Common Pediatric Surgical Emergencies

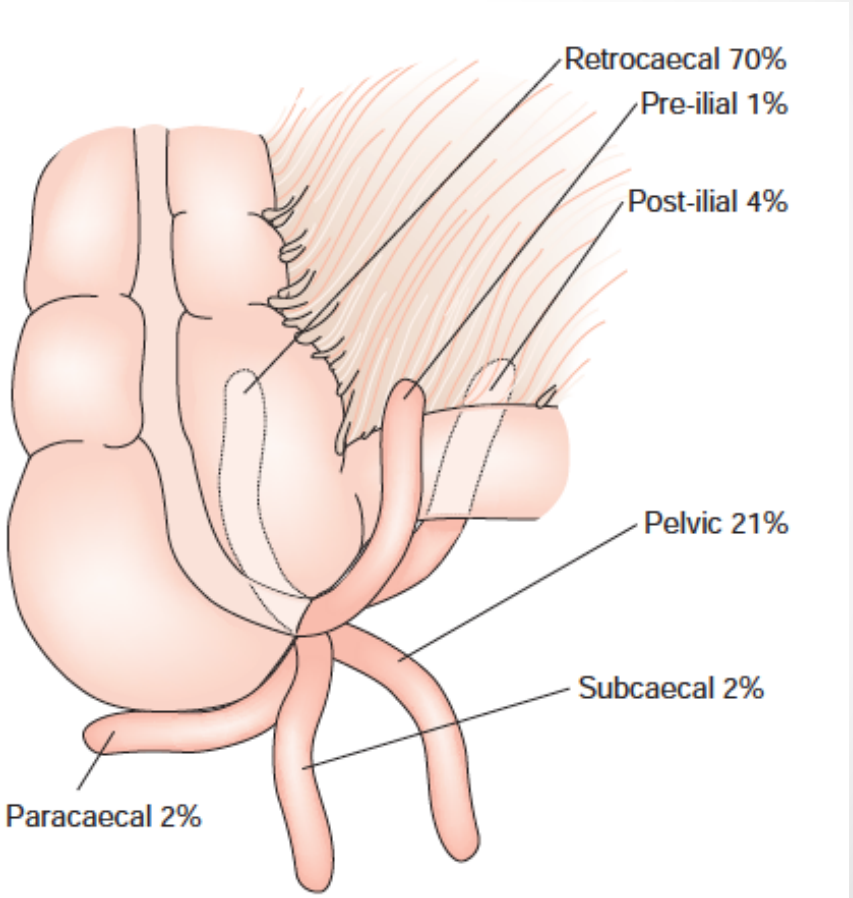
Abdulrahman M Alzahem, MBBS, FRCSC, MS, FRACS
Pediatric Surgery Division
Faculty of Medicine
King Saud University

Outlines

- Acute appendicitis
- Malrotation/ midgut volvulus
- Intussusception
- Pyloric stenosis
- Esophageal atresia
- Anorectal malformation (imperforate anus)
- Hirschsprung disease

Appendix- Anatomy

- 6-9cm long, worm-shaped, blind-ending tube
- Arise from postero-medial aspect of the cecum
- The base of the appendix is found at the point of convergence of the three taeniae coli of the caecum

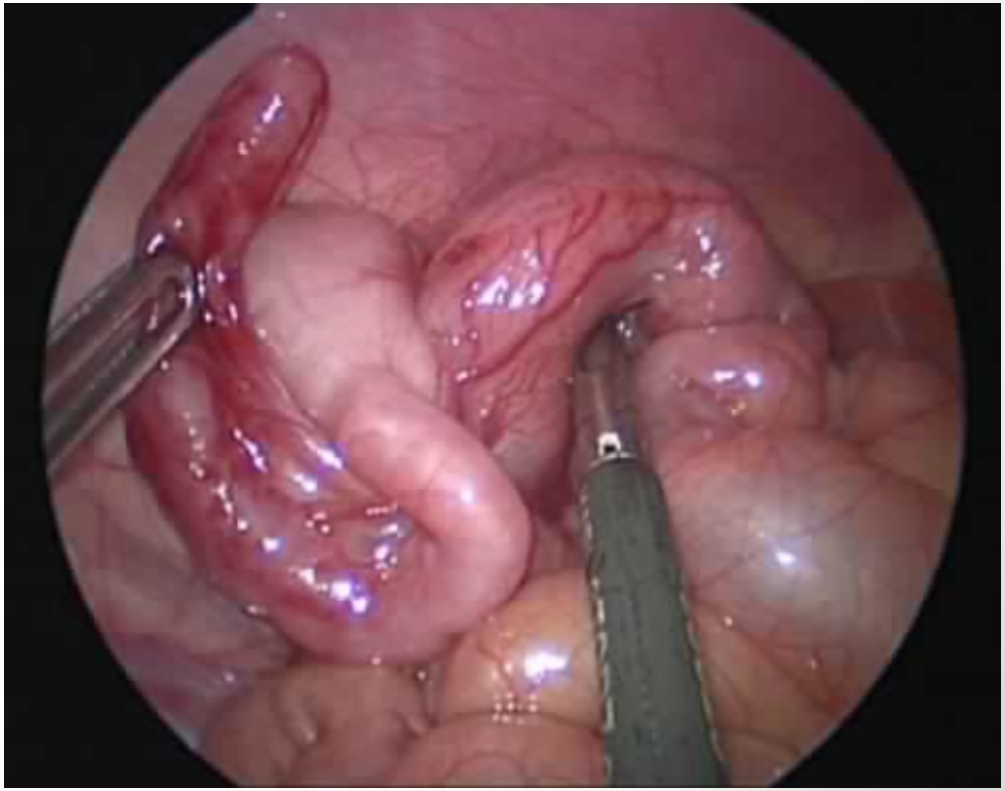


Acute Appendicitis

- Most common cause of acute surgical abdomen in children and adolescents
- Peak incidence 10-12 years
- Increased rate of perforation in children

Acute Appendicitis

- Causes- unclear
- Path: obstruction of the lumen (fecalith, lymphoid hyperplasia, foreign body, tumor, parasite)
- Stages:
  1. Catarrhal
  2. Phlegmonous
  3. Gangrenous
  4. Perforated



Case Study

- 12 year-old girl with 16 hours history of abdominal pain
- Initially diffuse discomfort, now RLQ
- Nausea and vomiting
- Normal BM yesterday

- P/E:
  - Sitting still, calm
  - T38.4, P100, BP 90/60
  - Abd--flat, RLQ tenderness

Differential Diagnoses

- Appendicitis
- Gastroenteritis
- Ovarian torsion
- Urinary tract infection
- Mesenteric lymphadenitis

History (Appendicitis)

- Diffuse/periumbilical pain, which eventually localizes to the right lower quadrant
- Pain followed by nausea/vomiting
- Anorexia
- Fever
- Peritonitis pain: worse with movement, walking (jumping test)

Physical Signs (Appendicitis)

- Child looks unwell, lying still.
- Tachycardia may be present.
- Fever
- Dehydrated
- Tenderness in the right lower quadrant
- Rovsing's sign —tenderness in the right lower quadrant elicited when pressure is exerted in the left lower quadrant.
- Diffuse peritonitis may indicate perforation of the appendix

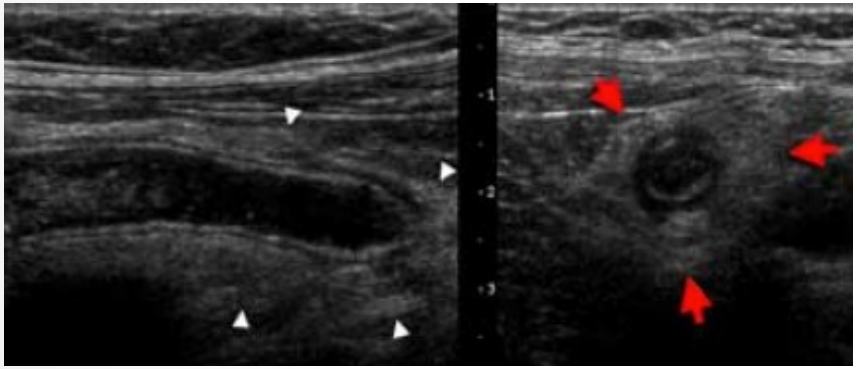
Investigations (Appendicitis)

