

Acute Abdomen in Children

Khaled Al-Omar

Presentations

History

- Ages
 - Children < 3 years → difficult to Dx
 - Atypical Presentation
 - Don't complain of pain (cry, irritable, poor feeding)
 - Late → septic (lethargic, Non-responsive, vomiting)
 - Children > 3
 - Similar to adult Symptom & Signs
 - Girls 12-16
 - DDX ovarian pathology (rupture cyst, torsion)
 - U/S is helpful

- **Neonatal causes:**

- Necrotizing enterocolitis
- Obstructive causes
- Mega colon
- Meconium plugs
- Atresia and its types
- Malrotation
- Birth injuries
- Gastroenteritis

- **Infant causes:**

- Nonspecific abdominal pain
- Complicated hernia
- Intussusception
- Malrotation
- Volvulus and vascular insufficiencies

Necrotizing Enterocolitis

- What is it?
 - Disorder involving inflammation and ischemic necrosis of intestinal walls.
 - Exact cause is uncertain. Popular theories include infection, inadequate perfusion of gut.
- Why is it important to identify NEC as early as possible?
 - NEC is a progressive disease with mortality rates from 15-30% (inversely related to gestational age and birth weight)

Epidemiology

- Occurs in 1-3 out of 1000 live births
- Males = Females
- Ethnic Incidence: Black > White > Hispanic infants
- While it is more common in premature, VLBW infants (<1500g), 13% occur in term infants (often with preexisting illness).

Staging NEC – Bell's Classification

Stage	Clinical findings	Radiographic findings
I: Suspected NEC		
Ia	Temp instability, apnea, lethargy, increased residuals, abd distention.	Normal or mild ileus.
Ib	See above. + grossly bloody stool.	
II: Proven NEC		
IIa	See above. + absent bowel sounds. +abd tenderness. Appear mildly ill.	Intestinal dilation, ileus, ascites, pneumatosis intestinalis.
IIb	See above. Appear moderately ill. +metabolic acidosis. +thrombocytopenia.	
III: Advanced NEC		
IIIa	See II. Bowel intact. Hypotension, bradycardia, apnea. +peritoneal signs. DIC, neutropenia.	Portal venous gas. Pneumoperitoneum (football sign) – specific for stage IIIb.
IIIb	See III. + Bowel perforation.	

Risk Factors

- VLBW infants
- Prematurity – inadequate perfusion gut mucosa
- Aggressive advancement of enteral feeding.
- Hyperosmolarity of solutions
- Bacterial overgrowth

What clinical findings should make you concerned?

- Dull, dusky-colored, distended abdomen
- Symptoms of sepsis (temp instability, poor perfusion, A/B/D, lethargy)
- Large, bilious residuals
- Bloody stool
- Hypoactive/absent bowel sounds
- Abdominal tenderness



<http://www.cincinnatichildrens.org/research/div/neonatology/research-areas/clinical-investigations.htm>

Initial work up: what to look for

Labs: Findings associated with NEC

- CBC
 - Thrombocytopenia
 - Neutropenia ($<1500/\mu\text{L}$) –poor prognosis
- DIC panel (PT/INR, PTT, Fibrinogen, D-dimer)
 - Elevated PT/INR, PTT, D-dimer
 - Decreased Fibrinogen
- BMP (may have values similar to those found in sepsis)
 - Hyponatremia (<130)
 - Hyperglycemia
 - Hyperkalemia
- Blood gas
 - Metabolic acidosis
- Blood culture
- Fecal occult blood test



Initial work up

Radiology:

- **STAT abd xray**
 - AP – pneumatosis intestinalis, neg football sign
 - Cross table lateral – no free air
 - How often?
 - Every 6-12 hours
- **Abd ultrasound (another option)**
 - Gas bubbles in hepatic parenchyma
 - Pseudo-kidney sign- central echogenic focus and hypoechoic rim
 - Limitations: user dependant, not always available overnight.



Example of football sign:



Example of cross-table lateral x-ray with free air



x-ray: Pneumatosis Intestinalis

Initial Management

Medical management (10-14 days)

- Make NPO, start on IVF (consider TPN).
- Insertion of nasogastric tube to suction for decompression
- Empiric antibiotics
 - Ampicillin, gentamicin
 - Clindamycin and/or flagyl are often added for severe cases
- Cardiovascular/pulmonary support as needed
- Pediatric surgery consultation
- Lab/radiologic monitoring:
 - Q6-8 hours while patient remains acutely ill
- Check urine output every 1-2 hours
 - If low, give 10-20ml/kg/hr NS

Surgical management

- Absolute indication for surgery
 - Pneumoperitoneum
- Relative indication for surgery
 - failure to improve
 - progressive thrombocytopenia
 - Portal vein gas
 - Severe peritonitis
- Surgical intervention
 - Peritoneal drainage
 - Laparotomy with resection of affected bowel.

Prognosis

- With aggressive treatment and earlier diagnosis, 70-80% of infants survive.
- Infants requiring surgical intervention have a higher mortality rate
- About half of survivors have no long-term sequelae.
- Long term sequelae:
 - Stunted growth
 - Short gut syndrome / intestinal adhesions (in patients requiring extensive resection.
 - ELBW and infants with extreme prematurity may also have developmental delay

Appendicitis

- Most common cause of abdominal surgical emergencies in children
- > 3 years, diagnosis is mainly clinical
 - Hx, P/E and CBC+diff
- < 3 years esp. Infant, difficult Dx
 - Early rupture = (elderly group)
 - Sepsis (fever, ↑ WBC)
 - Vomiting (ileus or abscess)

Investigation

- Not needed if the clinical picture is clear
- Mainly used in difficult Dx
 - Age < 3 years
 - Atypical symptoms
 - Girls > 12 years → R/O ovarian causes
- Abdominal XR
 - R/O perforation
 - Might show
 - Fecolith
 - Localised Ileus

Investigation

- U/S
 - Available
 - No sedation needed
 - No radiation
 - Children have thin abdominal wall → can see better
- U/S is operator dependent (need a good radiologist)
- Good for
 - Ovarian cysts
 - Intussusception
 - Free fluid
 - Stones
- Not very good for
 - Meckle's diverticulitis
 - Volvulus

Investigation

- CT scan
 - Problems:
 - Radiation → future risk of malignancies
 - Young children need sedation (Not to move)
 - Need IV contrast
 - Allergies
 - Renal failure
 - Good for
 - Abscess (late appendicitis)
 - Tumors
 - Sometime it is used to Dx Appendicitis

