Pediatric surgery - miniOSCE

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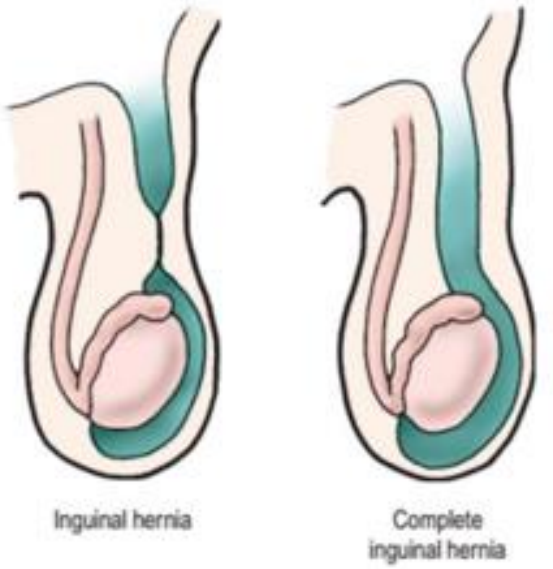
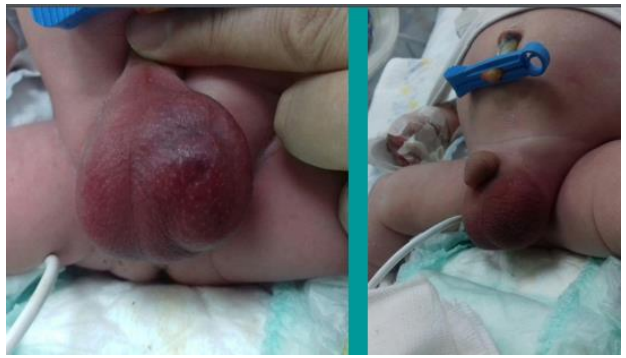
Inguinoscrotal conditions (indirect inguinal hernias)



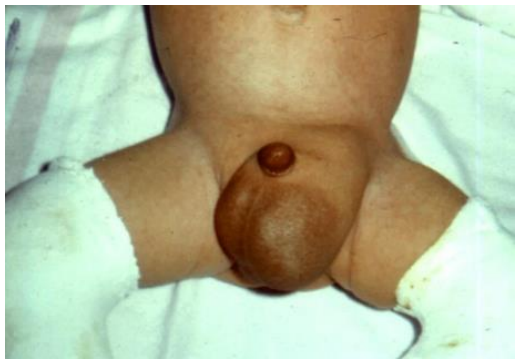
- Risk factors:

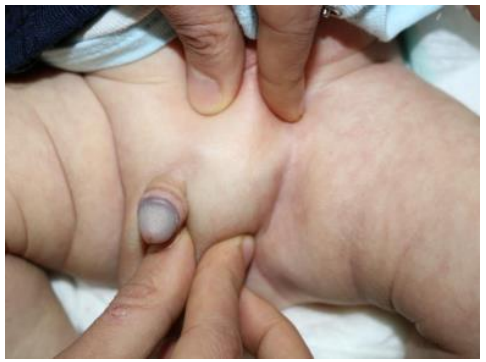
1. Male (M:F = 5:1)
2. Positive family hx
3. Twins
4. Prematurity

- **Right-sided** hernias > **Left-sided** hernias
- Associations: CF, hydrocephalus, peritoneal dialysis.
- Cause: Failure of **processus vaginalis** to close
- Dx is clinical: Hx & PE
- Incarceration: Incidence = 12 – 17%. Risk factors: Young age, prematurity. Tx: Reduction (unless peritonitis or septic shock are present [absolute contraindications]). Indications for urgent operation: (1) **Peritonitis/Shock** [strangulation] (2) **Failure of reduction** (3) Suspected **reduction en masse.**
- **Surgery:** High ligation of PPV
- **Contralateral evaluation** in case of: prematurity, younger age, female gender, left-sided unilateral hernia.



Strangulation

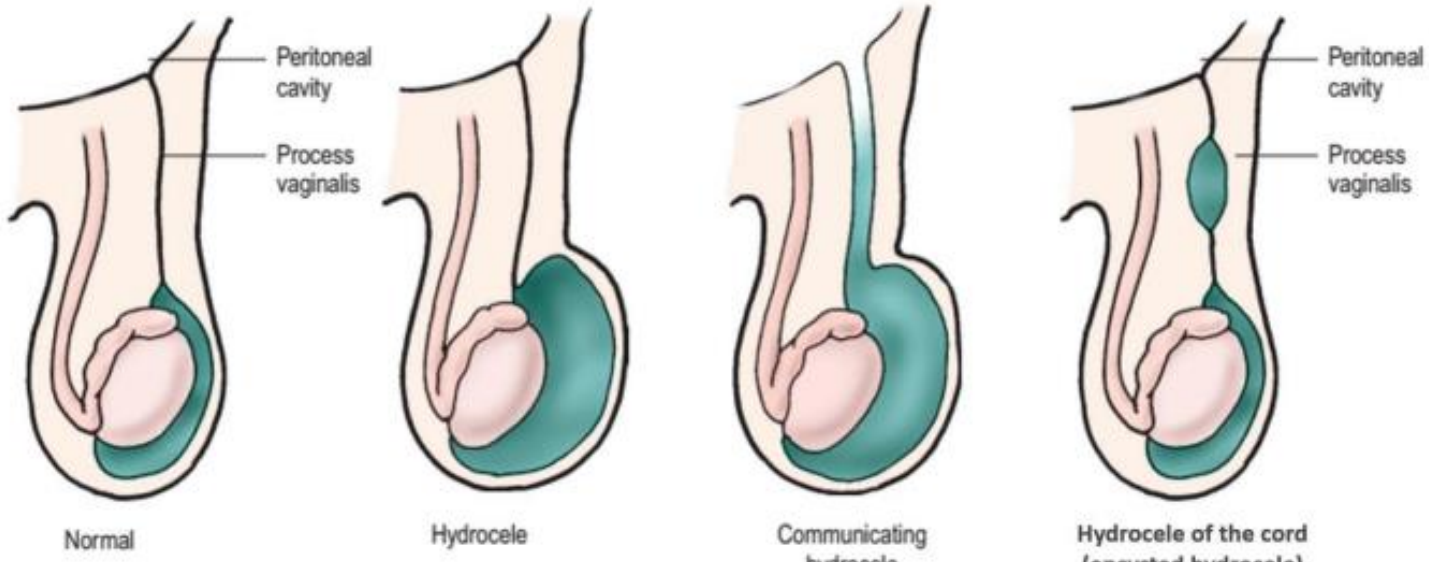




DDx includes:

- **indirect inguinal hernia** (#1)
- **retractile testis** [check if the testis is in the scrotum]
- **lymphadenopathy** [check other lymph nodes]
- **hydrocele** [transillumination]
- **prepubertal fat**

Inguinoscrotal conditions (hydrocele)



Non-communicating (classical) hydrocele

- 89% resolve by 1 year of age
- Tx: Reassurance & observe
- If it fails to resolve or is symptomatic = surgery

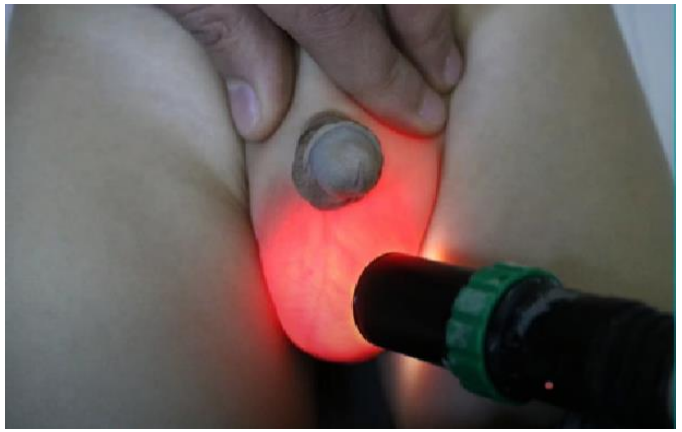
- 63% complete resolution without operation by 1 year of age
- Tx: Reassurance & observe
- If it fails to resolve or is symptomatic = surgery

Unlikely to resolve on its own → surgery

Hydroceles in *adolescents*:

- Complication of **varicocelectomy** (often)
- Inguinal hernia
- Idiopathic hydrocele

Tx: Surgery (not conservative)



Hydrocele (transillumination)

Inguinoscrotal conditions (undescended testes (UDT)/cryptorchidism)

- **UDT**: a testis that has halted somewhere along the normal path of descent from the abdomen to the scrotal sac.
- Risk of **infertility**, **malignancy**.
- Incidence = 3% → Most descend within the first 6-12 months → testicular descent after 1 year is unlikely → **orchidopexy** (at 12-18 months): ↓ risk of malignancy, infertility, torsion. ↑ endocrine function, normal appearance
- Palpable (65-75%) & Non-palpable.
- DDx of **non-palpable testis**: (U/S → MRI → Diagnostic laparoscopy)

1. Testicular agenesis
2. Intra-abdominal testis
3. Fat child
4. Inexperienced examiner
5. Vanished testis (e.g., testicular torsion)
6. Ectopic testis: one that has deviated from the path of normal descent.

- **'Peeping' testis**: when a previously palpable testis falls back into the abdomen through the open ring, or an intra-abdominal can be felt at the upper inguinal canal

- **Retractile testis**: a normally descended testis that retracts into the inguinal canal as a result of cremasteric contraction (e.g., cold exposure). Distinguishing features from UDTs:

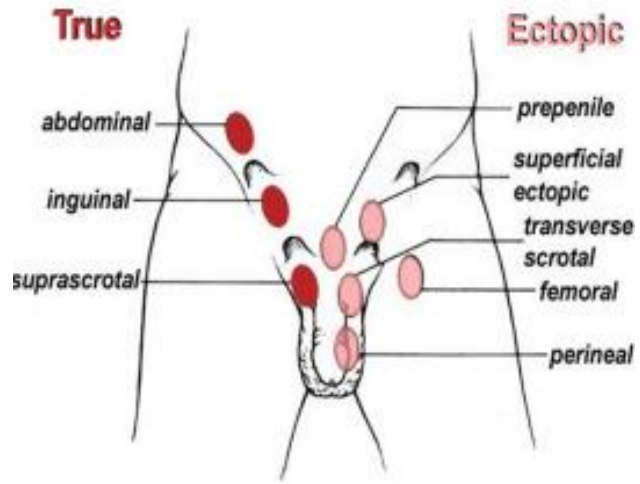
A- Older child age (3-5 yrs) [most UDTs will have been resolved by 18 months of age]

B- Well-developed scrotum

C- Once brought into the scrotum, the testis stays there.