- Elevated WBC (mainly neutrophils)
- Urinalysis to exclude UTI

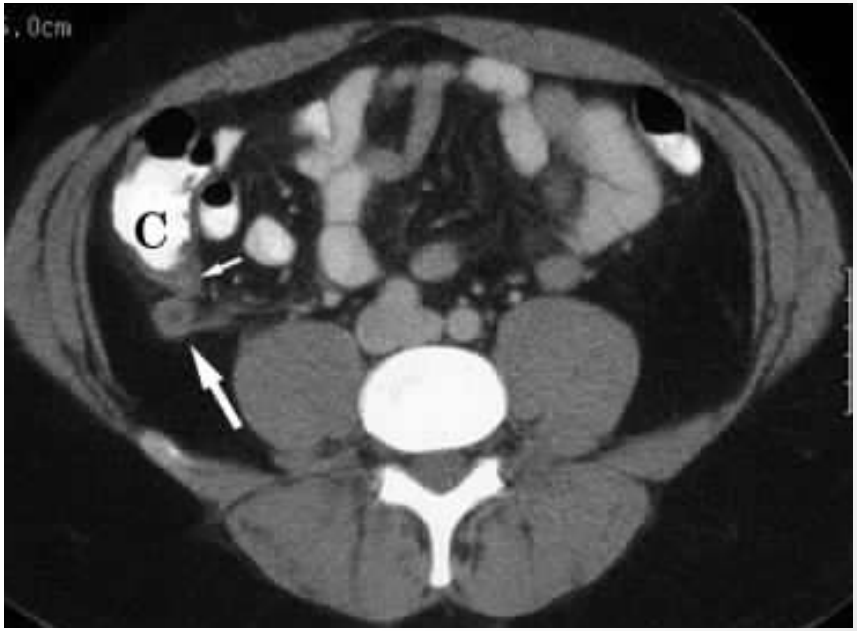
- Imaging:
  - Not always needed if the diagnosis is clear
  - >6mm, Dilated, thick, hyperemic appendix with adjacent inflammation
  - U/S:
    - Good first line
    - No radiation hazards
    - May miss the appendix
  - CT scan:
    - Very accurate
    - Radiation hazard

Acute Appendicitis

Ultrasound



CT scan



Treatment (Appendicitis)

- NPO
- Intravenous fluid
- Start antibiotics
- Urgent Appendectomy (open vs. laparoscopic)
- Patient can go home next day
- No antibiotics is required > 24hrs post-operatievely
- Fast recovery

Perforated Appendicitis

- Usually results from delayed presentation/diagnosis/Rx
- Patient can become very sick (septic shock)
- Need urgent appendectomy unless abscess cavity has developed
- Abscess can be treated with antibiotics + percutaneous insertion of drain + interval appendectomy in 6-8 weeks
- Prolonged recovery
- Need antibiotics post-operatively
- High risk of superficial/deep abdominal infections (20%)

Perforated Appendicitis

Intestinal Rotation

- Normal rotation of the intestine requires transformation from a simple, straight alimentary tube into the mature fixed and folded configuration normally present at birth.

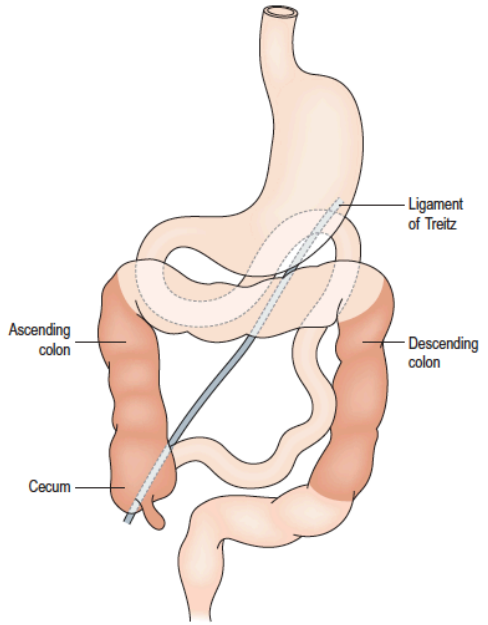


FIGURE 31-1 ■ Normal intestinal anatomy results in fixation of the duodenojejunal junction in the left upper quadrant and the cecum in the right lower quadrant. This allows a wide breadth to the mesentery of the small bowel.

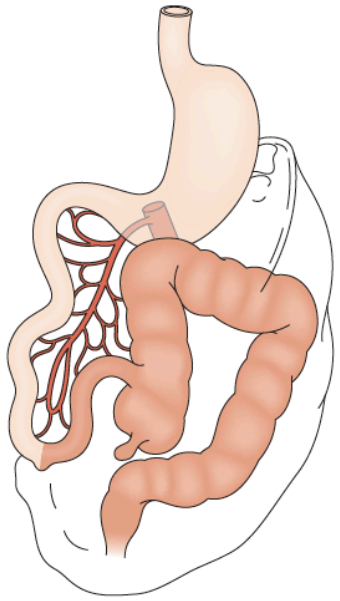


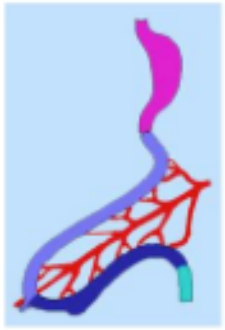
FIGURE 31-2 ■ Nonrotation. The prearterial midgut (lightly shaded) is found on the right side of the abdomen, while the postarterial midgut (darkly shaded) remains on the left. Neither segment has undergone appropriate rotation. Volvulus is a risk.

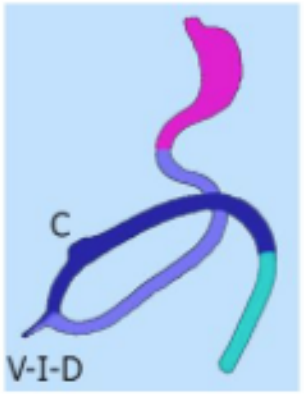
Normal Rotation

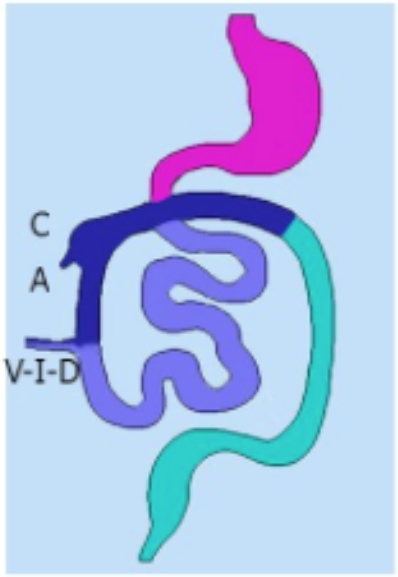
- Normal midgut rotation
  - 4-12 weeks of fetal life
  - 270 counterclockwise movement of the midgut
  - Video

Rotation – Midgut

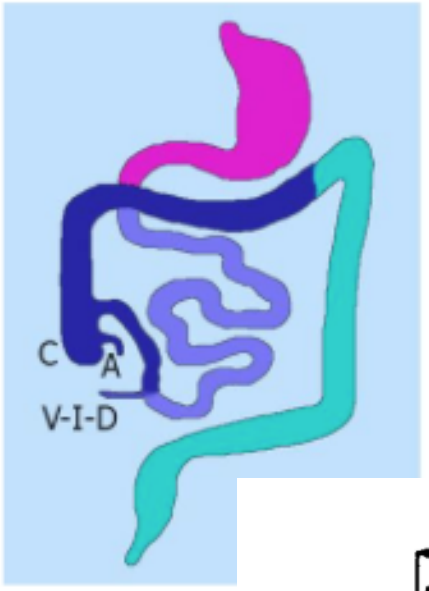
Also note hindgut derivatives

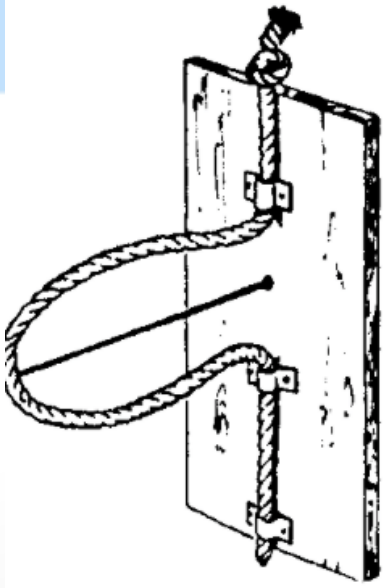


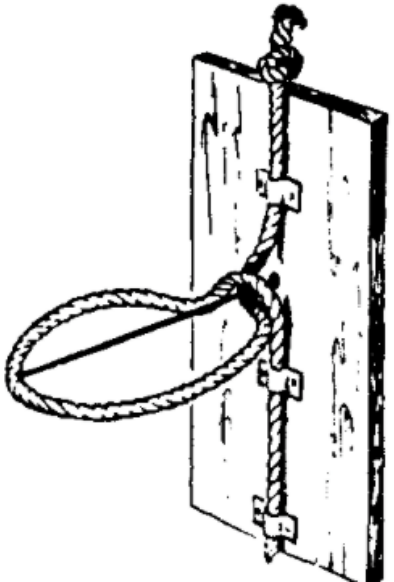




C : caecum
A : appendix
V-I-D : vitellointestinal duct







Malrotation

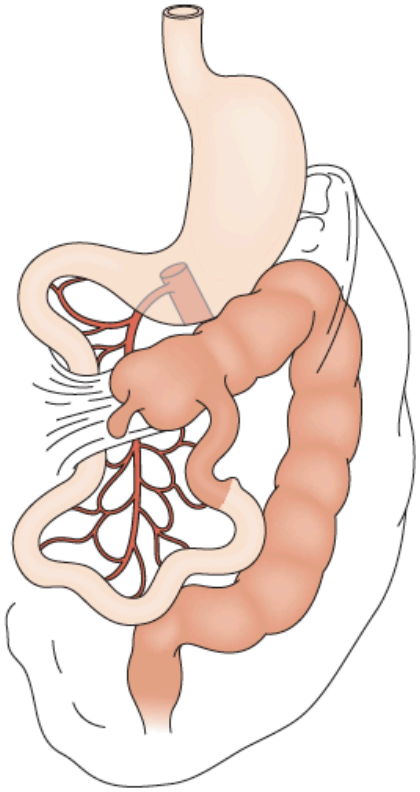


FIGURE 31-3 ■ Incomplete rotation. Both the prearterial (lightly shaded) and postarterial (darkly shaded) segments have undergone partial, yet not complete, rotation. Ladd's bands are seen attaching the cecum to the right posterior abdominal wall. The duodenum becomes compressed and possibly obstructed. Volvulus is a risk.