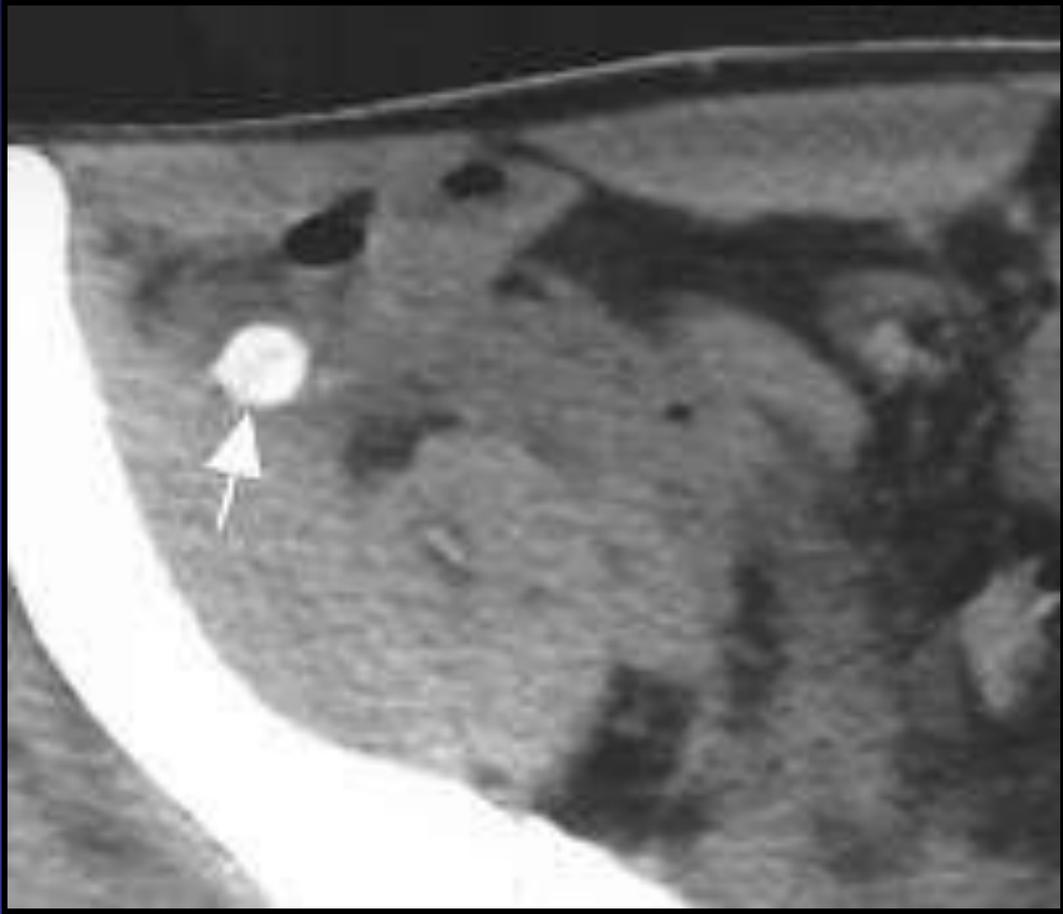
Investigation

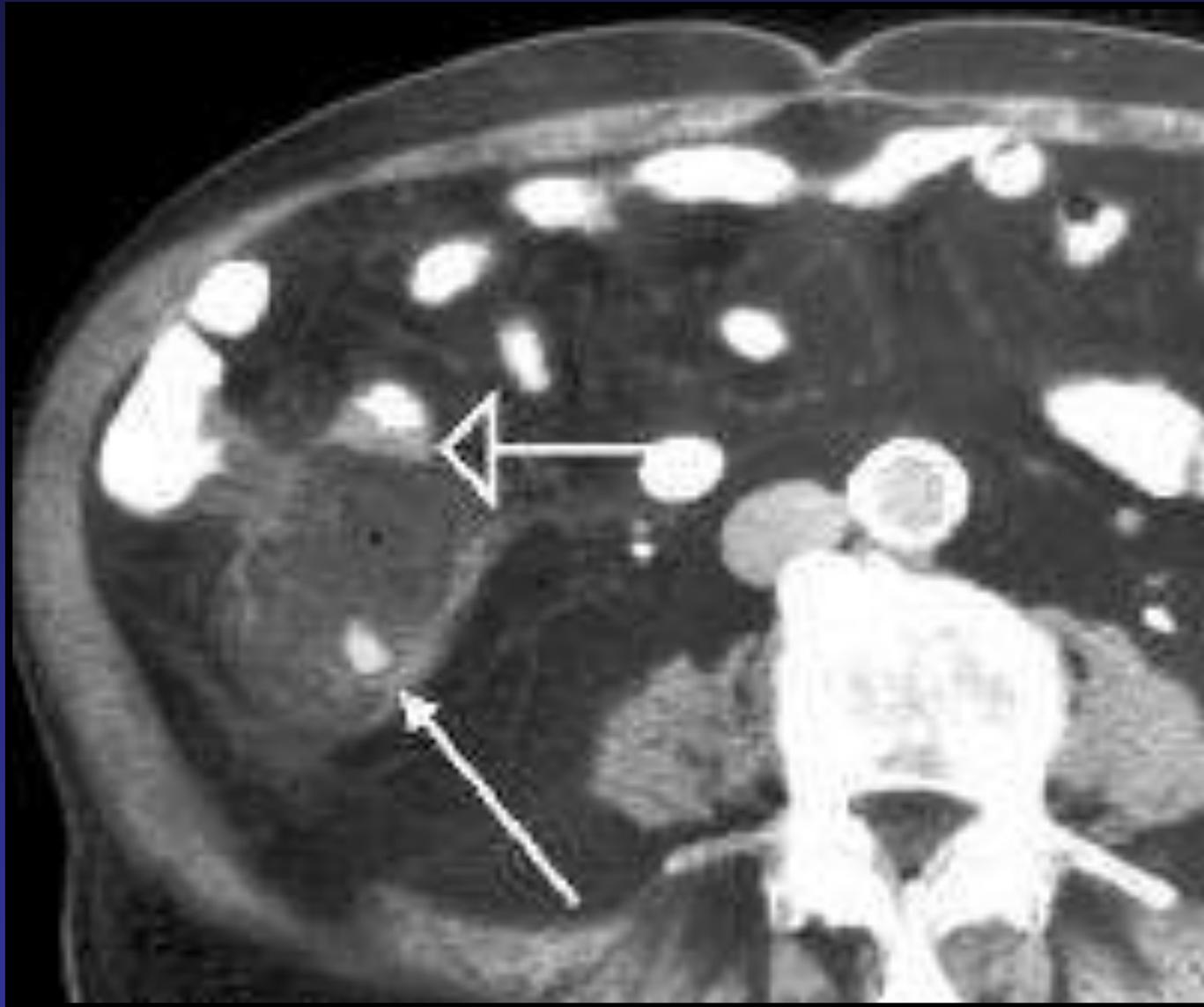
- If H&P is doesn't suggest AP
 - Low probability → observation + re-evaluation
 - Observation NPO, repeat (Exam + CBC)
 - If AP → it will become clear (worse inflammation)
 - Higher probability
 - Laparoscopy or open appendicectomy
 - 5-10% can be normal
 - When normal
 - Look for other ddx