Tx: Reassurance & observation.

***Indications** for surgery* (only 10%): (1) Acquired UDT/ Ascending testis, (2) Symptomatic, (3) Underdeveloped hemiscrotum, (4) Spends longer time in undescended position



(Google pic)

Inguinoscrotal conditions (undescended testes (UDT)/cryptorchidism)

Retractile testes:

- may be manipulated into the scrotum
- once in scrotal position, it remains in place
- ipsilateral hemiscrotum is fully developed (good size, darker, gross rugae)

Low UDTs:

- may be manipulated into the scrotum
- once in scrotal position, it does NOT remain in place
- ipsilateral hemiscrotum may be underdeveloped (smaller, the same color as surrounding skin, no/fine rugae)

Inguinoscrotal conditions (acute scrotum)

DDx:

1) Torsion of the testis (the most serious):

- Twisting of the spermatic cord → compromises the testicular vasculature (infarction)
- More common in adolescents (intravaginal = bell-clapper deformity) & perinatal (extravaginal; pre-natal = painless, post-natal = tender)
- **Presentation: Sudden** onset of **severe**, **unilateral** testicular pain; lower thigh, or lower abdominal pain; nausea and vomiting. What to do next? Surgical exploration → detorsion:

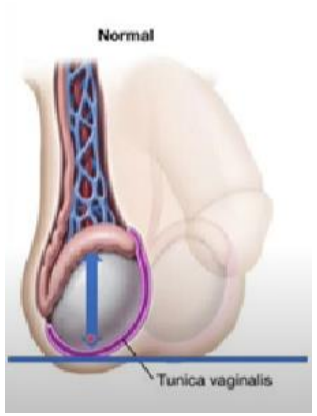
- if viable → fixation (**orchidopexy**; should be done on *both* sides)
- if non-viable → **orchidectomy**

- Probability of testicular salvage declines significantly beyond 6 hours

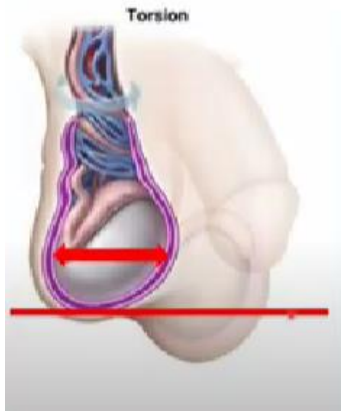
2) Torsion of the appendix testis/epididymis (the most common)

- More common in prepubertal boys (7-10 yrs)
- Same presentation as torsion of the testis + blue dot sign
- Tx: NSAIDs, restricted activity, warm compresses (self-limited)

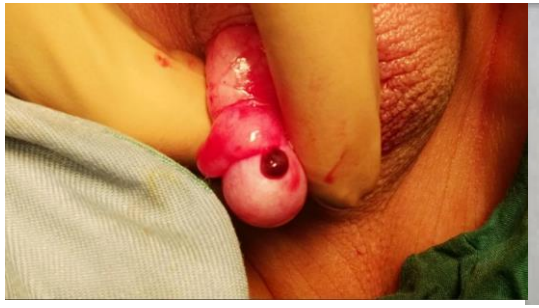
3) Others: Epididymitis/orchitis (urinalysis revealing pyuria and bacteriuria), hernia/hydrocele, trauma/sexual abuse, tumor, cellulitis, Henoch–Schönlein purpura (skin purpura, GI pain, hematuria), idiopathic scrotal edema.



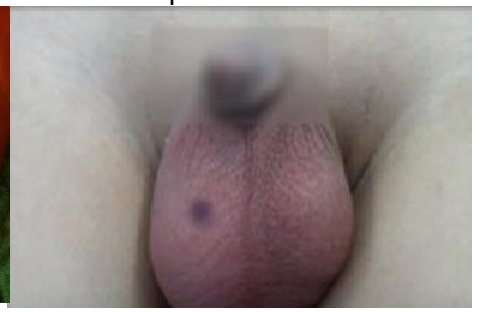
- Posterior epididymis
- Vertical orientation



- Anterior epididymis
- Transverse orientation
- Absent cremasteric reflex
- Enlarged, tender testis
- Retracted up

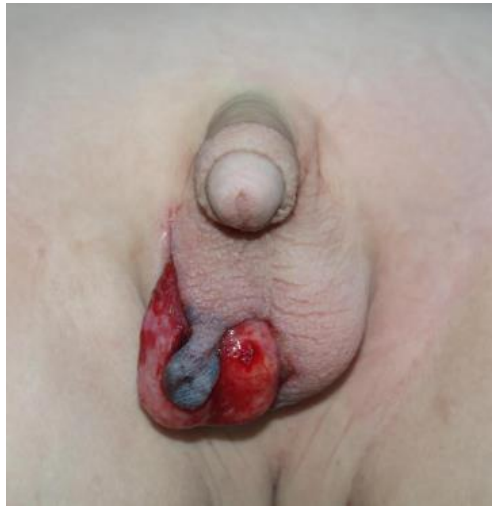


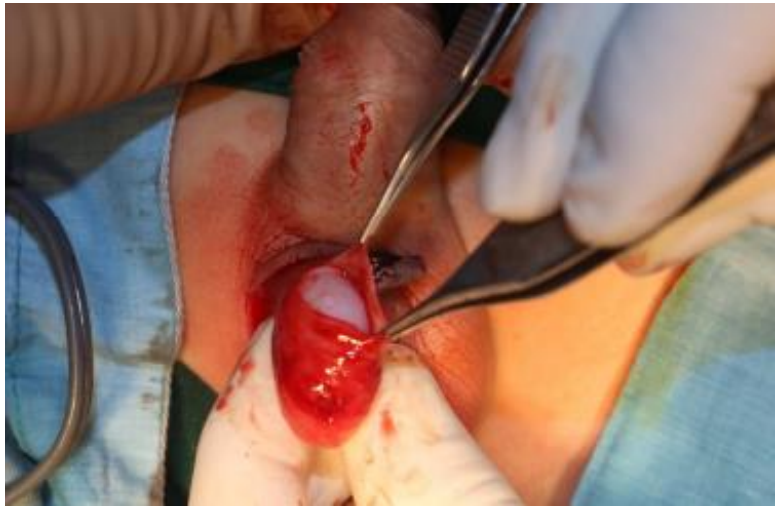
Torsion of the appendix



Blue dot sign

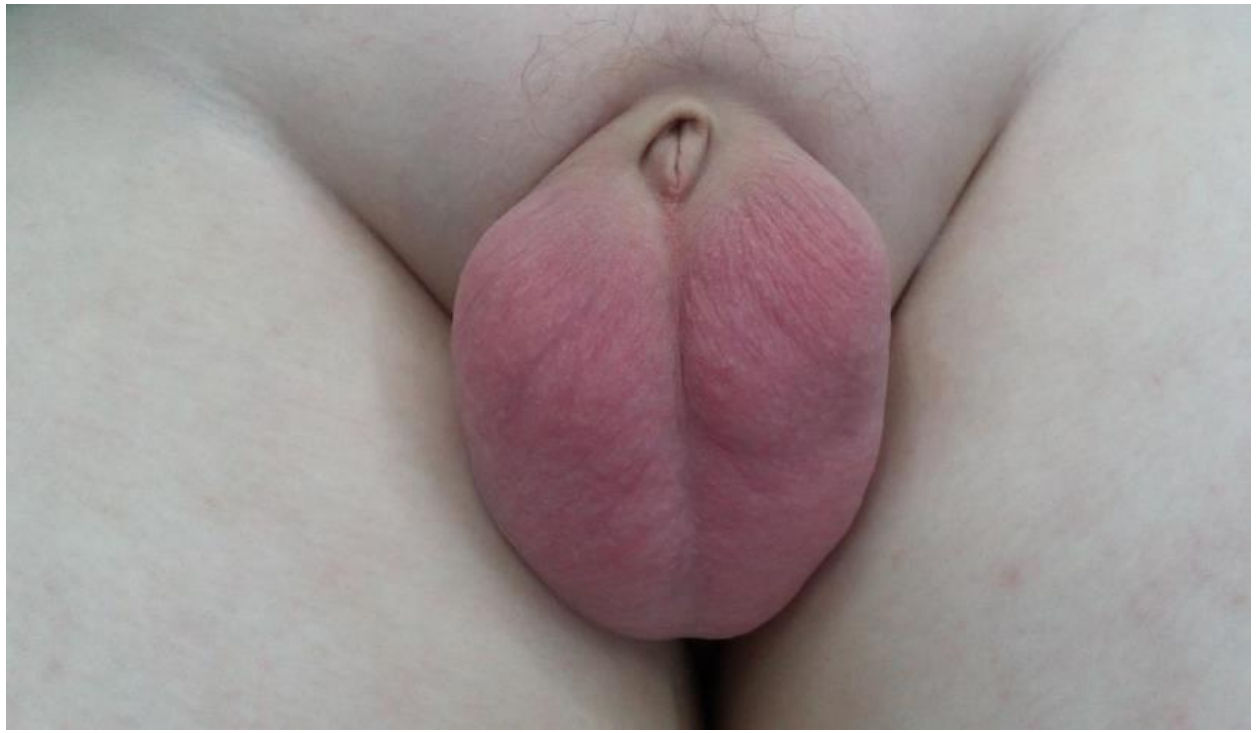
Inguinoscrotal conditions (acute scrotum)





Testicular trauma → exploration +/- repair of the ruptured **tunica albuginea**

In this case: tunica albuginea (white) is intact
Suspect sexual abuse



Idiopathic scrotal edema

Intestinal obstruction

Malrotation

Failure of the final 90° anticlockwise rotation taking the cecum from the RUQ to the right iliac fossa (cecum stays in RUQ)

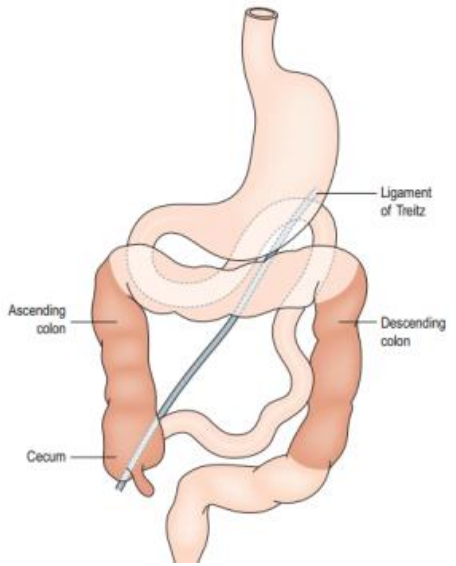
The cecum is fixed to the retroperitoneum by peritoneal bands running anteriorly to the 2nd part of the duodenum (**Ladd's bands:** yellow arrow).

