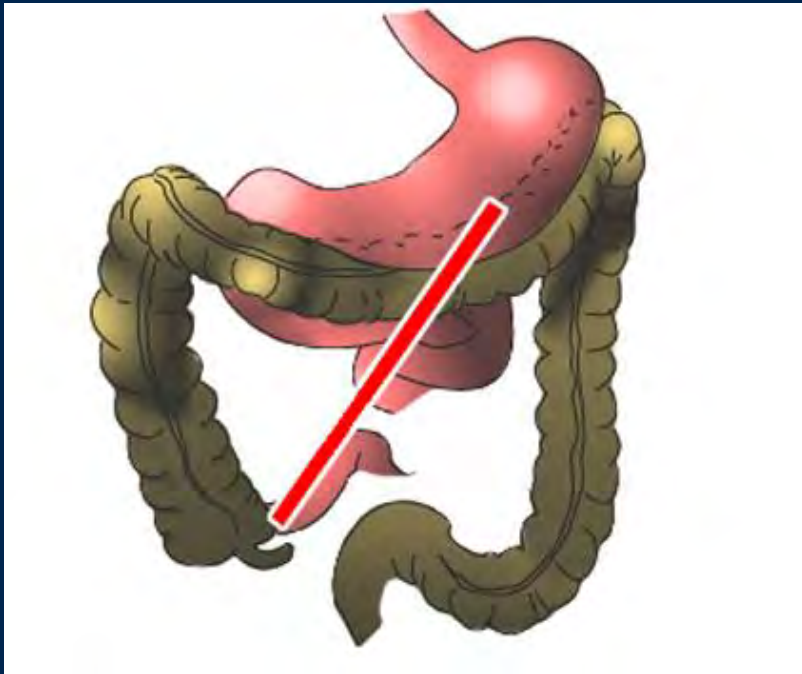
Case Study con't

What was **most likely** seen on US?

- A. Intussusception
- B. Midgut volvulus
- C. Perforated Appendicitis
- D. Pyloric stenosis

Malrotation

- Abnormal rotation during embryonic development of the gut
- Normal v abnormal rotation



Malrotation with Volvulus

- Bilious emesis in a child <1 year old = malrotation with midgut volvulus until proven otherwise!!
- EMERGENT surgical intervention
- High suspicion – must rule this out
- Examine for signs of peritonitis
- Always ask if baby is making wet diapers

Malrotation with Volvulus

- Signs of perforation or intestinal ischemia
 - Peritonitis
 - Shock
 - Hematochezia
- Appropriate resuscitation
- Immediate surgical intervention

Spontaneous Tension Pneumothorax

- Presence of air in pleural cavity
 - Between chest wall and lung tissue
- Sudden onset chest pain and shortness of breath
- Adolescents
- CXR: unilateral collapsed lung, mediastinal shift
- Oxygen
- Needle decompression/thoracostomy tube placement
- Admission

Other Considerations

- Imperforate anus
 - Take of the diaper!
- Anal atresia
- Post abdominal surgery
 - Bilious emesis
 - Adhesive bands
- Battery ingestion
 - May lead to intestinal ischemia and perforation
- Magnets
 - Intestinal perforation

References

- [Fallon SC¹, Orth RC², Guillerman RP³, Munden MM³, Zhang W⁴, Elder SC¹, Cruz AT⁵, Brandt ML¹, Lopez ME¹, Bisset GS³. *Pediatr Radiol*. Development and validation of an ultrasound scoring system for children with suspected acute appendicitis. 2015 Dec;45\(13\):1945-52. doi: 10.1007/s00247-015-3443-4. Epub 2015 Aug 18.](#)
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