What is the problem with malrotation?

- Ladd's band obstructing the duodenum>>bilious vomiting
- Midgut volvulus (twisting)>> ischemia and bowel gangrene
- If not identified quickly>> patient will die due to septic shock
- If the patient does not die>> entire bowel loss (short bowel syndrome)- not compatible with life

Malrotation

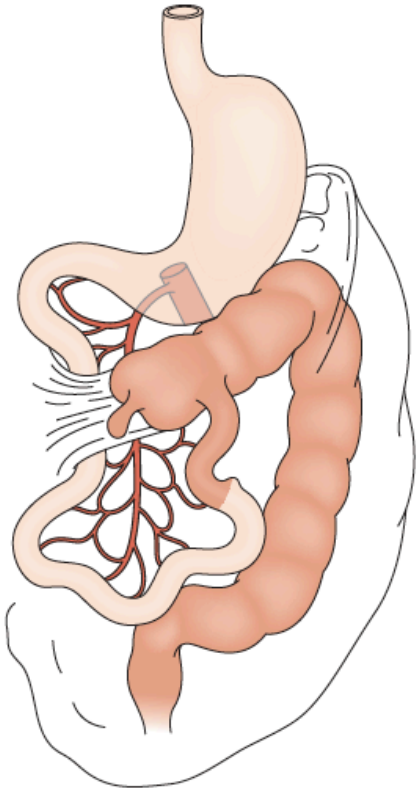


FIGURE 31-3 ■ Incomplete rotation. Both the prearterial (lightly shaded) and postarterial (darkly shaded) segments have undergone partial, yet not complete, rotation. Ladd's bands are seen attaching the cecum to the right posterior abdominal wall. The duodenum becomes compressed and possibly obstructed. Volvulus is a risk.

Presentation (Malrotation)

- 75% present in the first month of life
- 15% in the first year

- Cardinal symptom:
  - BILIOUS VOMITING

- Other symptoms:
  - Abdominal pain
  - Scaphoid abdomen (initially)
  - Distended abdomen (late)
  - Rectal blood (not always)

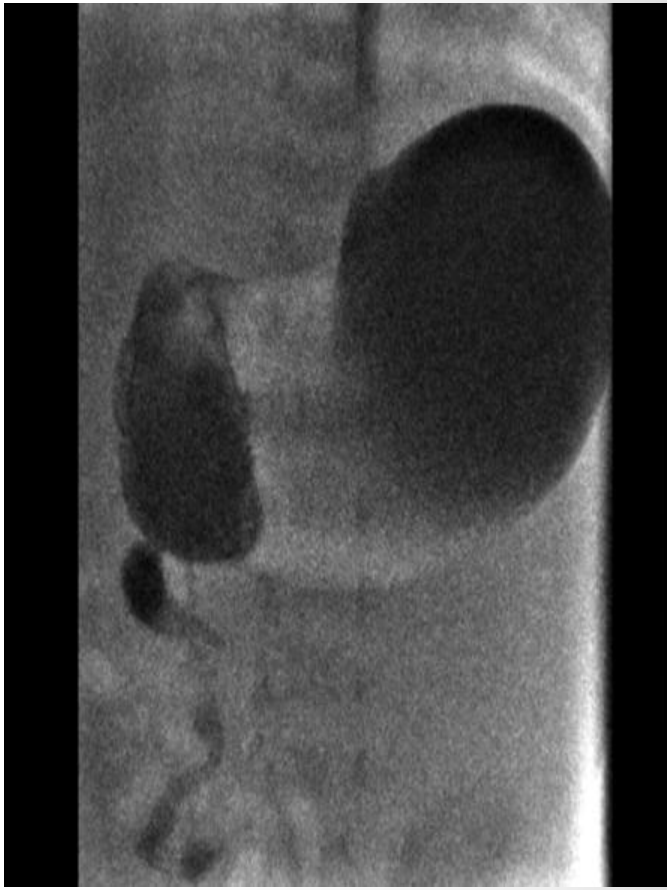
Physical Signs (Malrotation +/- MGV)

- Lethargic
- Dehydrated
- Tachycardia, hypotension, +/- fever
- Distended upper abdomen (stomach)
- Distended abdomen (late)
- Peritonitis (late)
- Abdominal wall erythema (late)

Investigations (Malrotation)

- Abdominal X ray:
  - Can be totally normal
  - Dilated stomach
- Upper GI contrast study:
  - The most sensitive test to diagnose malrotation **(gold standard)**
  - Take time (should not be done if the patient has picture of bowel ischemia)

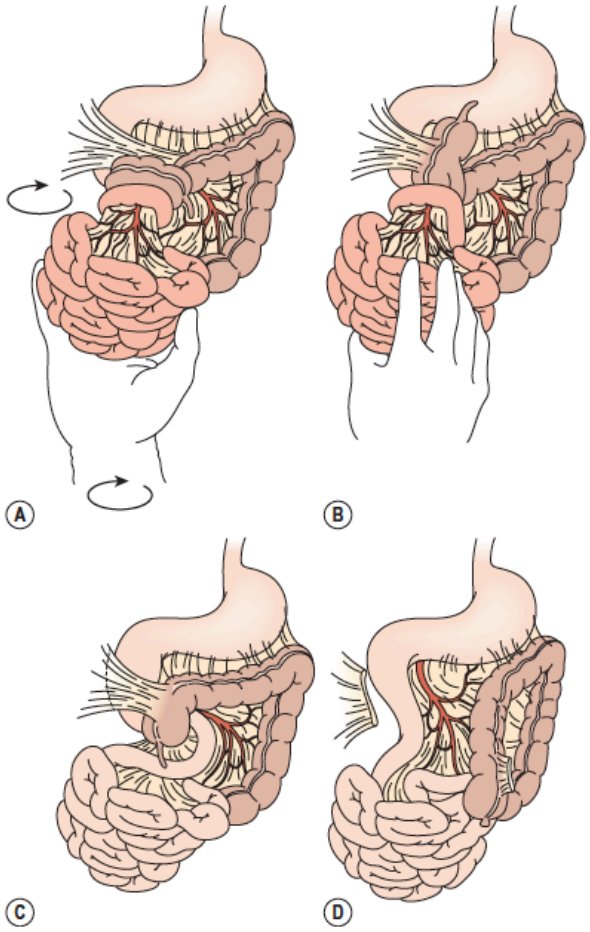

RT. AP



Treatment (Malrotation)

- Intravenous fluid
- NPO
- NGT
- Broad spectrum antibiotics
- Immediate surgical consultation
- Urgent Ladd's procedure:
  - Laparotomy
  - Untwist the bowel
  - Resect gangrenous intestines
  - Divide Ladd's band
  - Place the bowel in non-rotation position (small intestine on the right, large intestine on the left of the abdomen)

Ladd's Procedure



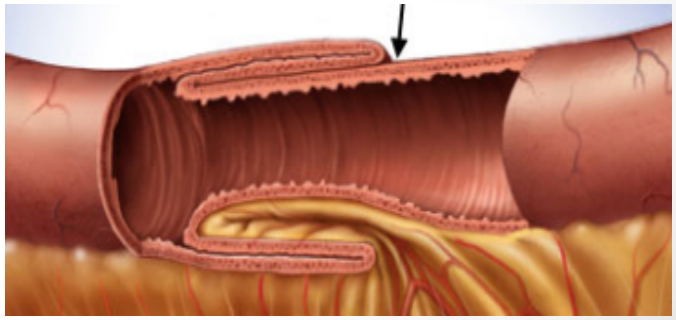
Delayed Treatment (Malrotation + MGV)