Appendicitis

- Late presentation (ruptured)
 - Contained → abscess
 - Percutaneous drain + antibiotics
 - > 6 wks if no abscess → appendicectomy
 - Diffuse peritonitis
 - Laparotomy or laparoscopy
 - Abdominal washout
 - Appendicectomy

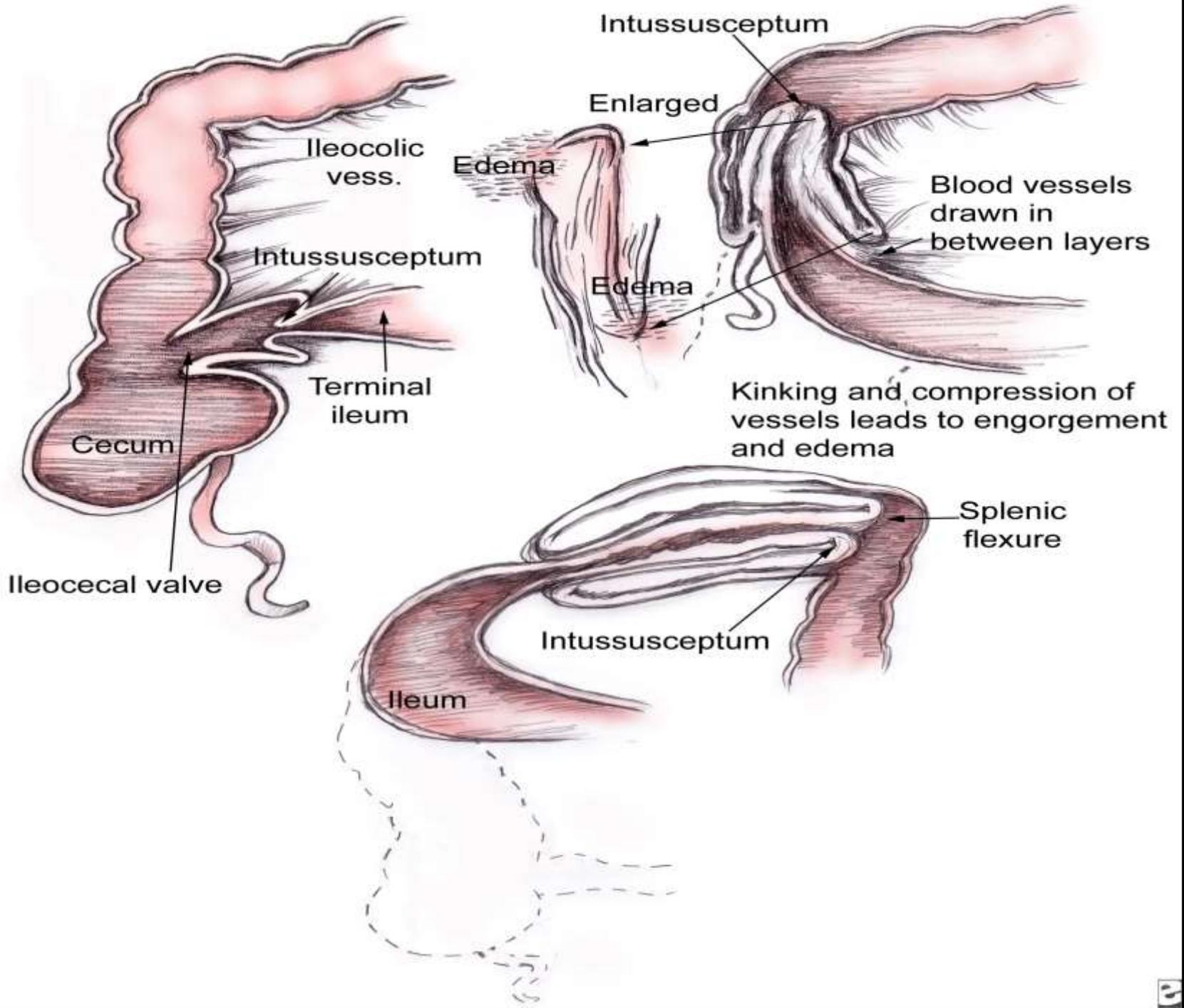


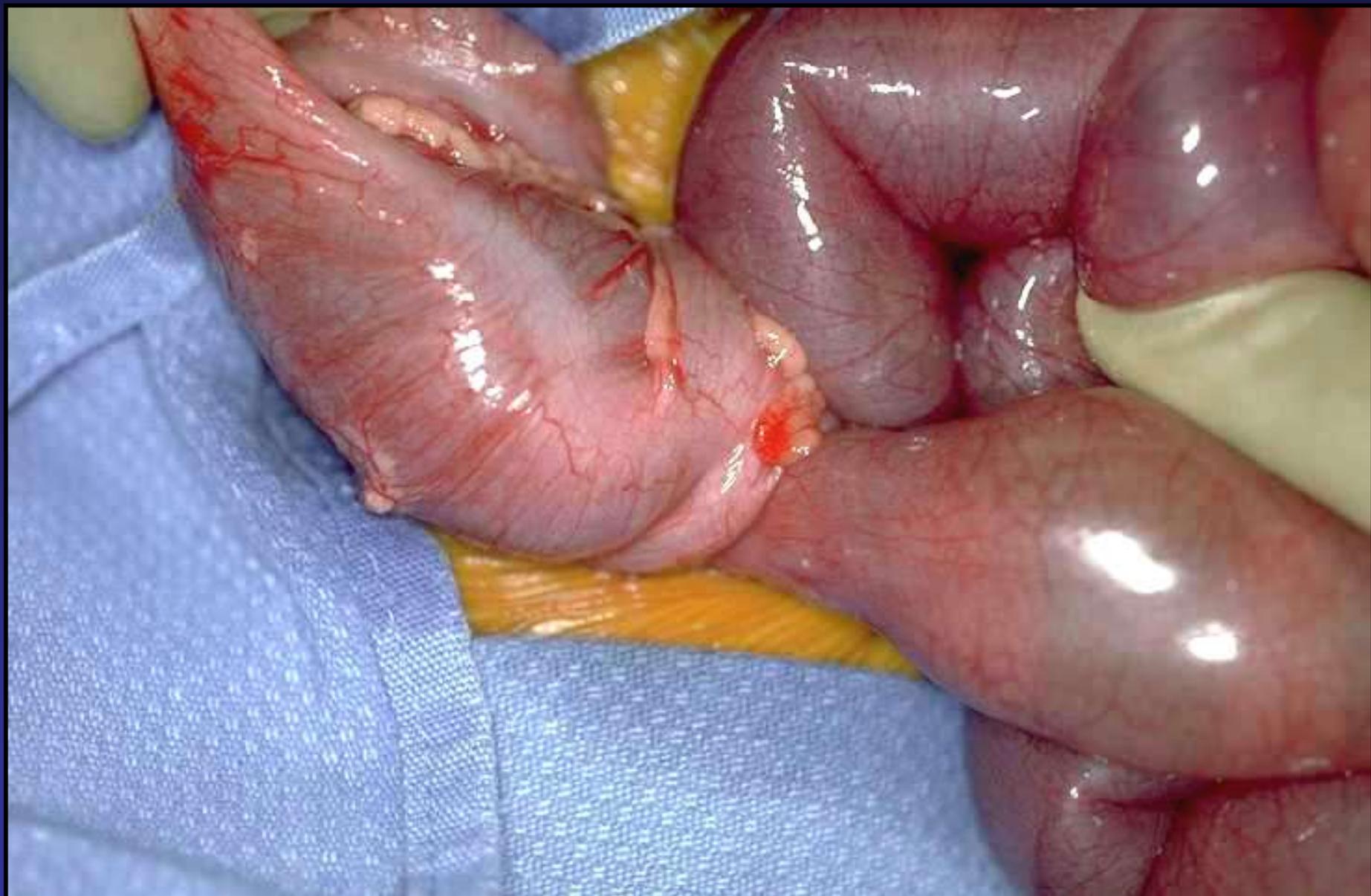




Intussusception

- Telescoping of bowel
- Proximal (inside) distal
- Caused usually by:
 - Hypertrophied Peyer Patches (submucosal lymphoid tissue) due to viral infection
 - PLP (Pathological Lead Point)
 - Meckle's diverticulum
 - Tumors eg. Intestinal lymphoma
 - CF