Presentation (often in neonates):

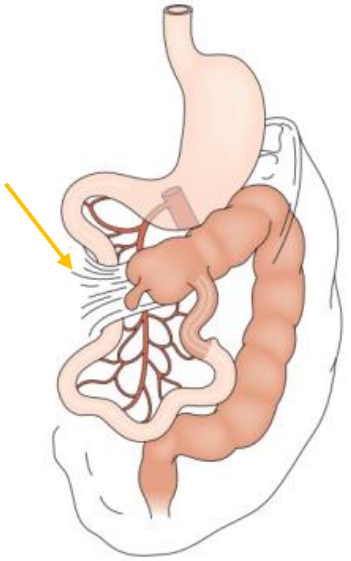
- Duodenal obstruction (bilious vomiting)
- Volvulus (if suspected → urgent laparotomy → Ladd's procedure)

Outcome and Complications

- Midgut infarction
- Recurrence of midgut volvulus post-Ladd's procedure
- Adhesional intestinal obstruction



Normal


Malrotation

C-shaped duodenum	Redundant duodenum, right-sided jejunal loops
DJ junction is on the left	**DJ junction** is on the right

Intestinal obstruction

Intestinal atresia

- Jejunoileal > duodenal > colonic
- *Presentation*: Bilious vomiting; abdominal distension
- ***Types***:

Type I – Membrane or web

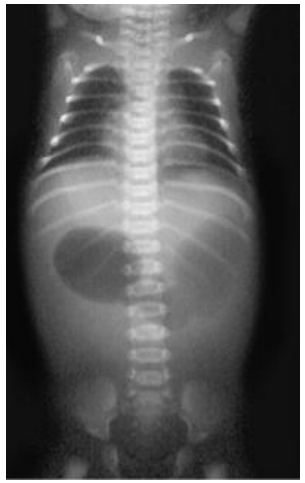
Type II – Fibrous cord joins two blind ends of the bowel

Type III:

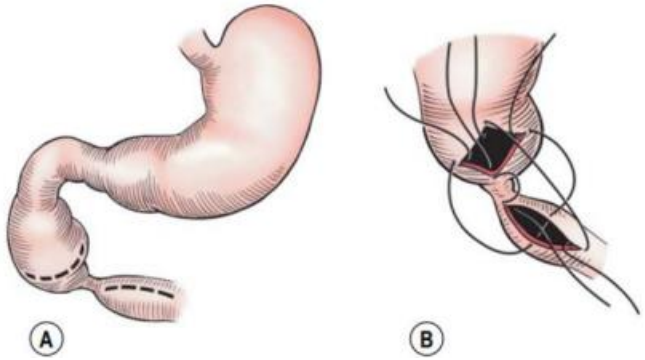
- IIIa – Gap between ends with a V-shaped *mesenteric defect*
- **IIIb** – Large defect in the mesentery, significant intestinal loss, and distal intestine winds around a rudimentary artery ***("apple-peel"*** *or "Christmas tree" atresia*)

Type IV – Multiple atresias ("string of sausages" appearance)

- *Tx*:
- Duodenal atresia: **Duodeno-duodenostomy**
- Jejuno-ileal atresia: Resection of atretic segments + re-anastomosis

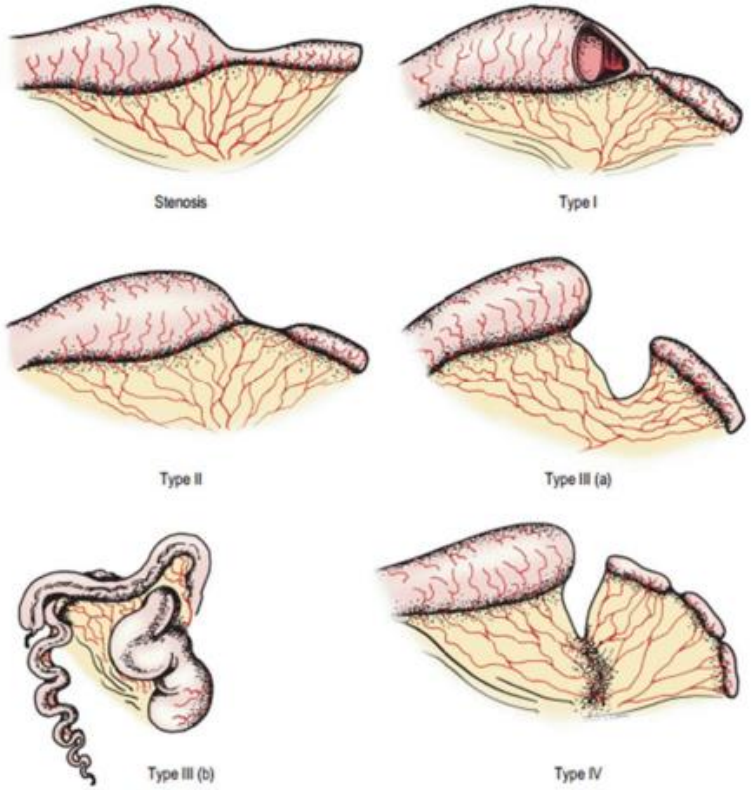


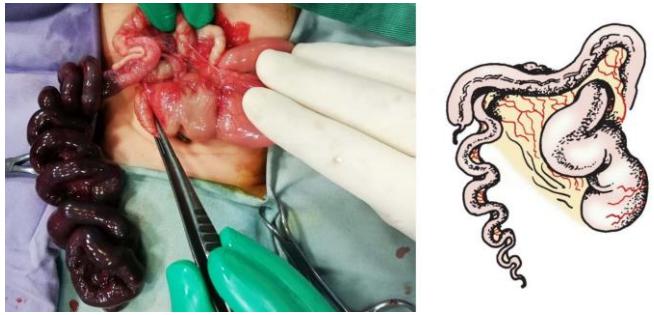
"**Double bubble**" and **no distal gas**
(classical feature in duodenal atresia)



Duodeno-duodenostomy
(direct anastomosis; no resection)

Types of intestinal atresia





Jejunal atresia – type IIIb "Apple-peel" atresia complicated by necrosis.

Intestinal obstruction

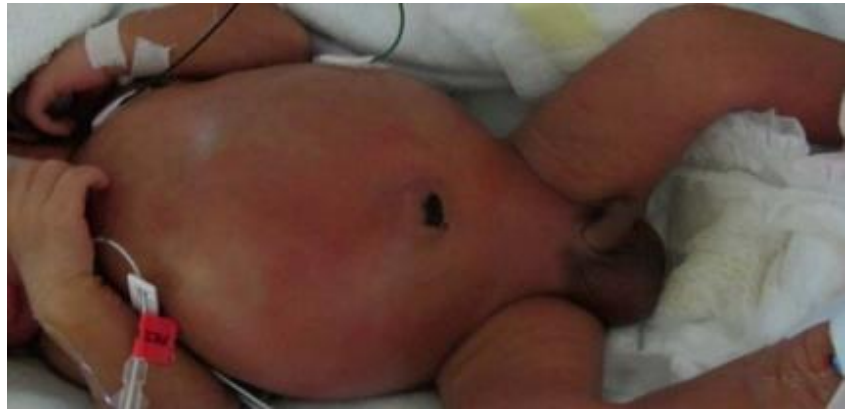
Necrotizing enterocolitis (NEC)

- **Preterm, formula-fed** infants
- *Age of onset*: between **7-10 days**
- *Most common location*: **ileocecal**
- *Presentation*:

Nonspecific signs related to sepsis and ischemia (tachycardia, hypotension, metabolic acidosis,…)

Specific local signs related to the affected bowel loops (peritonism, **abdominal wall erythema**, bile-vomiting, GI bleeding, abdominal mass formation)

- *Complications*: Recurrence; short-gut syndrome; strictures



Abdominal wall erythema
(sign of diffuse peritonitis)

Pan-intestinal NEC

Intestinal obstruction

Necrotizing enterocolitis (NEC) – con.