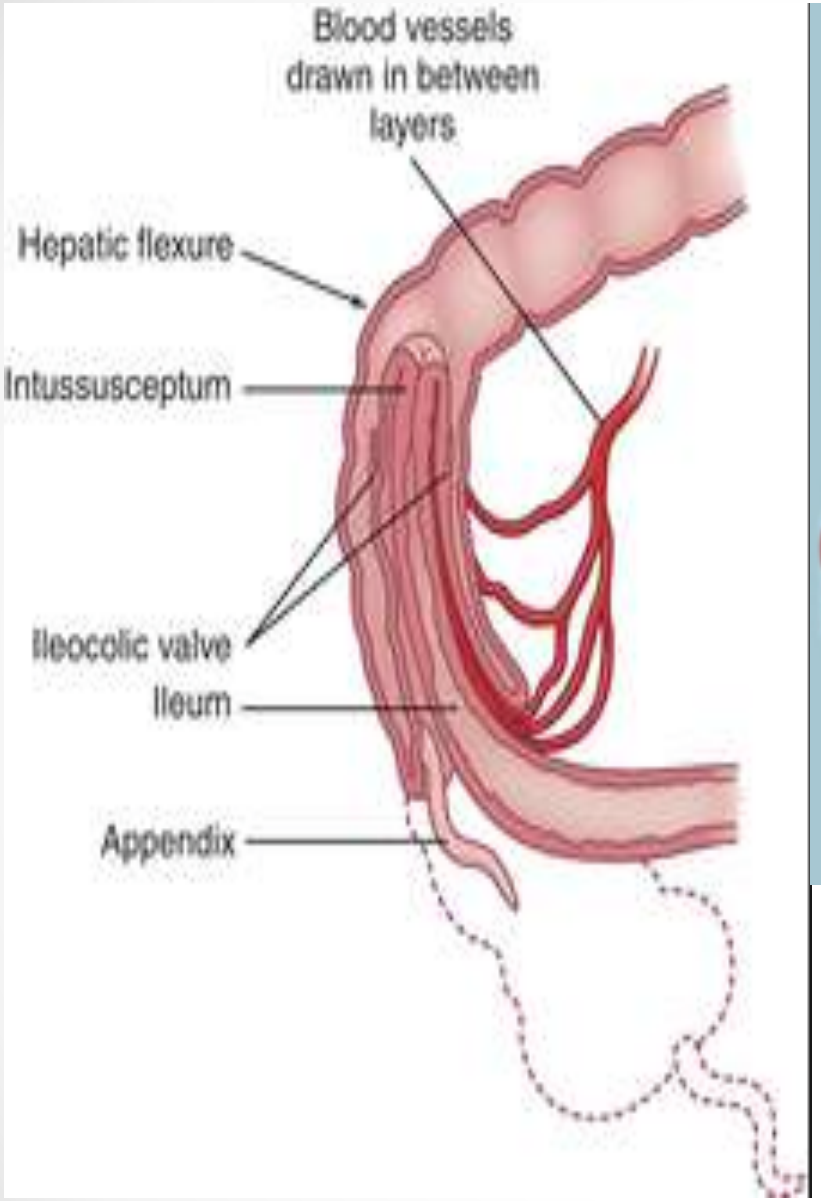
Delayed Diagnosis/Management (Malrotation + MGV)

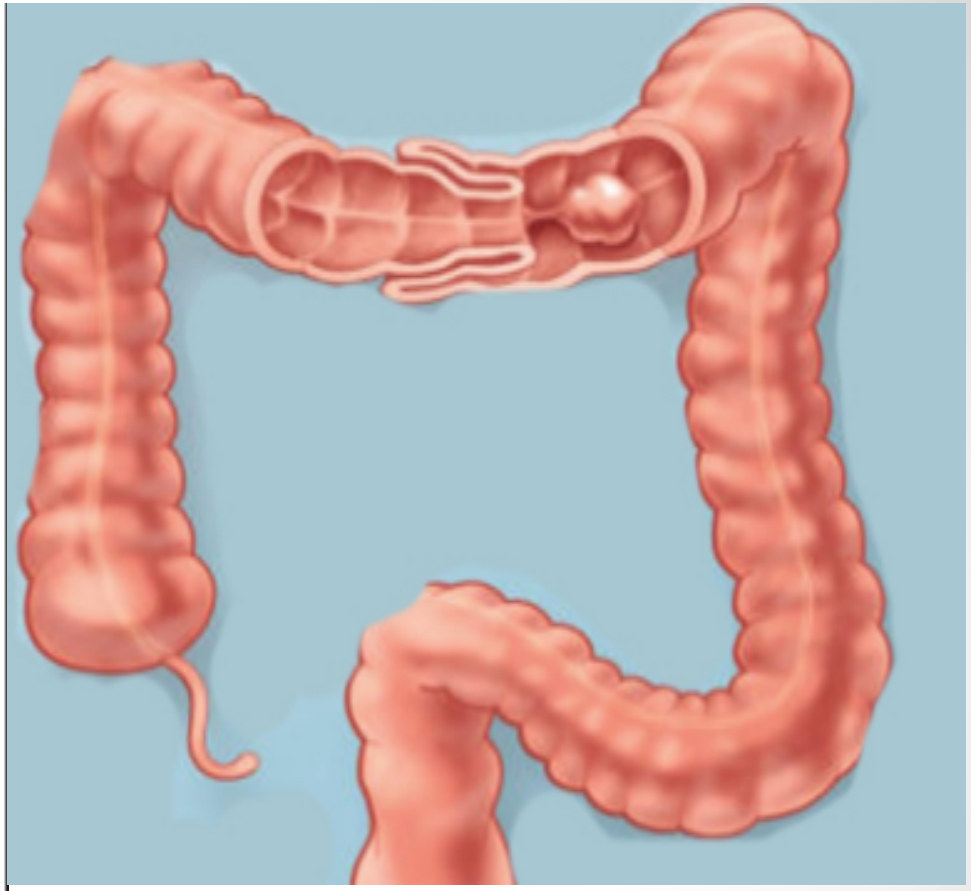
- Bowel gangrene
- Short bowel syndrome
- Septic shock
- Multi-organ failure
- Death

Intussusception

- Part of the intestine telescopes into the distal bowel by peristaltic activity.
- Bowel is compressed > venous obstruction > bowel wall edema> arterial insufficiency > ischemia & bowel wall necrosis
- Causes:
  - Idiopathic -95% (Peyer's Patch)
  - Pathologic lead point- 4% Meckle diverticulum
    - Polyp
    - Neoplasm
    - Inverted appendix
    - Celiac disease, CF, HSP
    - Feeding tubes (GJ tube)

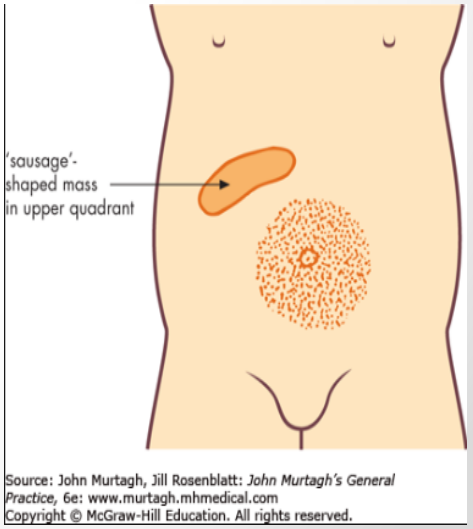



Blood vessels drawn in between layers
Hepatic flexure
Intussusceptum
Ileocolic valve
Ileum
Appendix



Presentation

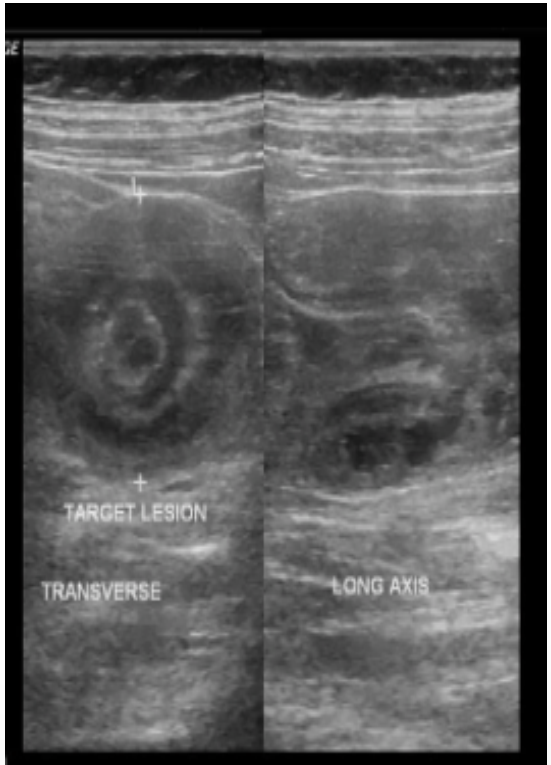
- Typical age: 3 months-3 yrs
- Episodic colicky abdominal pain
- Child is well between the attacks
- Bilious vomiting
- Red currant jelly stool
- Sausage-shaped abdominal mass in RUQ (65% of cases)
- Empty RLQ



Source: John Murtagh, Jill Rosenblatt: *John Murtagh's General Practice*, 6e: www.murtagh.mhmedical.com