- Most common site (ileo-cecal)





Intussusception

- Age 6-18 months
 - If present later in age → likely to find PLP
- Presentation
 - Hx of URTI
 - Colicky (on&off) abdominal pain
 - Infant is calm between attacks
 - Current Jelly stool (blood PR)
 - +/- Vomiting (intestinal obstruction is late)

Intussusception

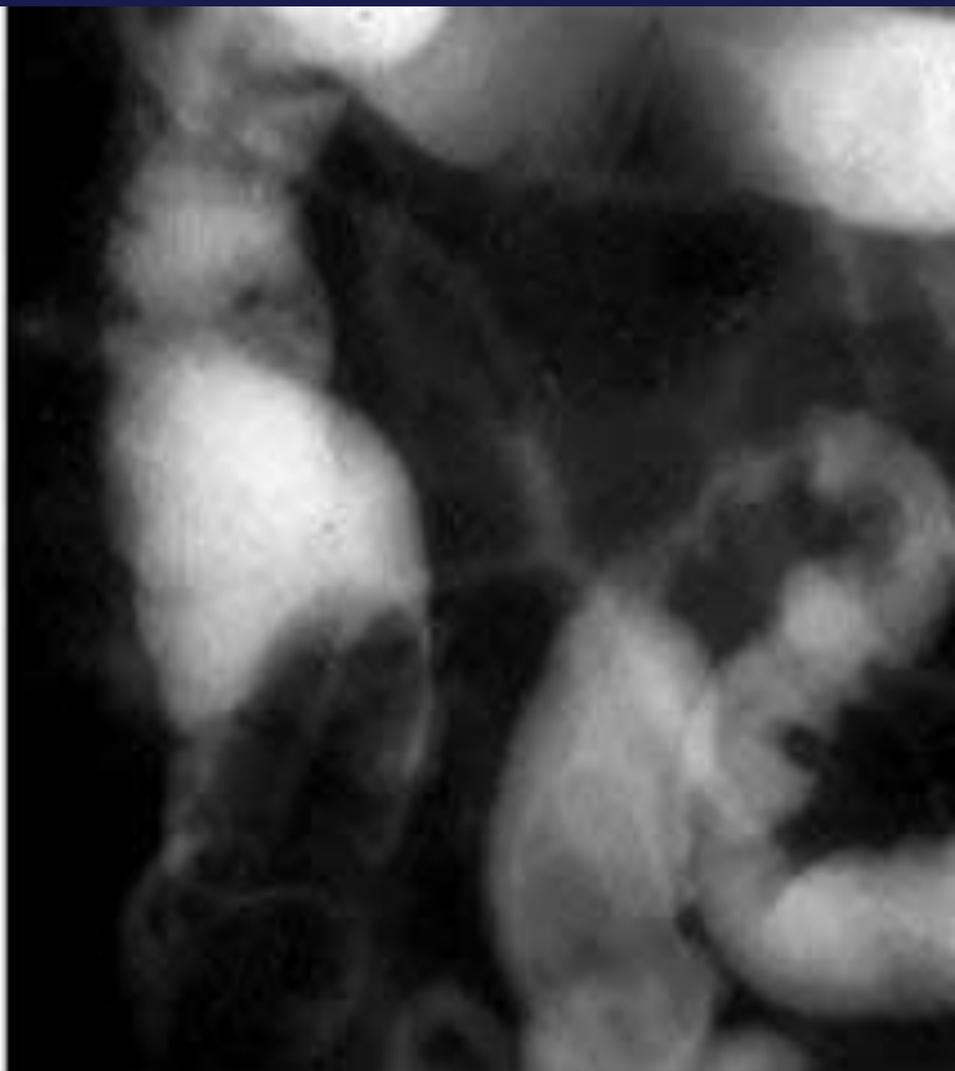
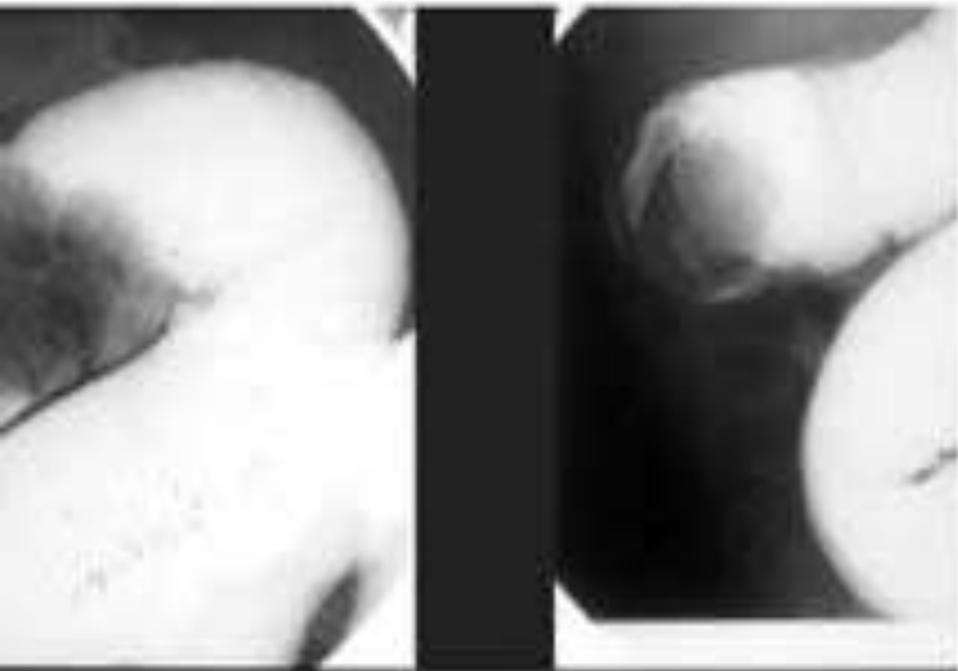
- Dx
 - Best by U/S
 - Target sign, Donut sign.
 - 95% accurate
 - Contrast Enema
 - Dx and treatment
- Rx
 - Pressure reduction
 - Barium
 - Water
 - Air is most common (less complications)