- *Dx*: **Supine AP**:-

a) **Pneumatosis intestinalis** (seen as linear radiolucent bands parallel to the wall of the bowel or "soap-bubble" appearance)

b) **Portal venous gas**

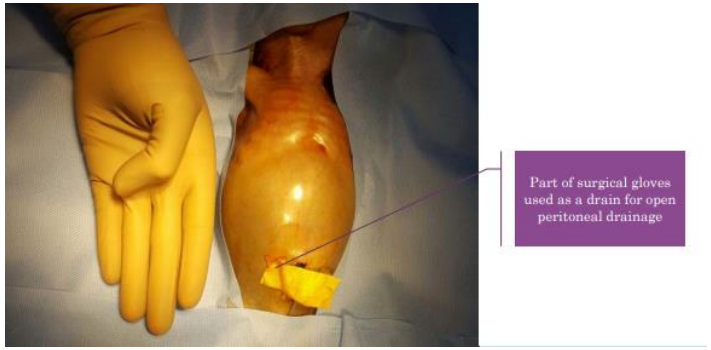
c) **Extravisceral free air** (most seen between the liver and the diaphragm and anteriorly outlining falciform ligament "football sign")

- *Management*: supportive (NPO, NGT, O2, antibiotics, analgesia,…)

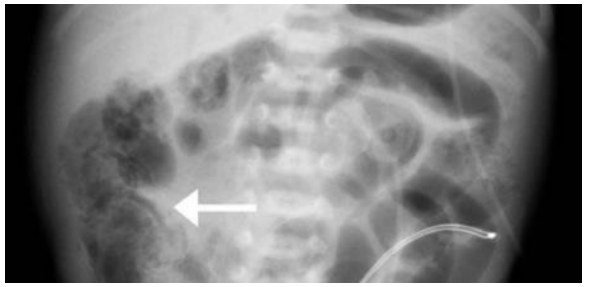
Indications for **Surgery**:

1. **Pneumoperitoneum** (perforation)
2. Failure to progress (after 24 h of full, supportive management)
3. Obstructive features (↑ distension, ↑ bile aspirates)
4. "Sentinel-loop" on imaging
5. ↑ Abdominal wall erythema
6. Palpable abdominal mass

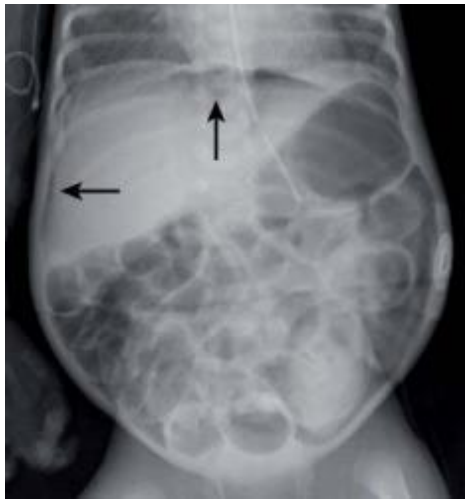
- If ***unstable*** for surgery: →



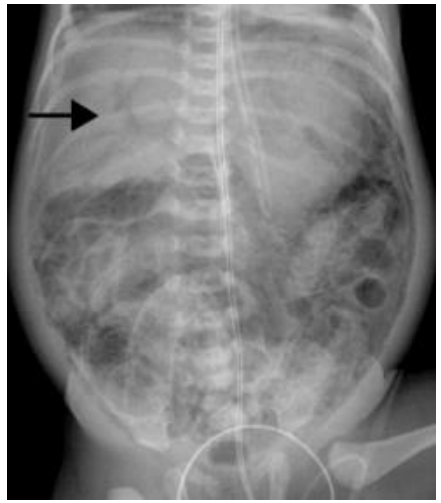
Primary peritoneal drainage



Pneumatosis intestinalis
(linear radiolucent bands parallel to the wall of the bowel)



Extravesical free air (pneumoperitoneum)



Portal venous gas

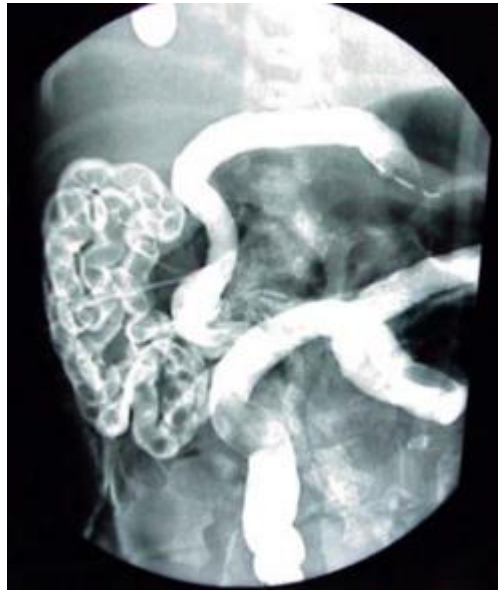
Intestinal obstruction

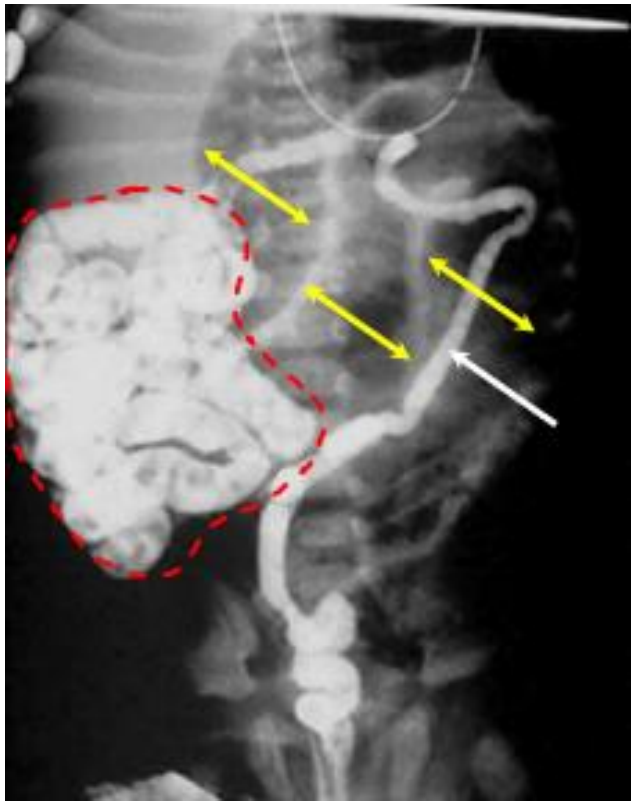
Meconium ileus

- 90% have **cystic fibrosis**
- Two types:

1- Simple → Bilious vomiting, abdominal distension, failure to pass meconium. “Doughy,” palpable bowel loops. → Tx? Water-soluble contrast enema

2- Complicated: Perforation & gangrene → resection & anastomosis





- Micro-colon [white arrow]
- Dilated proximal small bowel loops filled with gas (black shadow) [yellow arrows]
- Distal small bowel filled with inspissated meconium (“soap-bubble” appearance or “Neuhauser’s sign”) [red dash-lines]

Intestinal obstruction

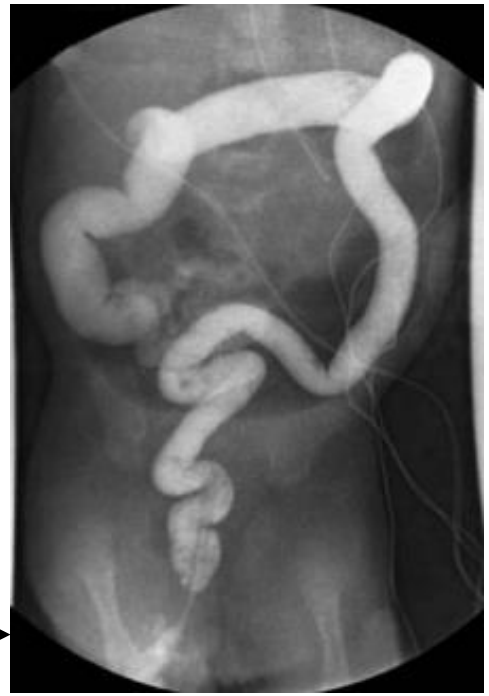
Hirschsprung's Disease

- *Pathological hallmark*: Lack of progression of the peristaltic wave into the aganglionic segment of the intestine + absent internal anal sphincter relaxation (absence of recto-anal inhibitory reflex).
- *Associations*: **Down syndrome**, developmental **colon anomalies** (colon atresia, anorectal atresia), **RET mutation.**
- *Types*:
  - Short segment (recto-sigmoid)
  - Long segment (total colon)
- *Presentation*:

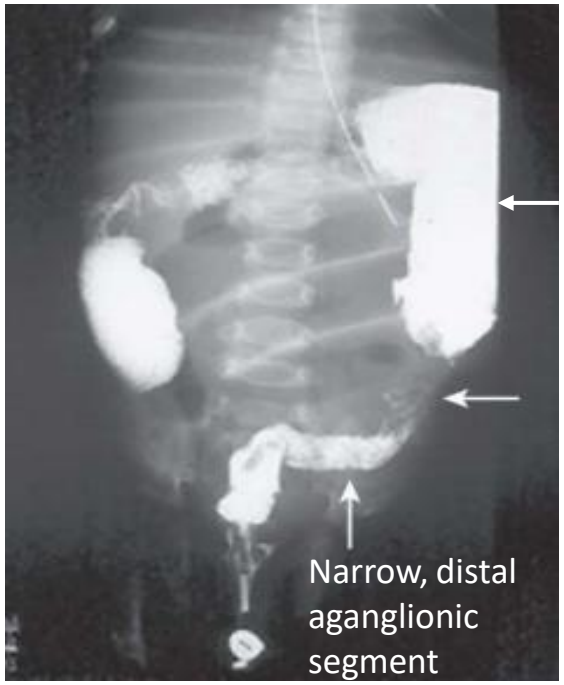
1. Neonatal bowel obstruction: Delayed passage of meconium; abdominal distension; bilious vomiting

2. Chronic constipation (without soiling)

- *Dx*: **Rectal suction biopsy** (taken 1 cm above the dentate line for neonates; 3 cm for older children)
- *Tx*: **Decompression** (Rectal washout) → **Surgery** (Resection of aganglionic segment & Pull-through procedure)



Total colonic HD



Dilated, proximal ganglionic segment

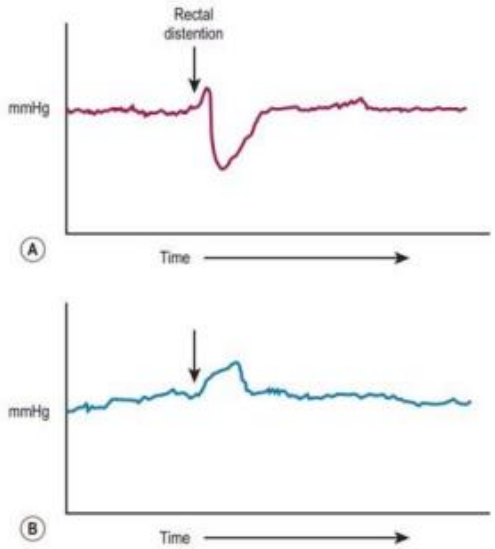
Transition zone

↓

Biopsy = ↓ # of ganglionic cells

Anorectal Manometry

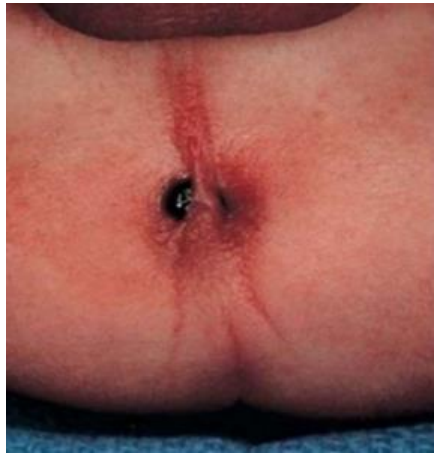
A. Normal response to rectal distension (presence of Recto-Anal Inhibitory Reflex).
B. Absence of Recto-Anal Inhibitory Reflex.