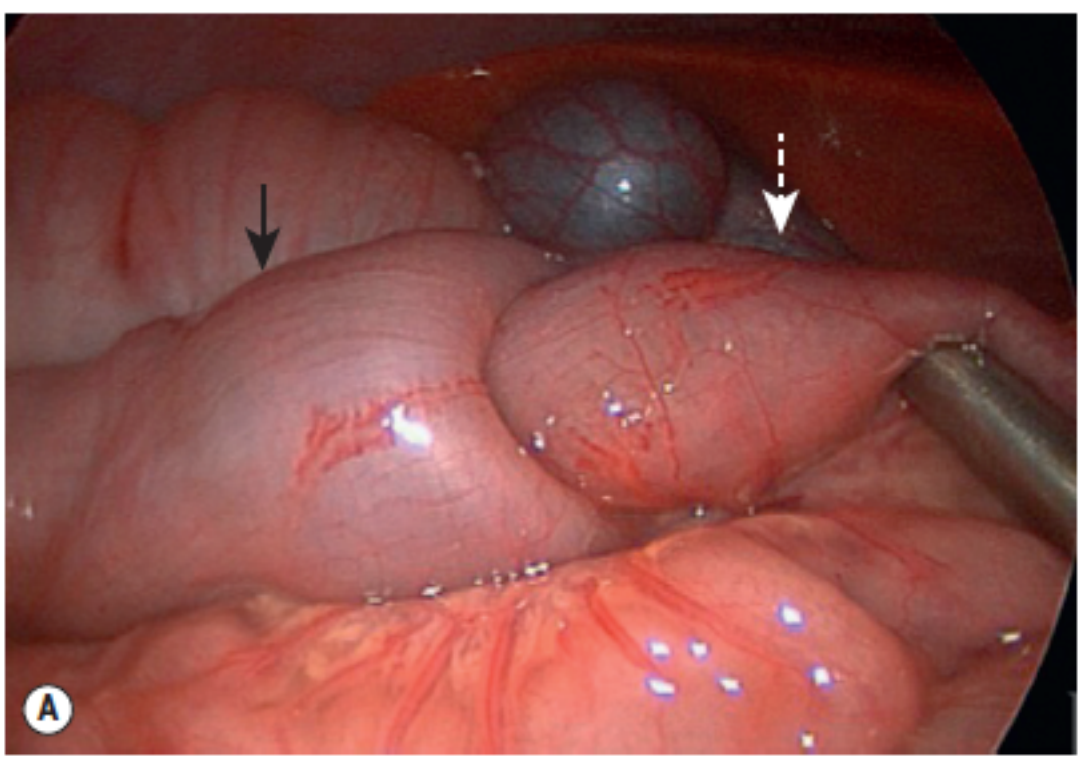
Intussusception

- Imaging:
  - AXR: RUQ mass, dilated bowel, Air/fluid levels
  - US: gold standard, target sign



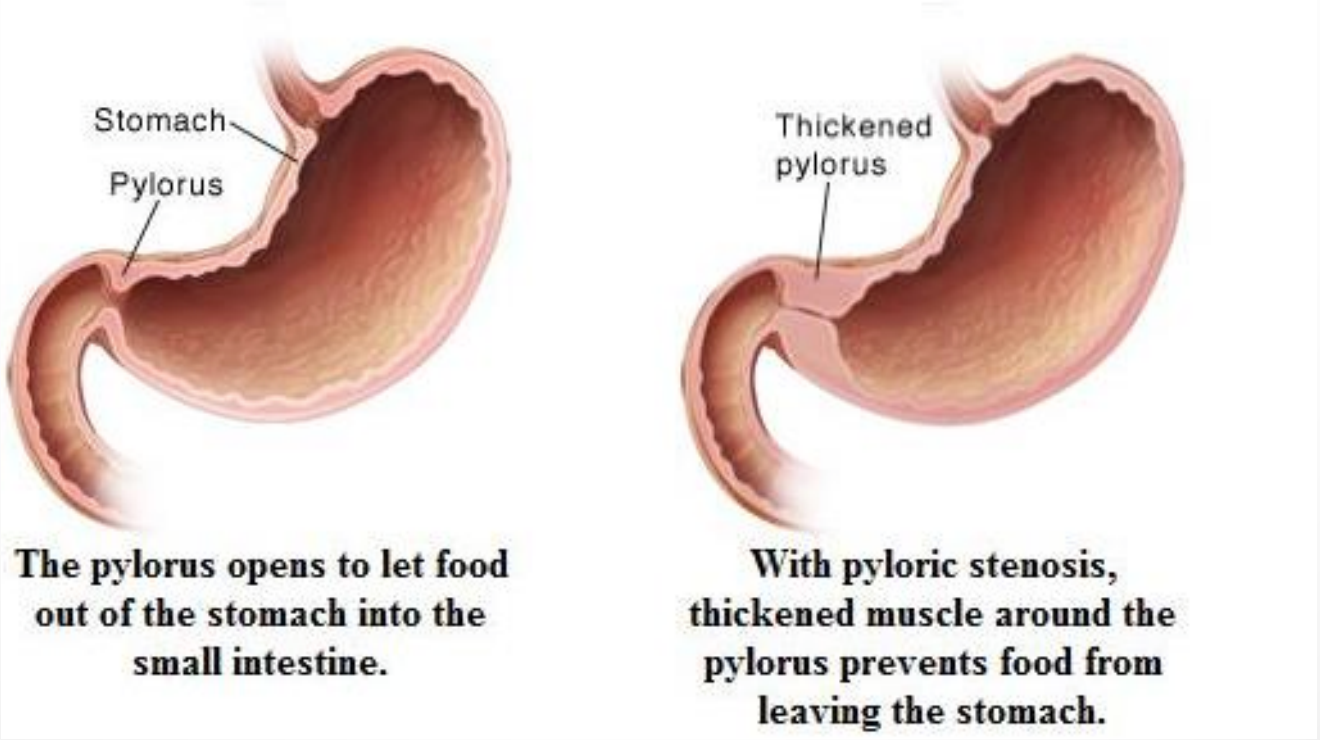
Intussusception

- Rx:
  - NPO, IVF
  - Reduction enema under fluoroscopic guidance (done by a radiologist)
  - Surgical reduction: if enema reduction is not successful or not available

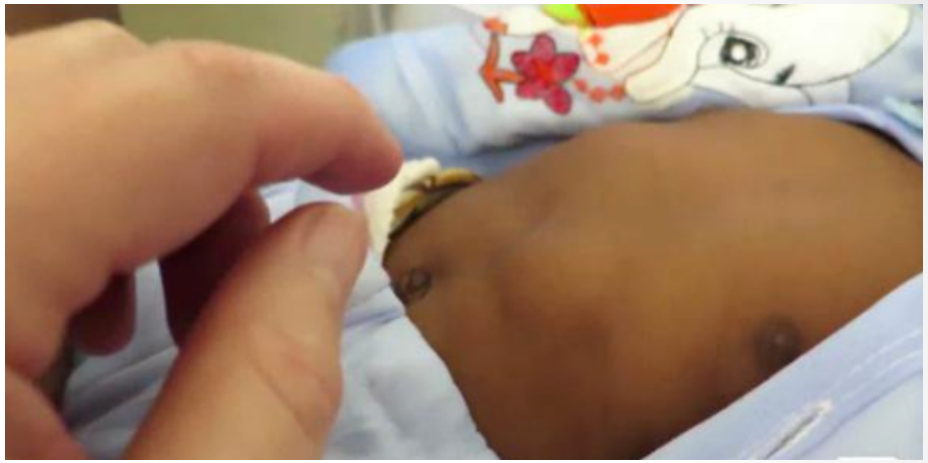


Infantile Hypertrophic Pyloric Stenosis

- Gastric outlet obstruction due to hypertrophied pyloric muscle



Infantile Hypertrophic Pyloric Stenosis

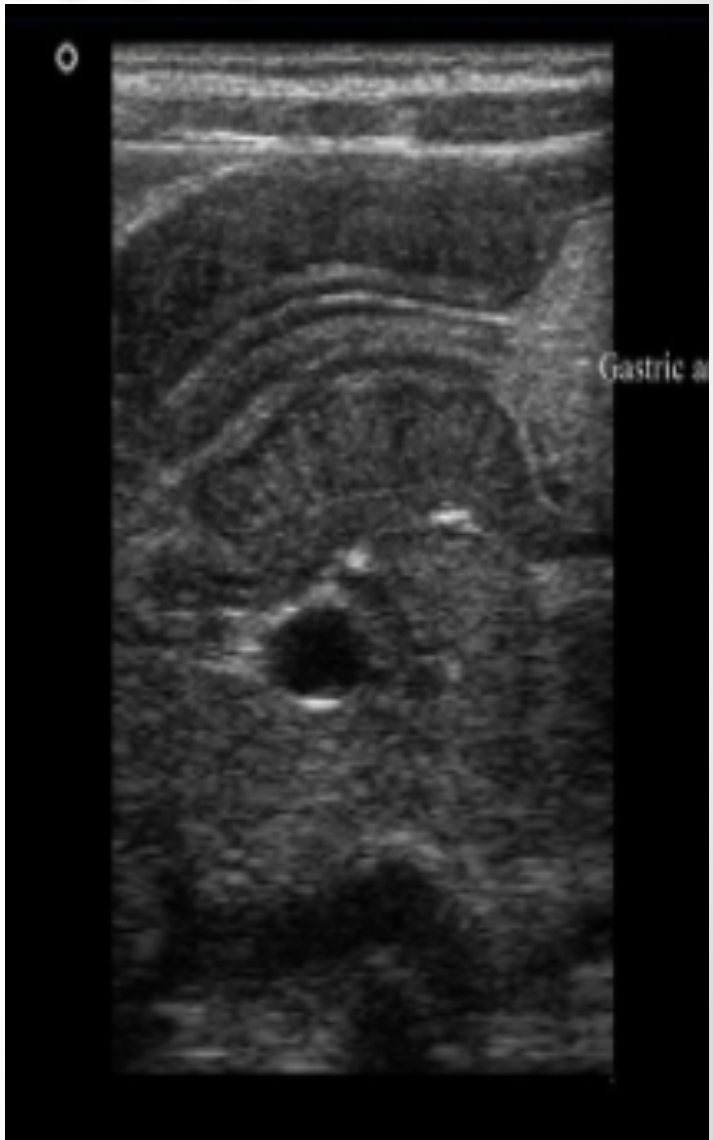


- Classic triad:
  - Term baby
  - 2-8 weeks of life
  - Projectile, non-bilious vomiting
- P/E:
  - Hungry & dehydrated baby,
  - Palpable pyloric muscle (Olive sign)
  - Gastric peristalsis can sometimes be seen
- Electrolytes + blood gas:
  - Hypochloremia
  - Hypokalemia
  - Metabolic alkalosis