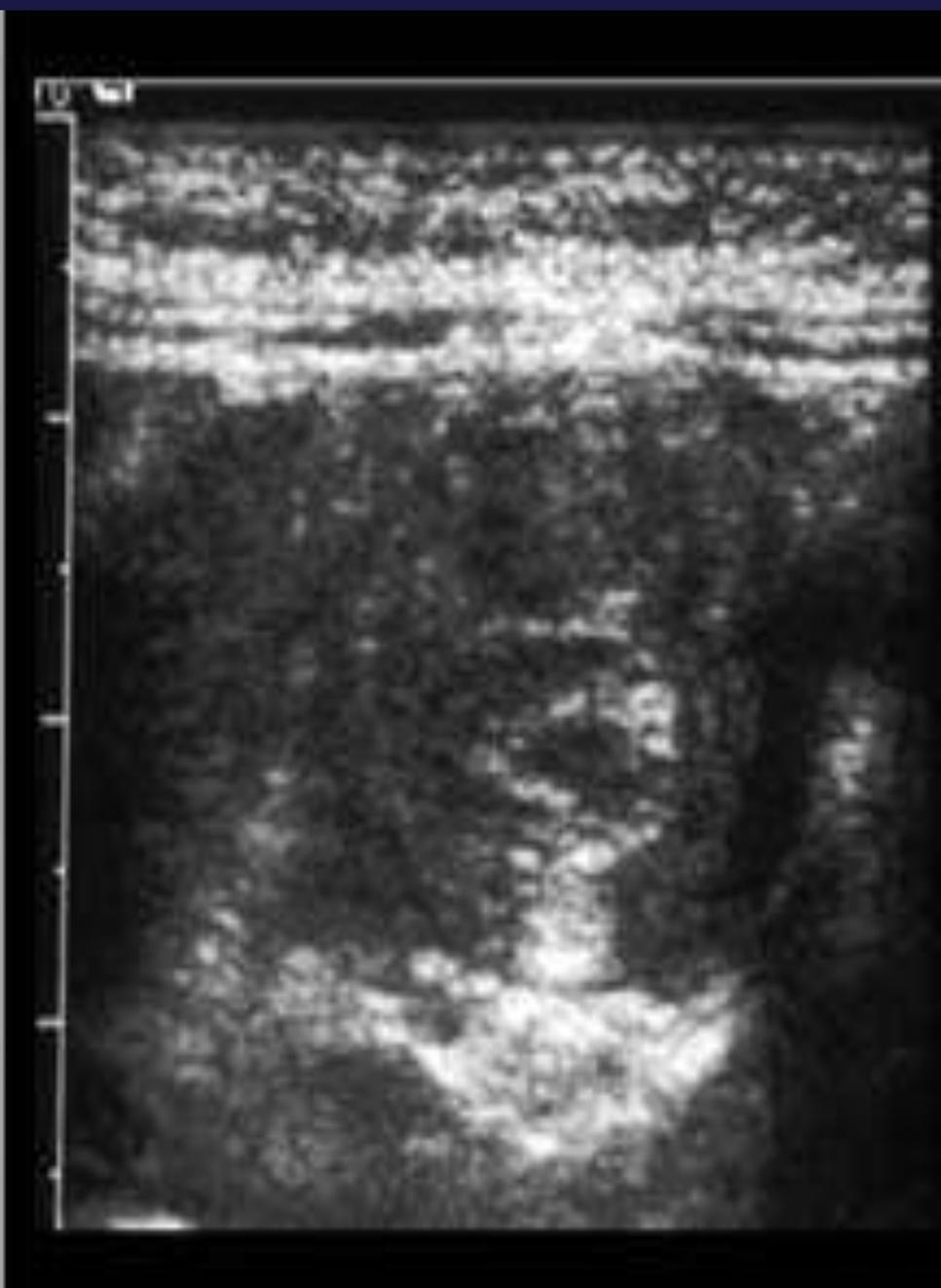
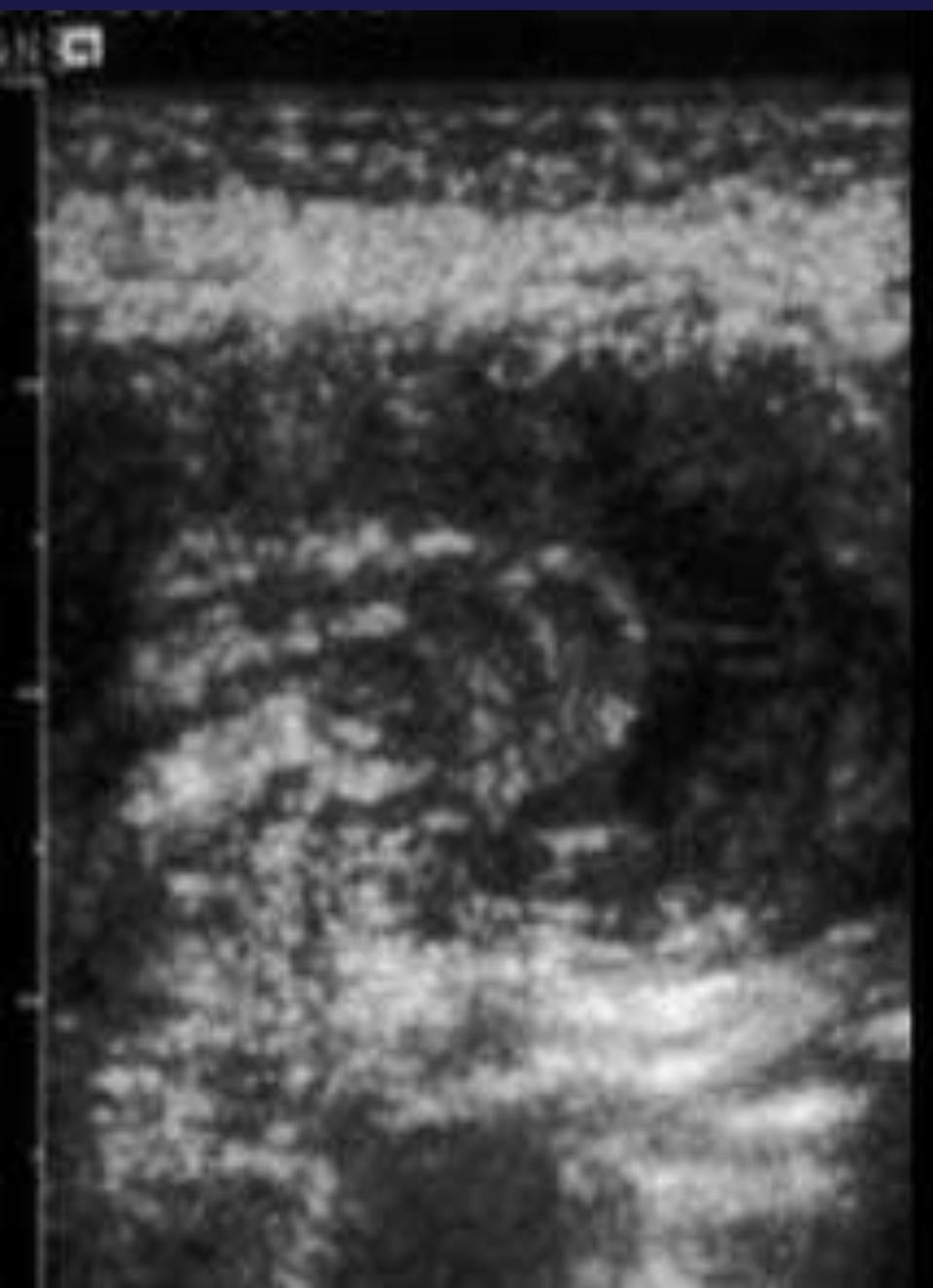