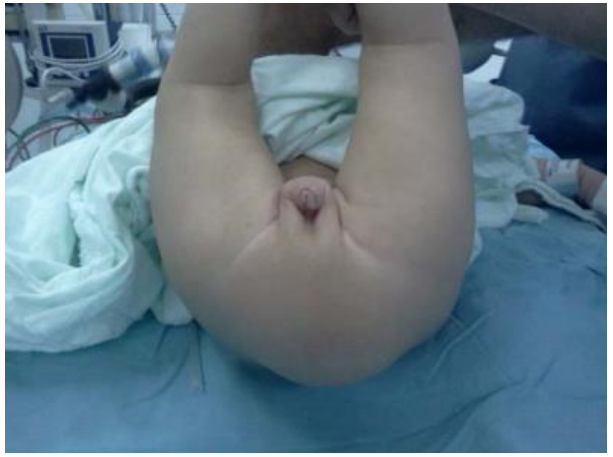
Intestinal obstruction

Anorectal malformations

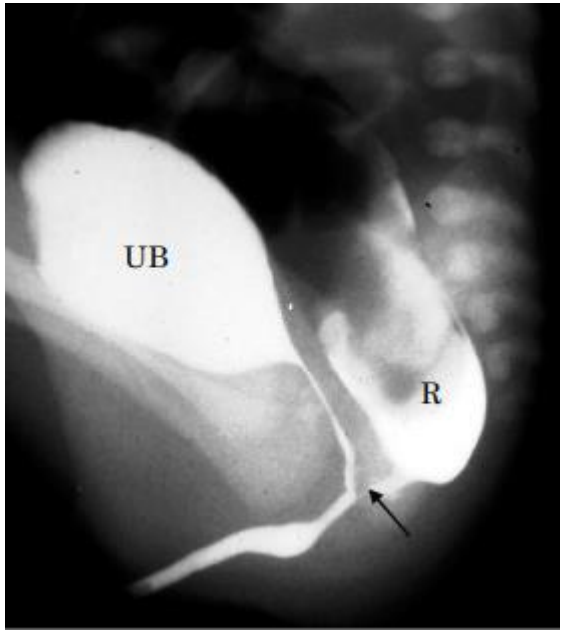
- Can be part of VACTERL association
- Surgery: **Posterior Sagittal Anorectoplasty (PSARP)**



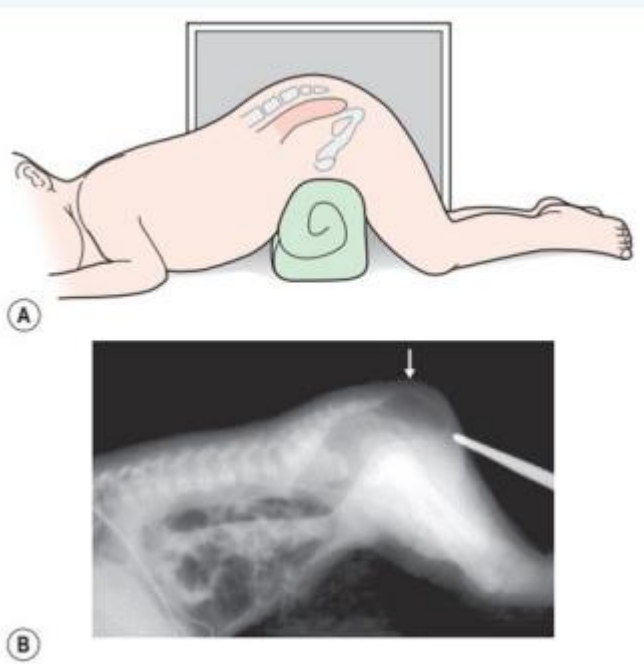
"Bucket-handle" deformity, suggesting a low type ARM



Imperforate anus with flat perineum, suggesting a high type ARM



Distal Colostogram: the contrast is passing through a recto-membranous urethral fistula **(black arrow)** filling the urinary bladder and urethra



Cross-table lateral film (after 12–24 h of life) in Jackknife position:
to localize the distance of rectal gas from the perineum

Intussusception

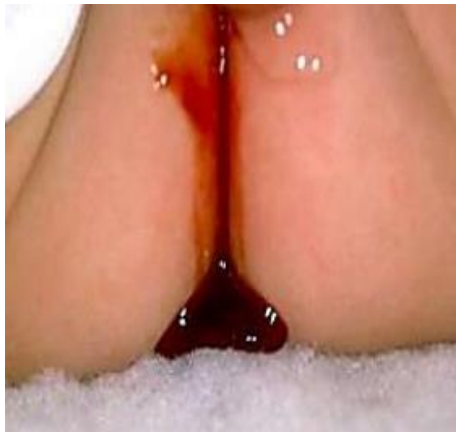
- **Acquired** invagination of the proximal bowel (intussusceptum) into the distal bowel (intussuscipiens).
- The most common cause of intestinal obstruction in children between ages **3 months** and **3 years old.**
- **1ry** (idiopathic; most common) or **2ry** (lead point: *Meckel diverticulum* is the MC in children)
- Triad (in 25% of cases):

(1) Intermittent, crampy abdominal pain

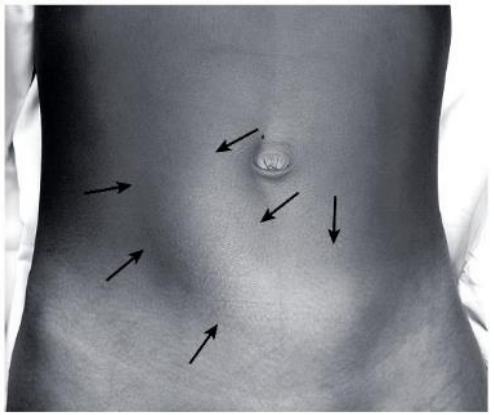
(2) Red currant jelly stool

(3) Palpable mass on PE

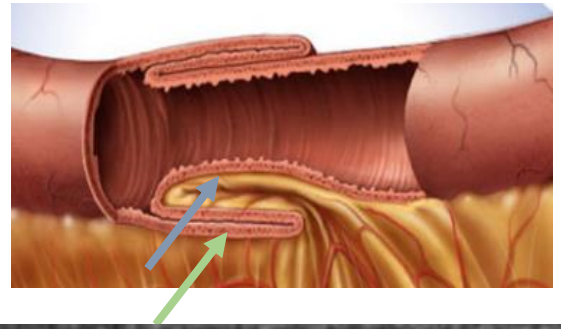
- **Dx**: Ultrasound

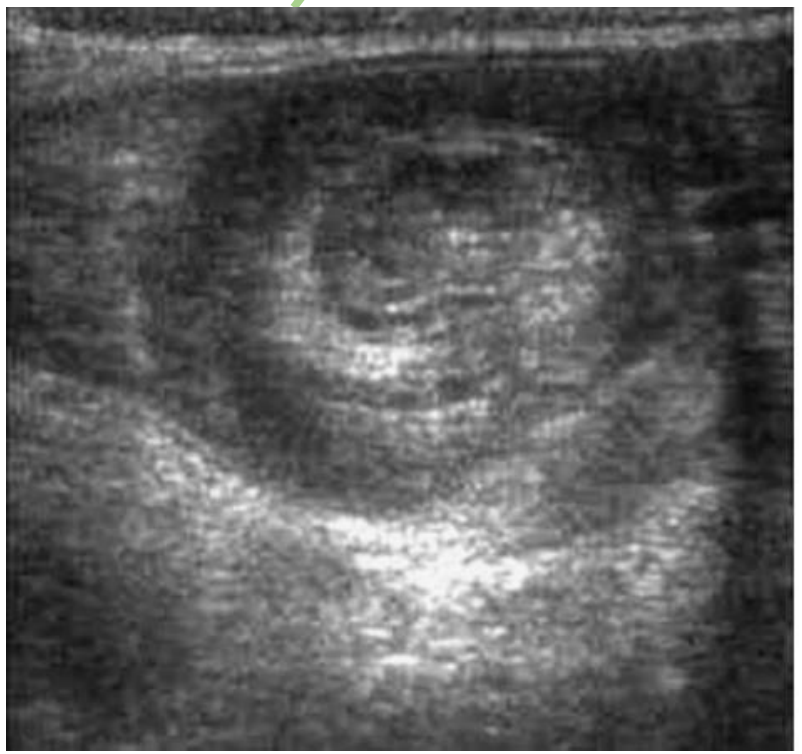


Red currant jelly stool

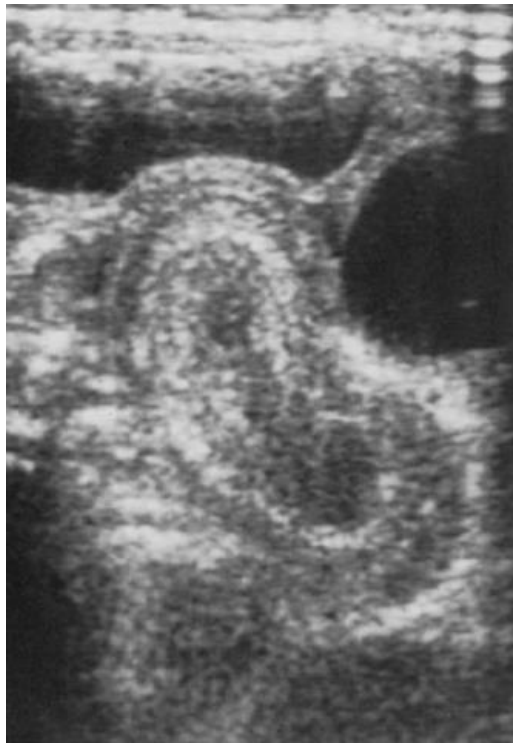


Sausage-shaped mass





Target sign or donut sign (transverse)



Pseudo kidney sign (longitudinal)

Intussusception

- **Management**:

- NGT, NPO, IV fluid resuscitation.
- Nonoperative: pneumatic or hydrostatic endoscopic reduction

Contraindications: perforation (air under diaphragm), peritonitis, persistent hypotension.