Projectile Vomiting

Pyloric Stenosis

- Imaging:
  - US: **gold standard**
  - Thick and elongated pyloric muscle
- Management:
  - NPO
  - IVF
  - **Correct electrolytes and pH**
  - Surgical separation of pyloric muscles (pyloromyotomy)

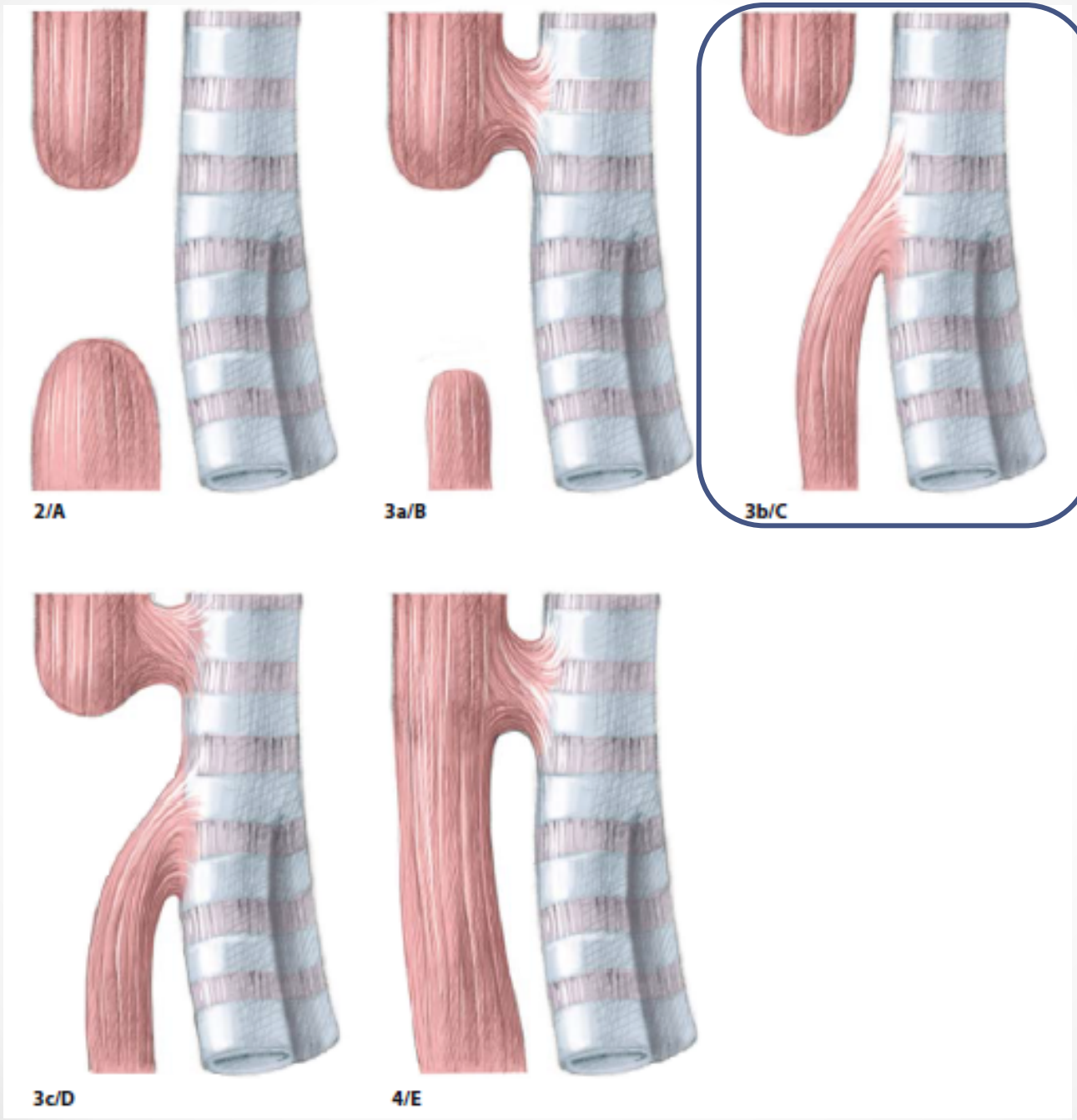


Pyloromyotomy

Esophageal Atresia

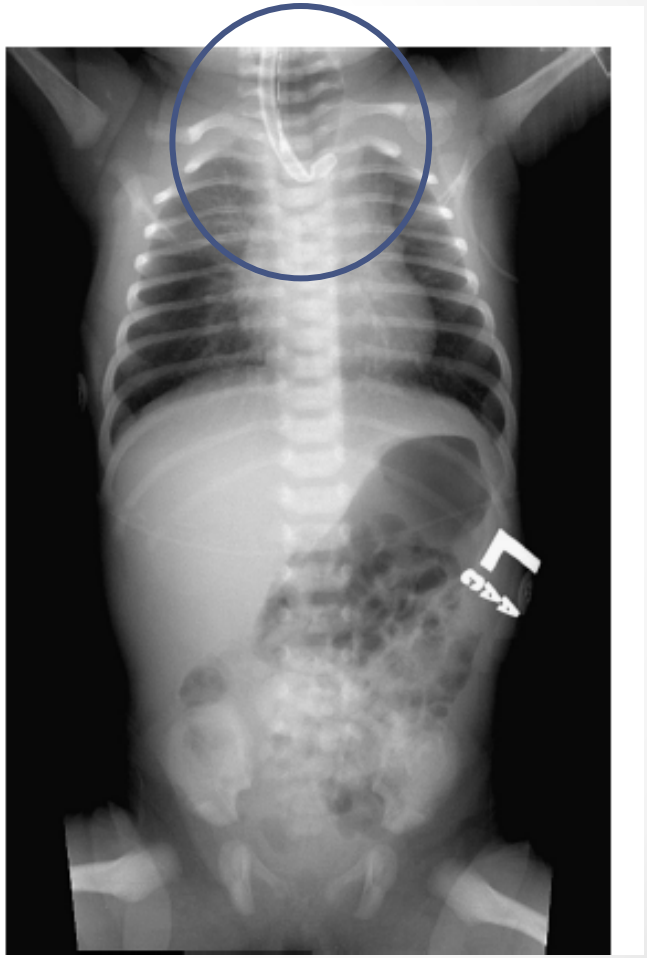
(+/- Tracheoesophageal Fistula)

- Interruption in the continuity of the esophagus with or without fistula
- Caused by error in separation of esophagus & trachea (4th week gestation)
- 1:4500 live birth
- Male > female
- 50-60% associated anomalies
  - **VACTERL: Vertebral, Anal, Cardiac, TracheoEsophageal, Renal, Limb**