Intussusception

- Failed pressure reduction
 - Only few patients (15%)
 - Next is surgical reduction → if can't → resection
 - Likely PLP







Volvulus

- 75% First month of life, 90% first year
- Malrotation is the risk for volvulus
 - Small and large bowel are not fixed
 - Narrow mesentery
 - → more likely to turn around itself
- Malrotation can cause or present with:
 - Volvulus is dangerous
 - Acute obstruction
 - Chronic intermittent obstruction



Volvulus is lethal

- Malrotation → midgut volvulus → midgut intestinal death → surgery (resected) → short-gut syndrome → death
- C/F
 - Most in infant (1st year of life)
 - **Bilious vomiting**
 - +/- pain
 - if +pain (irritable) → likely volvulus +ischemia
 - - pain (calm) → malrotation+obstruction



**Malrotation,
obstruction**

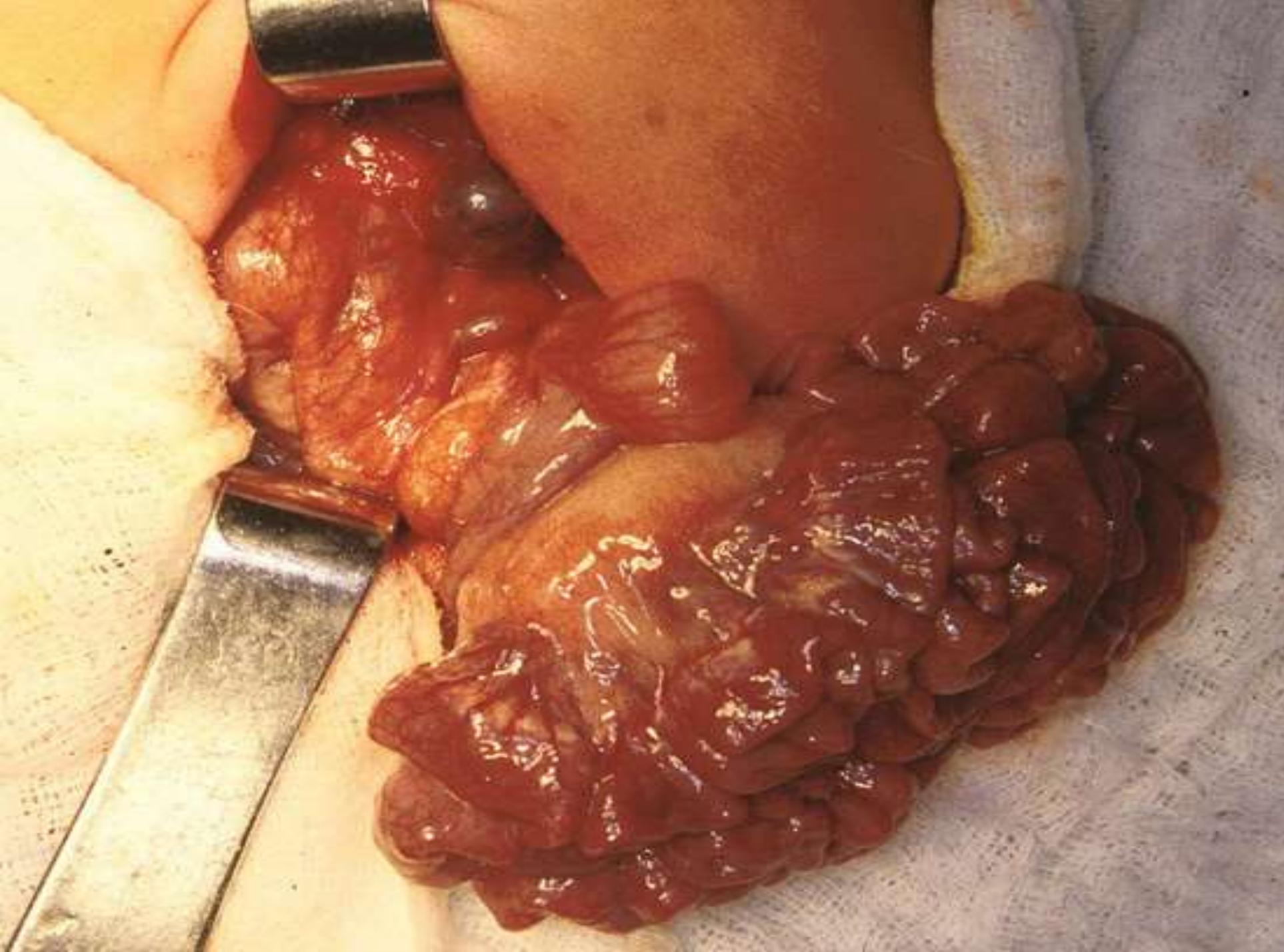


midgut volvulus

- Infant + Bilious vomiting is EMERGENCY
- Investigate (if infant is not sick)
 - Upper GI series (look for malrotation)
 - No duodenal C-loop
 - Duodeno-jejunal junction (ligament of Treitz) to the right of Vertebral col.
 - Duodenal obstruction
 - Whirlpool or corkscrew sign (volvulus)
 - U/S
 - Can't R/O volvulus
 - Can Dx volvulus → Inversion of mesenteric vessels

midgut volvulus

- Pt should go directly for surgery if:
 - If can't do investigation immediately
 - Pt is sick + bilious vomiting
- Time = \$ = bowel
- Surgery:
 - Untwist (counter clock wise) → assess viability
 - If extensive ischemia → close 2nd look 24-48 hrs
 - Viable SB → close and observe
 - Ladd's procedure
 - Cut Ladd's band
 - Broaden midgut mesentery
 - Place SB → Rt and Colon → LT
 - Appendectomy