Complications: Tension pneumoperitoneum (pneumatic reduction)

Success rate: 85%

- Operative reduction:

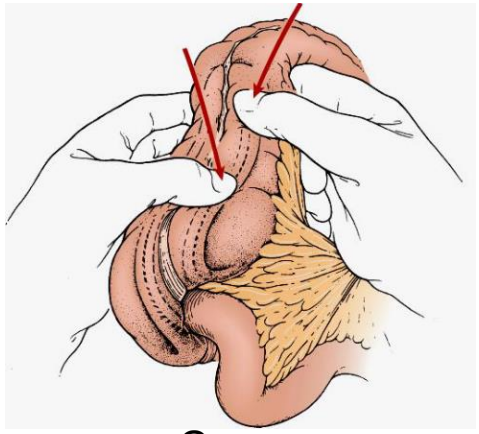
- Indications:

(1) Unsuccessful non-operative reduction

(2) Peritonitis

(3) Perforation (AUD)

(4) Lead point (e.g., tumor)



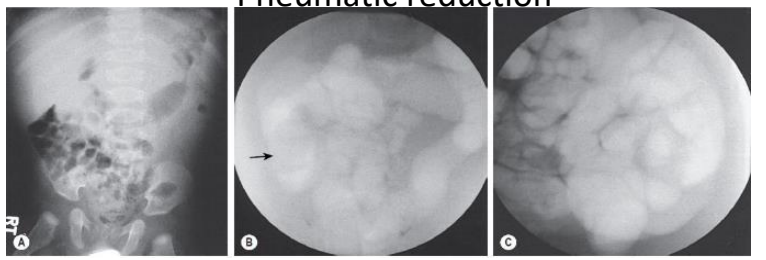
Open

- Types:

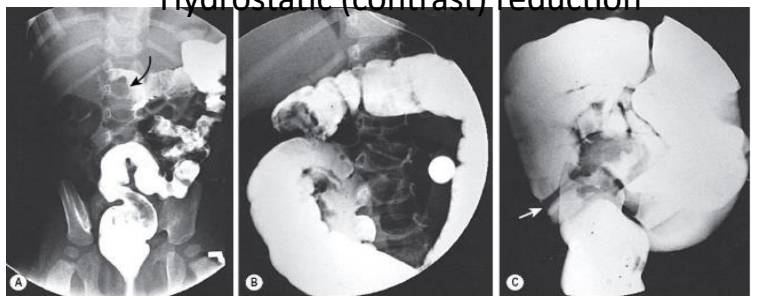
(1) Open ± appendectomy ± resection (if: ischemic bowel, lead point, inability to manually reduce intussusception)

(2) Laparoscopic

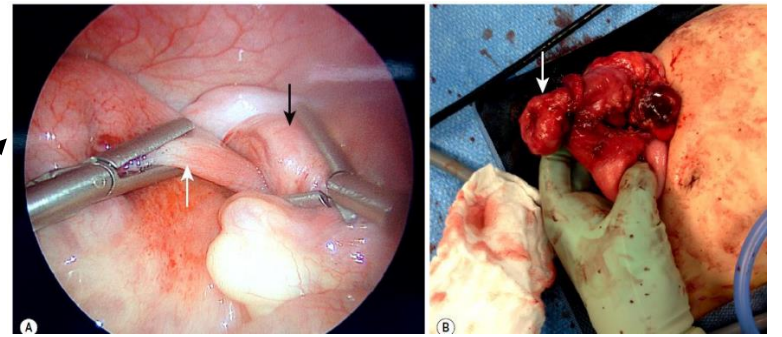
Pneumatic reduction

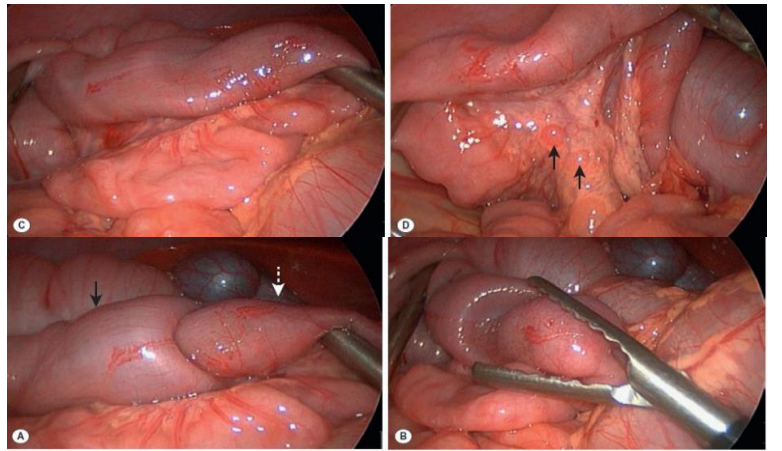


Hydrostatic (contrast) reduction



Laparoscopic





Hypertrophic pyloric stenosis (HPS)

Risk factors:

1. Male (M:F = 4:1)
2. Firstborn
3. Family hx
4. Younger maternal age
5. Maternal feeding patterns

Presentation:

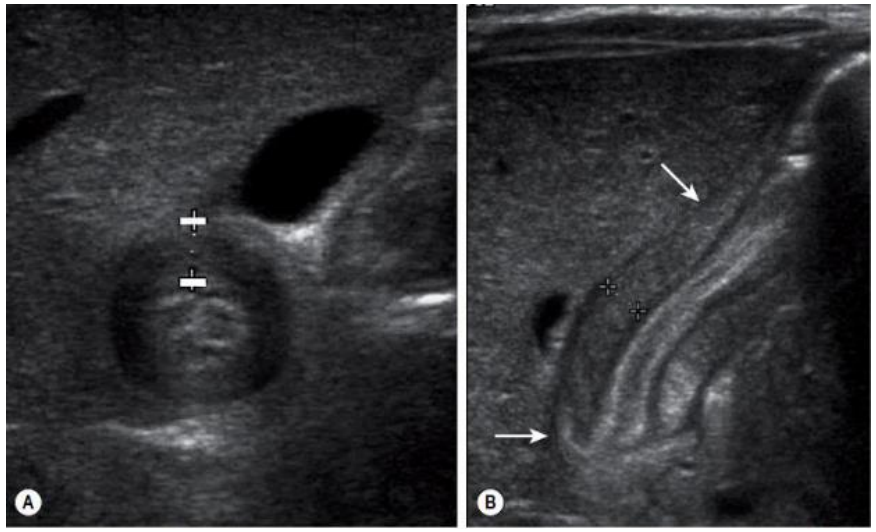
Hx: Projectile, non-bilious vomiting

PE: Olive sign (70-90%), visible peristaltic waves

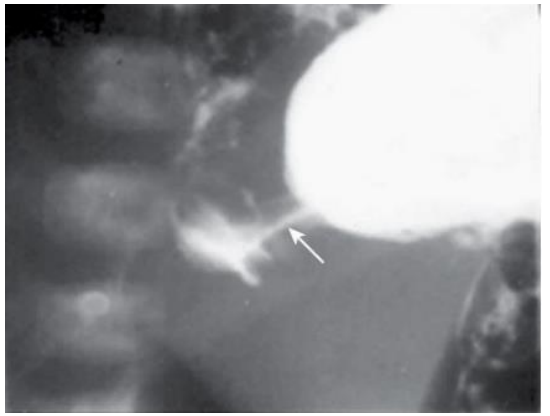
Labs: Hypokalemic, hypochloremic metabolic alkalosis

Imaging: Ultrasound (gold standard). If equivocal: upper GI series.

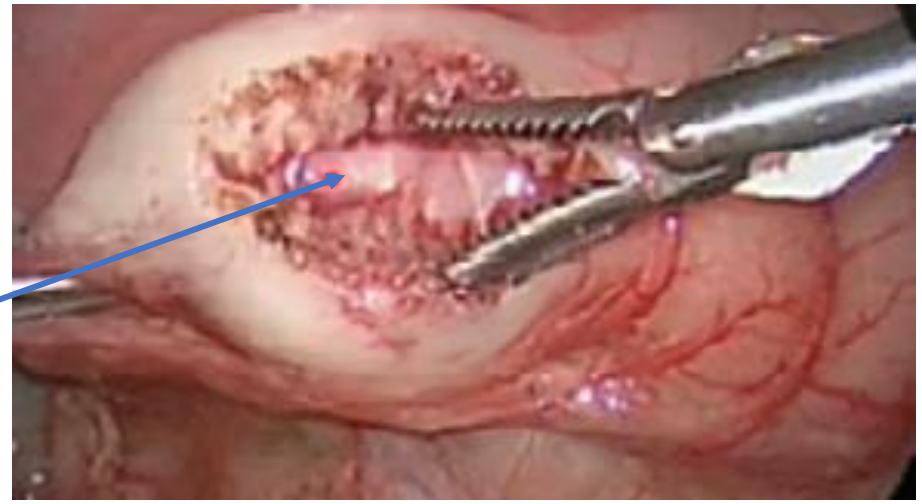
Tx: Pyloromyotomy (HPS is NOT a surgical emergency → correct fluid & electrolytes 1st)