2/A
3a/B
3b/C
3c/D
4/E

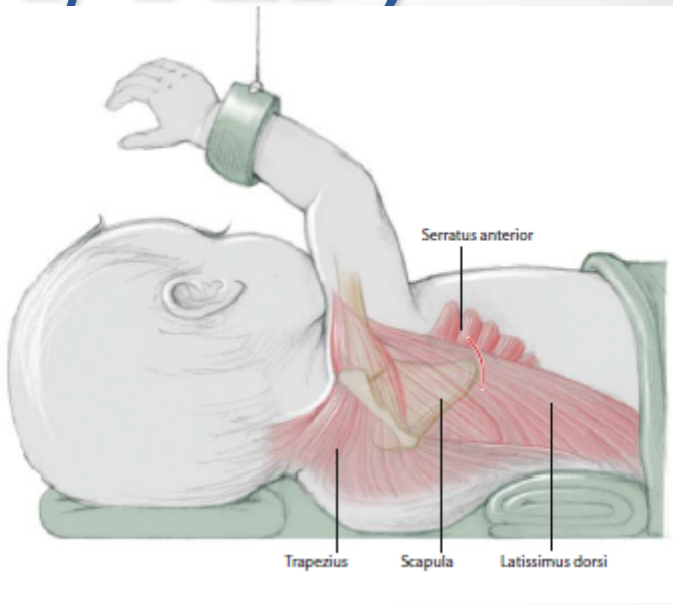
Presentation

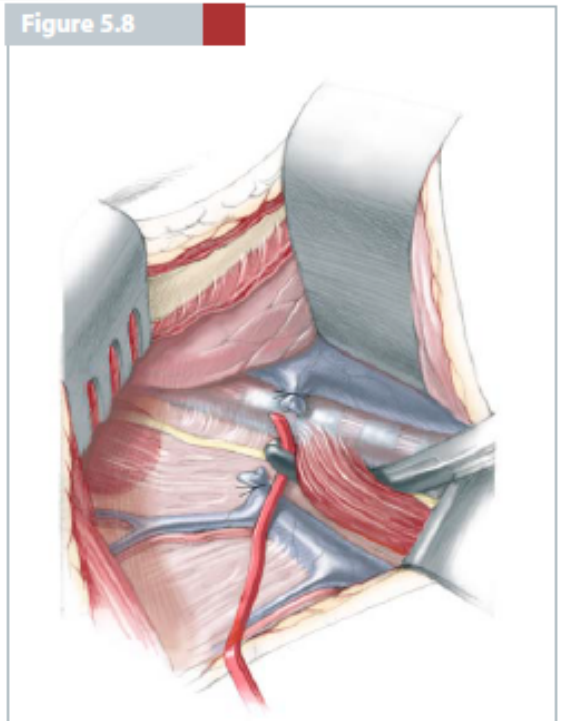
- Prenatal:
  - Polyhydramnios
- Postnatal
  - Drooling
  - Vomiting
  - Respiratory distress
  - Resistance upon insertion of NGT (coiled in the chest)

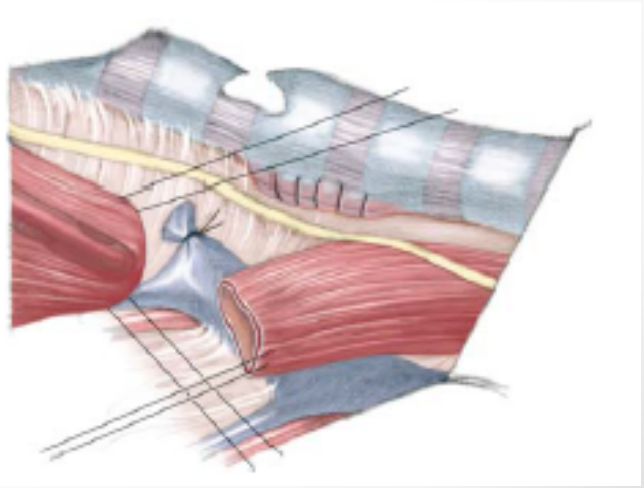


Treatment (EA/TEF)

- Urgent surgery
- Right thoracotomy
- Division of fistula
- Repair esophagus





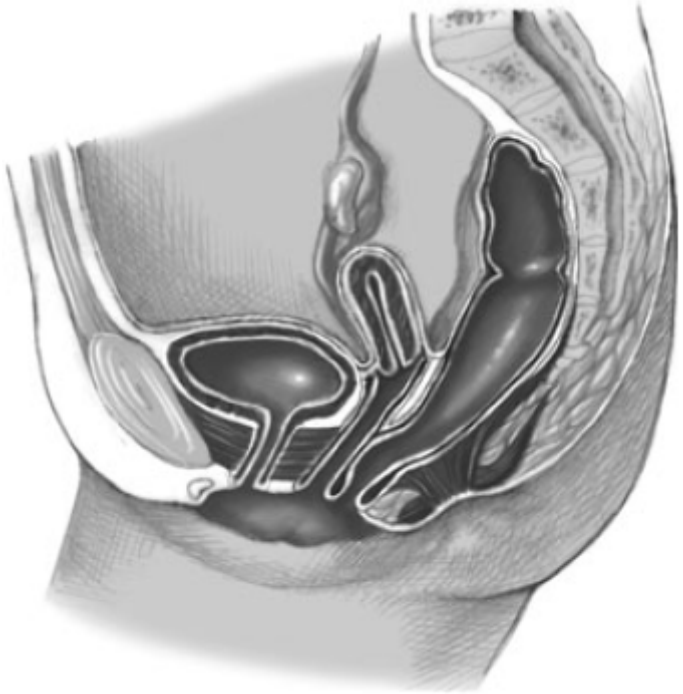


Imperforate Anus

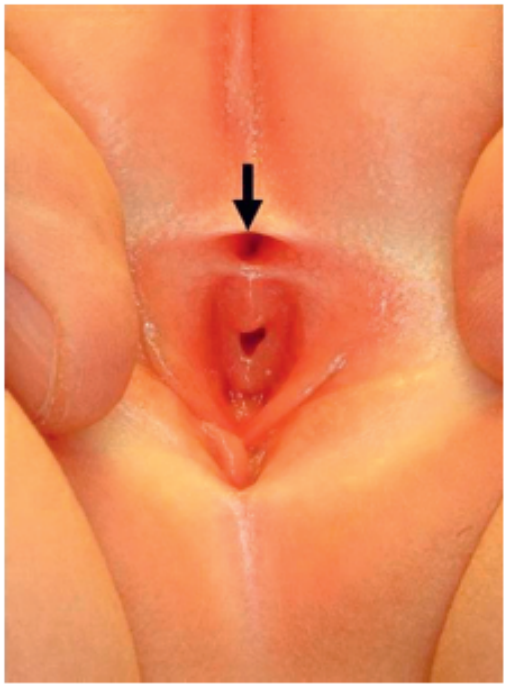
- Various forms of anorectal anomaly
- Normal anus:
  - Normal size
  - Location at the center of the muscle sphincter
- 1:4000
- Male> female
- 65% has associated anomalies (VACTERL)

Female	Perineal fistula	
	Vestibular fistula	
	Persistent cloaca	<3 cm common channel
		>3 cm common channel
	Imperforate anus without fistula	
	Rectal atresia	
Male	Perineal fistula	
	Rectourethral fistula	Bulbar
		Prostatic
	Rectovesical fistula	
	Imperforate anus without fistula	
	Rectal atresia	

Vestibular Fistula



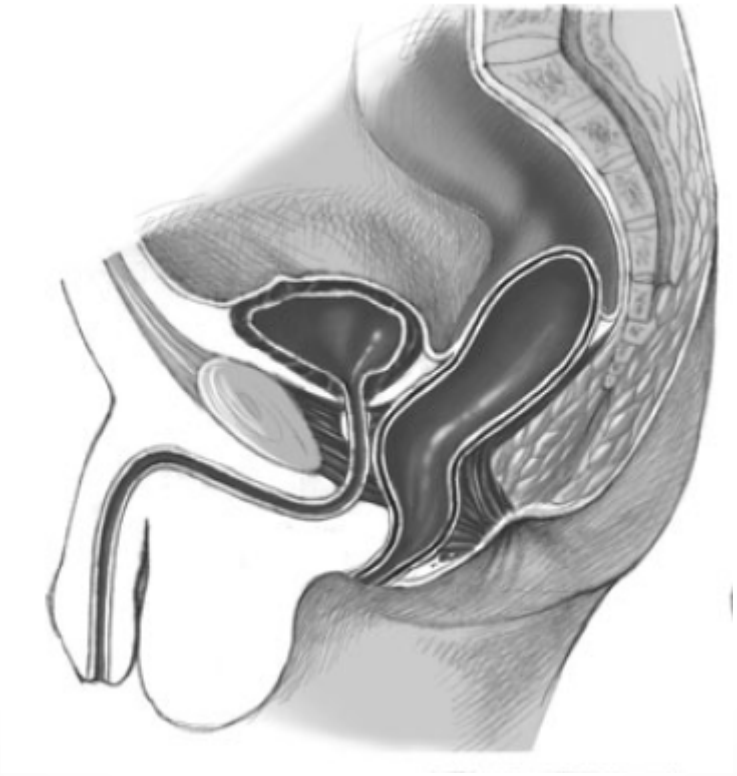
Vestibular Fistula



Ⓑ

FIGURE 35-7 ■ **(A)** Schematic drawing of a rectovestibular fistula. **(B)** Female neonate with a rectovestibular fistula is in the prone position. The rectal fistula (arrow) is located in the posterior aspect of the vestibule.