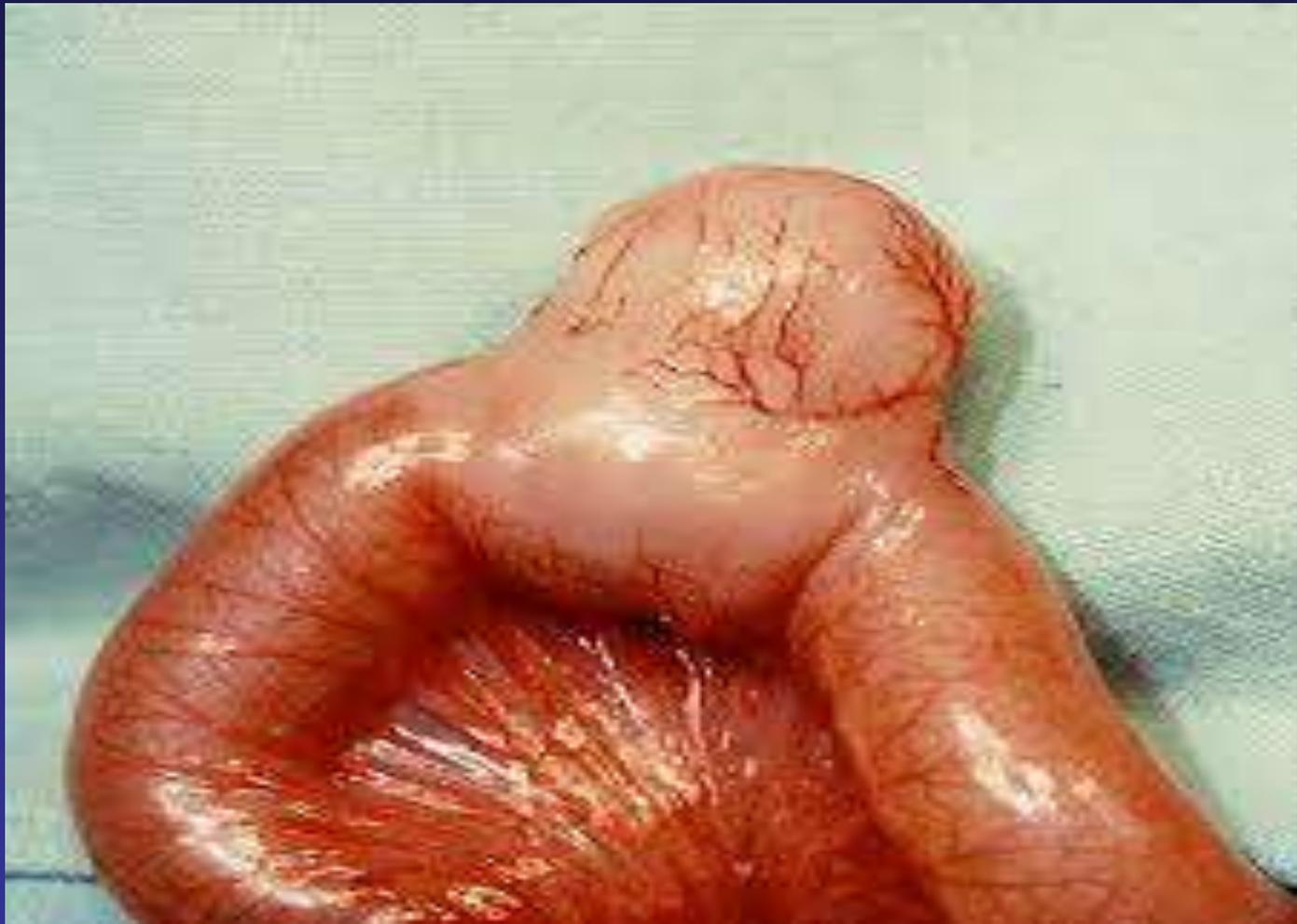




Meckel's Diverticulum

- A Meckel's diverticulum, a true congenital diverticulum and a vestigial remnant of the omphalomesenteric duct.
- A memory aid is the rule of 2s:
 - 2% (of the population)
 - 2 feet (proximal to the ileocecal valve)
 - 2 inches (in length)
 - 2 types of common ectopic tissue (gastric and pancreatic)
 - 2 years is the most common age at clinical presentation
 - 2:1 male:female ratio

- Present as:
 - Lower GI bleeding
 - ulcer from ectopic gastric mucosa
 - Can cause severe bleeding
 - Diverticulitis
 - like appendicitis (non-shifting pain)
 - Intussusception (PLP)
 - Obstruction
 - Fibrous band remnant
 - *Hernia?*



Meckel's Diverticulum

- Investigation

- Bleeding GI

- Meckle's Scan Tc99

- Uptake by gastric mucosa in Meckle's

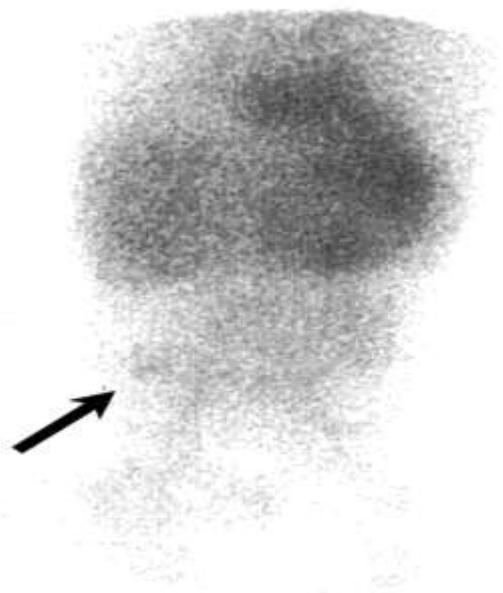
- Laparoscopy or laparotomy

Trt: Symptomatic patients need surgical resection

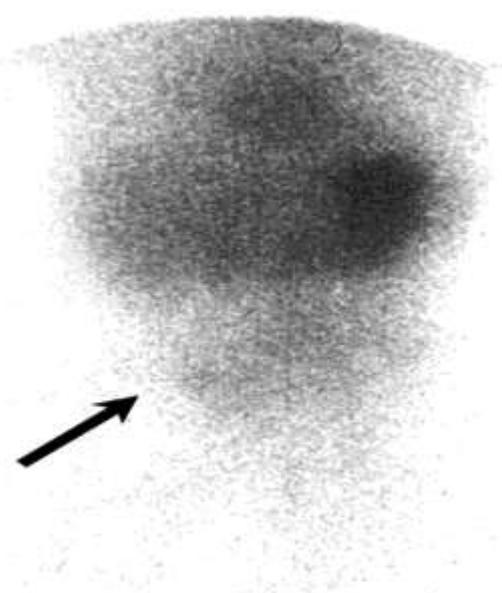
Controversies