Ultrasound: Muscle thickness ≥ 4mm; pyloric channel length ≥ 16 mm



Upper GI series: String sign; double-track sign

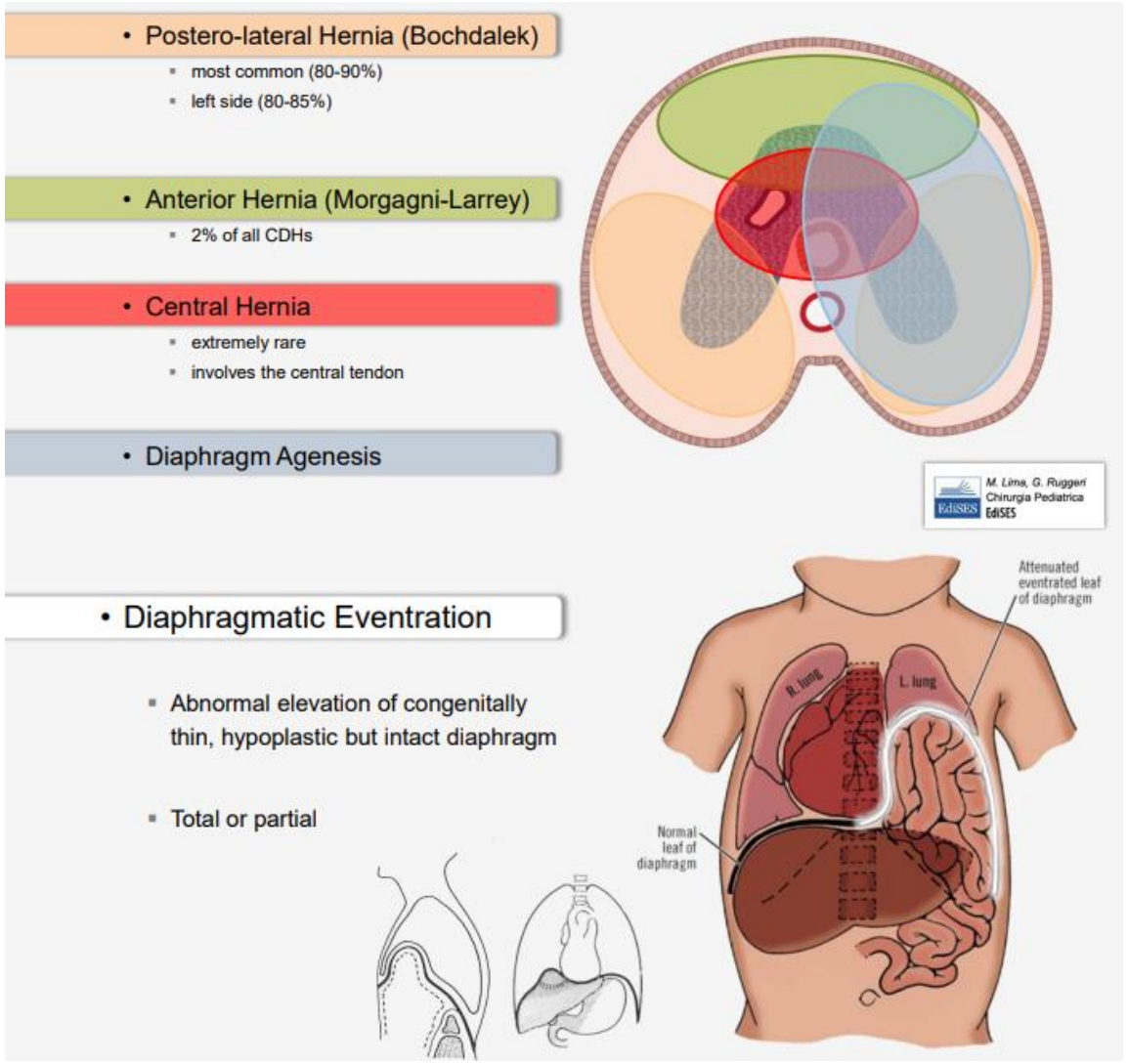


Pyloromyotomy
(Muscle is released, mucosa is left intact)

Congenital diaphragmatic hernia (CDH)

- A developmental discontinuity of the diaphragm that allows **abdominal viscera** to **herniate** into the **chest.**
- **Bad prognostic factors:**

1. Associated malformations
2. Right-sided defects (liver herniation)
3. <30% of expected lung volume
4. ↓ Lung area to head circumference ratio (LHR)



Congenital diaphragmatic hernia (CDH)

- Clinical presentation: (ranges in severity from hydrops fetalis/stillbirth (fetus) to asymptomatic or non-specific symptoms (infants & children)

▪ *Prenatal:*

- *Screening by **fetal ultrasound.*** If inconclusive → **Fetal MRI**

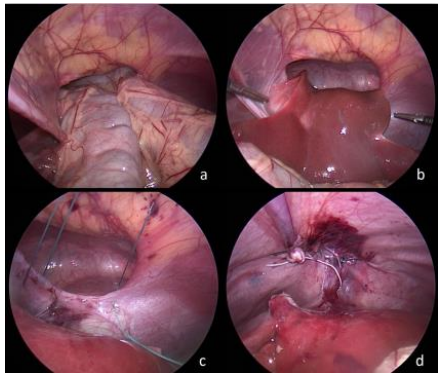
▪ *Postnatal:*

- Most common presentation: **respiratory distress** (why? Pulmonary hypoplasia → Persistent Pulmonary hypertension → Right-to-left shunting → Hypoxemia & acidosis → Cardiorespiratory failure → death)
- PE: Scaphoid abdomen, absent breath sounds, bowel sounds can be heard over the chest.
- Dx: **Chest X-ray**
- Tx: Open or minimally-invasive surgery after optimizing the baby's condition (Reduce lung compression [intubation, NGT] Ventilatory support; cardiovascular support; correction of acid-base status; **correction of pulmonary hypertension**)

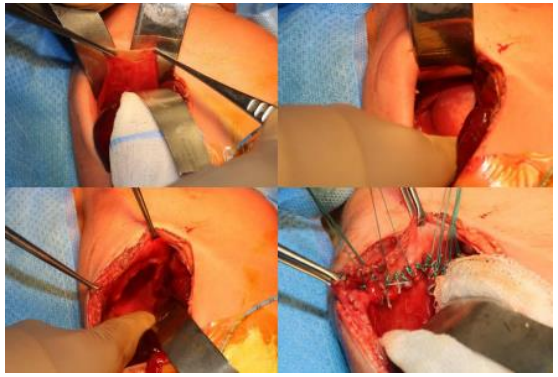
▪ *Infants & children:*

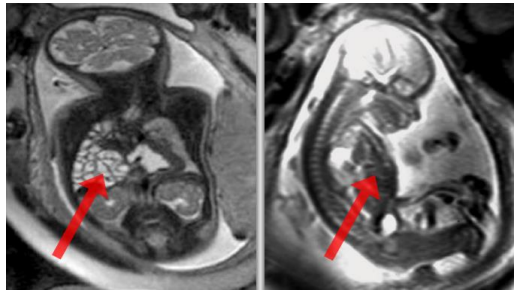
- *Non-specific respiratory/GI symptoms*
- Dx: ***Incidental finding*** *on chest X-ray*

MIS



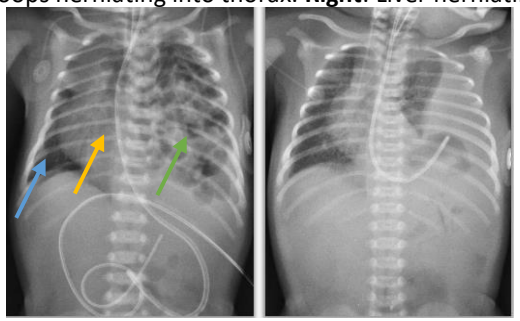
Open





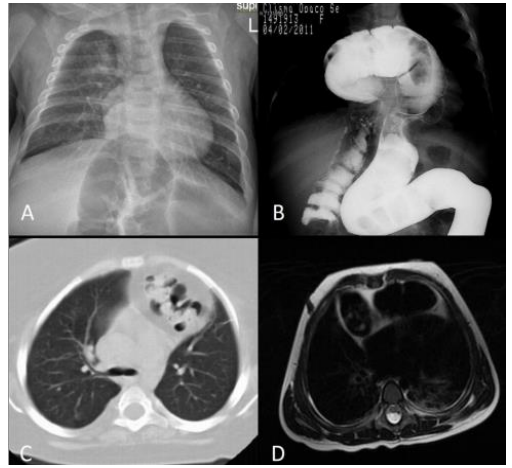
Prenatal

Fetal MRI: **Left**: Bowel loops herniating into thorax. **Right**: Liver herniating into thorax (right)



Postnatal

Chest X-ray: **Left**: Bowel loops herniating into thorax **[green]**, mediastinum shifted to the right hemithorax **[yellow]**, compressed lung **[blue]**, NG tube reaches the stomach in the abdomen = no stomach herniation. **Right**: NG tube folds back into the thorax = stomach is herniated into the chest



Infants & children

Morgagni Hernia (anterior CDH). A: Chest X-ray. B: Trans-anal contrast. C: CT.

Esophageal Atresia ± Tracheoesophageal Fistula (EA ± TEF)

- Associated anomalies:

- **VACTERL**: **V**ertebral defects, **A**nal atresia, **C**ardiac defects (the most common), **T**racheo**E**sophageal fistula, **R**enal anomalies, and **L**imb abnormalities. (should be screened for)

- Presentation:

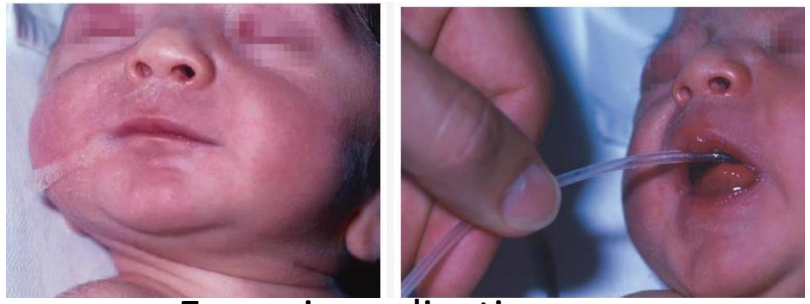
A- Antenatal diagnosis: nonspecific signs (polyhydramnios, absent/small gastric bubble)

B- Postnatal diagnosis (more common): Excessive salivation, coiled feeding tube in the blind upper pouch of the esophagus.