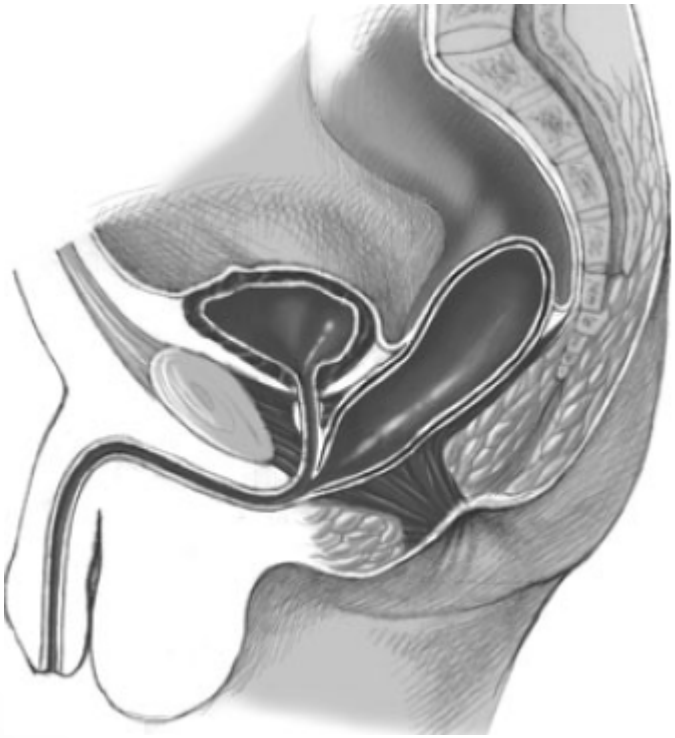
Perineal Fistula



Perineal Fistula

FIGURE 35-2 ■ This male infant has a rectoperineal fistula with a subepithelial tract filled with either mucus or meconium that extends into the scrotal raphe.

Rectourethral Fistula

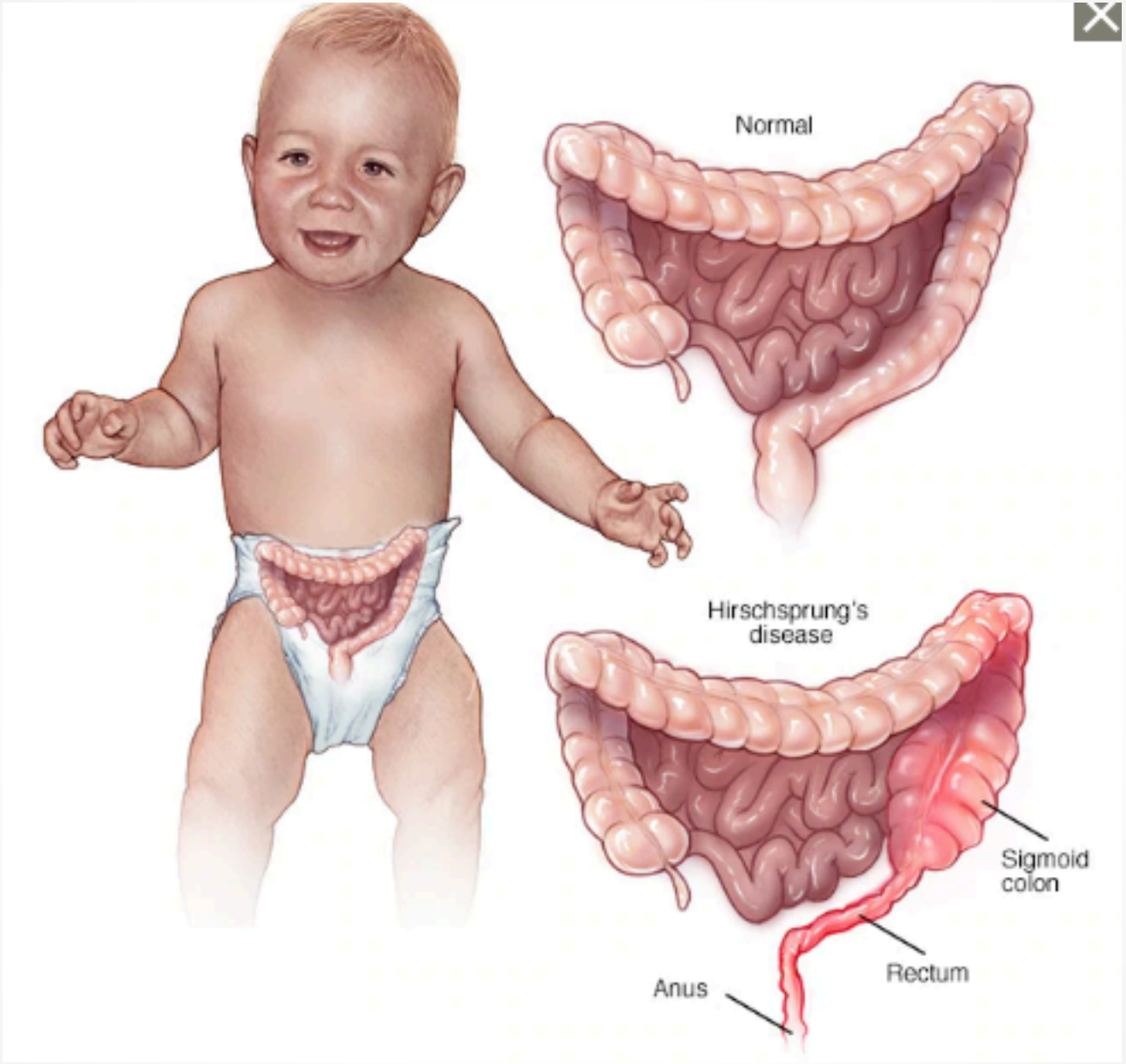


Treatment (ARM)

- Surgical options:
  - Primary anoplasty
  - Colostomy with delayed anoplasty

Hirschsprung Disease (HD)

- Absence of ganglion cells in the myenteric & submucosal plexus of the intestine
- Arrest in ganglion cells migration from proximal to distal part of GI tract
- Transition zone (TZ): area between normal & agangionated bowel
- Types:
  - 80%- rectosigmoid TZ
  - 10%- proximal colon TZ
  - 5%- total colonic HD
  - Rare- near total intestinal HD


Normal
Hirschsprung's disease
Sigmoid colon
Rectum
Anus

Presentation (HSCR)

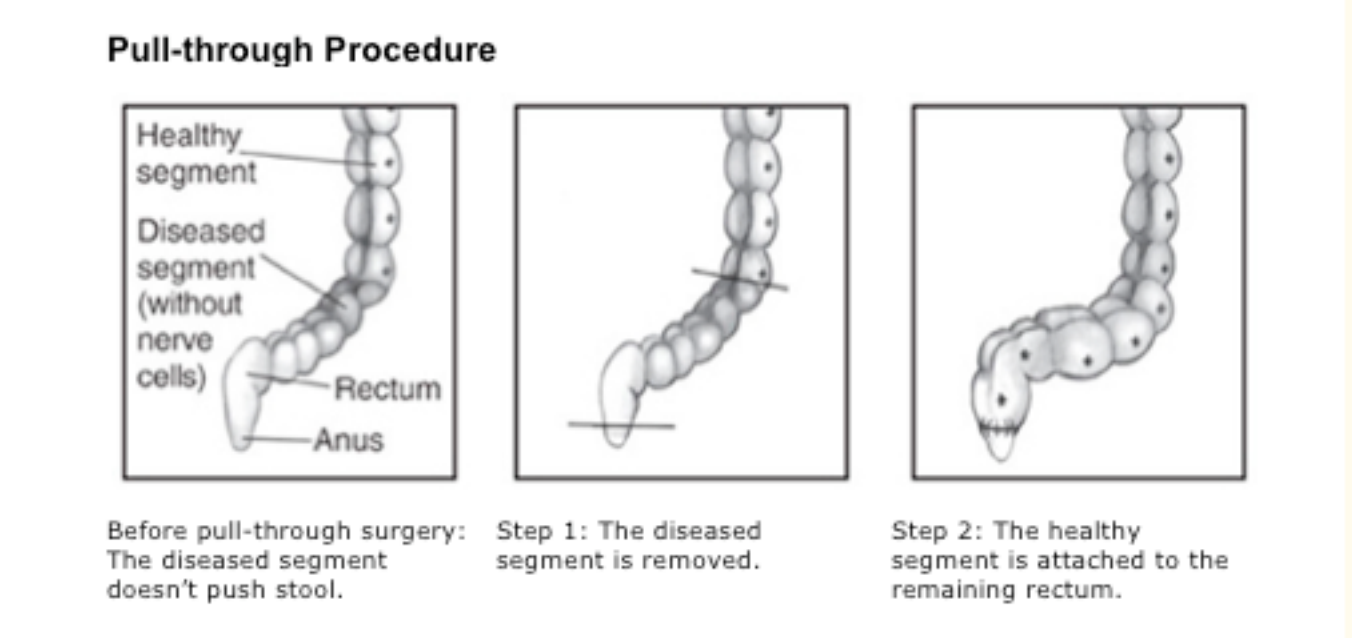
- Neonatal:
  - Delayed passage of meconium >24hr
  - Bilious vomiting
  - Abdominal distension
  - Feeding intolerance
- Delayed:
  - Chronic refractory constipation
  - Abdominal distension
  - Failure to thrive

Diagnosis (HSCR)

- Rectal manometry: absent recto-anal inhibitory reflex
- Rectal biopsy:
  - Gold standard
  - Look for ganglion cells in the myenteric & submucosal plexus

Treatment (HSCR)

- Resection of aganglionic bowel
- Pull through procedure



Questions!