- For laparoscopy the argument is that, because the base of the diverticulum and the ileum cannot be palpated, ectopic mucosa could be left behind.
 - For diverticulectomy some believe that ulcerated areas of the ileum remain, and, thus, the patient is still at risk for bleeding episodes in the immediate postoperative period.
- Meckel diverticulum when it is discovered during an exploration for other reasons.
 - If a thickening appears to be present upon palpation, the diverticulum may contain ectopic mucosa resection is warranted. Likewise, if the diverticulum has a narrow base, resection is appropriate.

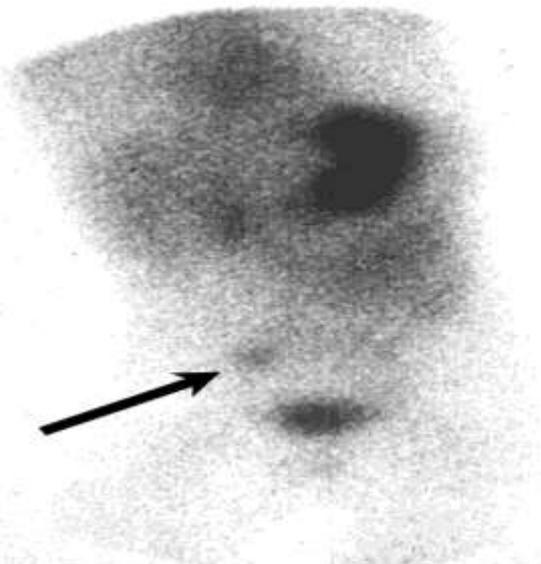
IMMEDIATE



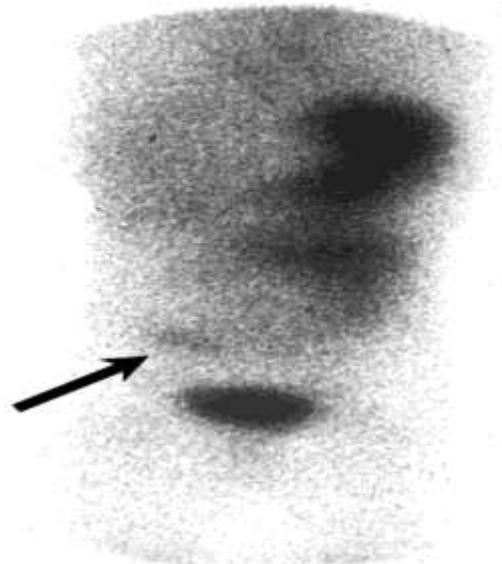
5MINS



10MINS



20MINS



Ovarian torsion

- Adolescent girls
- Acute sever abdominal pain Lt or Rt
- U/S confirm Dx
- Or
 - Laparoscopy or laparotomy
 - De-rotate
 - Assess viability
 - If necrotic remove
 - Dark → leave it
- Fixation

Other DDX of abdominal pain

Thank you