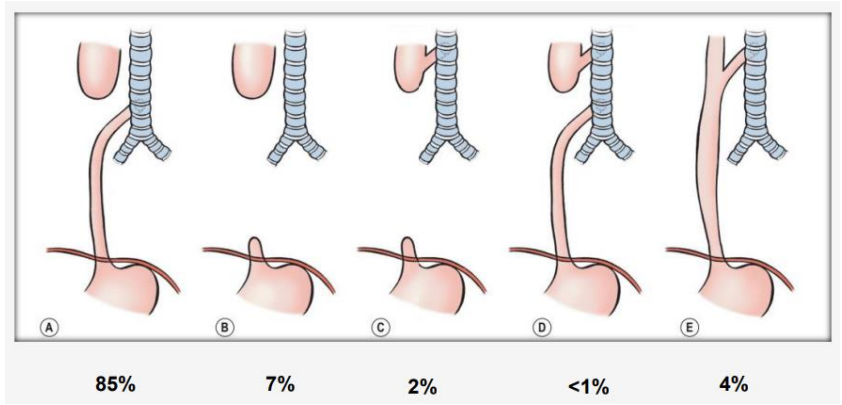
If the gas in the stomach and bowel on abdominal x-ray is:

Absent: pure esophageal atresia (without TEF)

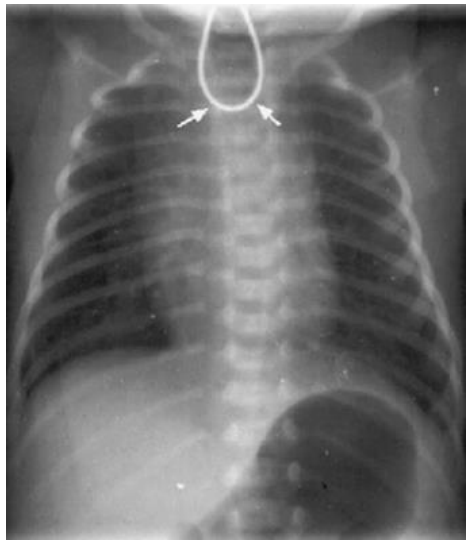
Present: there is an associated tracheoesophageal fistula



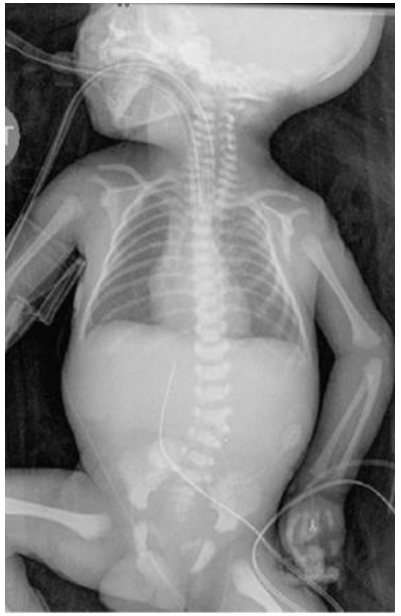
Excessive salivation



A: Proximal esophageal atresia with distal tracheoesophageal fistula (the most common)
B: Pure EA
C: Proximal esophageal atresia with proximal fistula
D: Proximal esophageal atresia with proximal & distal fistula
E: Pure TEF (H type)



Coiled feeding tube in the blind upper pouch of the esophagus.
Gastric bubble present (there is a TEF)



Complete opacity of the abdomen ["gasless abdomen"] (pure EA)

Esophageal Atresia ± Tracheoesophageal Fistula (EA ± TEF)

- Preoperative measures:

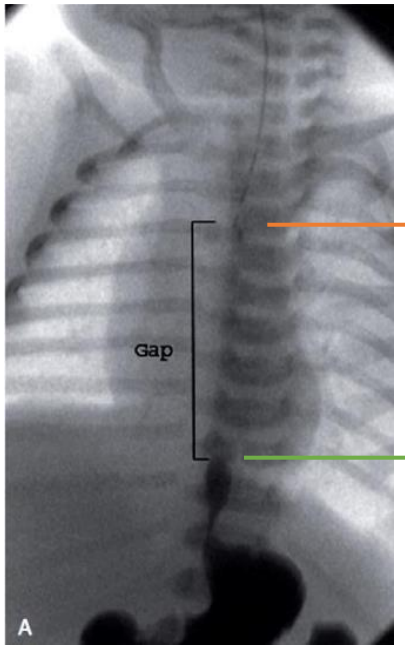
1. Continuous suctioning tube in the upper esophagus (prevention of aspiration pneumonia)
2. Head-up position & on the side
3. If in respiratory distress → gentle low-pressure ventilation

- Operative repair (MIS > Open) depends on the gap between esophageal ends:

- **<2 vertebrae** → primary anastomosis
- **2-6 vertebrae** → gastrostomy + delayed primary anastomosis
- **6 vertebrae** → gastrostomy + esophagostomy + esophageal replacement later on.

- Complications of surgery:

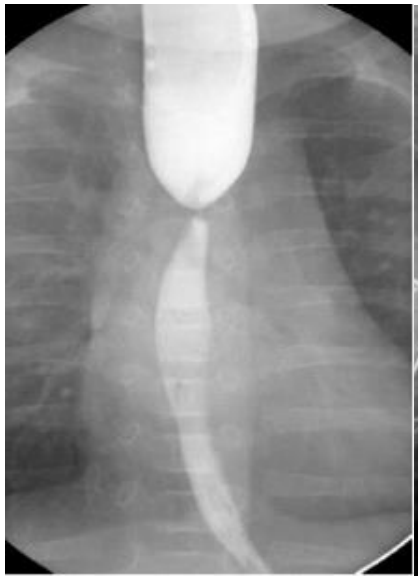
1. **Strictures (the most common)**
2. **Anastomotic leak**
3. Others: Recurrent fistula, GERD, vocal cord dysfunction, tracheomalacia.



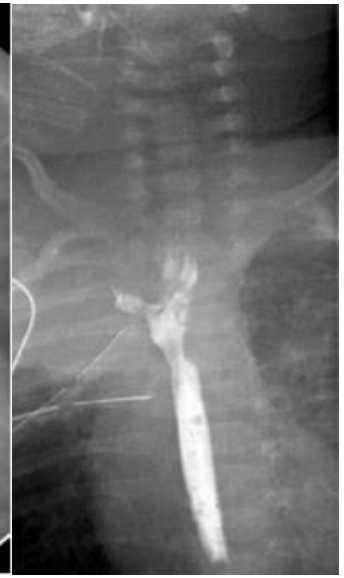
Most distal site of NG tube

Gap = 6 ribs (**Tx**: Mostly esophageal replacement)

Most proximal site of contrast injected from gastrostomy tube



Stricture



Leak

Pediatric solid tumors
(Neuroblastoma & Nephroblastoma)

- Neuroblastoma

❑ Most common intraabdominal malignancy in children

❑ Can arise in any sympathetic ganglia (**Adrenal medulla** [50%] > Abdominal sympathetic ganglia [25%] > posterior mediastinum [20%])

❑ *Presentation*: children appear very **sick** [vs. well-looking child in **nephroblastoma**]: fatigue, lethargy, fever, sweating, bone pain, and weight loss. **Palpable abdominal mass** on PE.

❑ *Histology*: Dark blue round cells with **rosette** formation

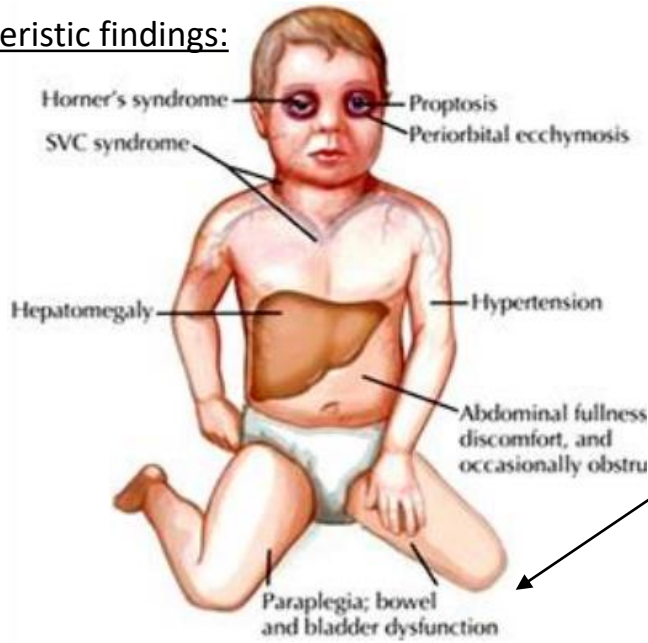
❑ Abdomen X-ray: large mass with **calcification** (vs. **nephroblastoma** which does not show calcifications)

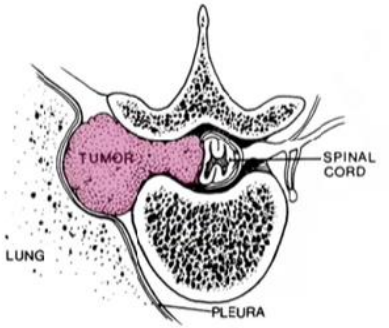
❑ **Favorable** prognostic factors:

1. Early age of onset (infants) [vs. **nephroblastoma**, which is worse in infants]
2. Well-differentiated
3. Stroma-rich
4. Low Mitosis-Karyorrhexis Index (MKI) [less mitosis]

❑ ↑ stage = ↓ prognosis (EXCEPTION: **stage 4S**: Infants with distant mets to the skin (Blueberry muffin spots), liver, and BM. >80% survive without treatment (excellent prognosis).

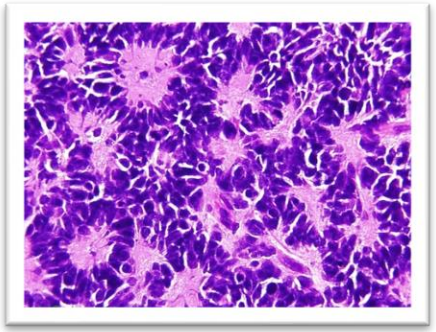
Characteristic findings:





Intra-spinal extension ("dumbbell tumor")

Blueberry muffin spots (subcutaneous nodules) – seen in stage 4S



Homer-Wright rosettes

Pediatric solid tumors

- Nephroblastoma (Wilm's tumor)

❑ 2nd most common intraabdominal malignancy (2nd only to **neuroblastoma**)

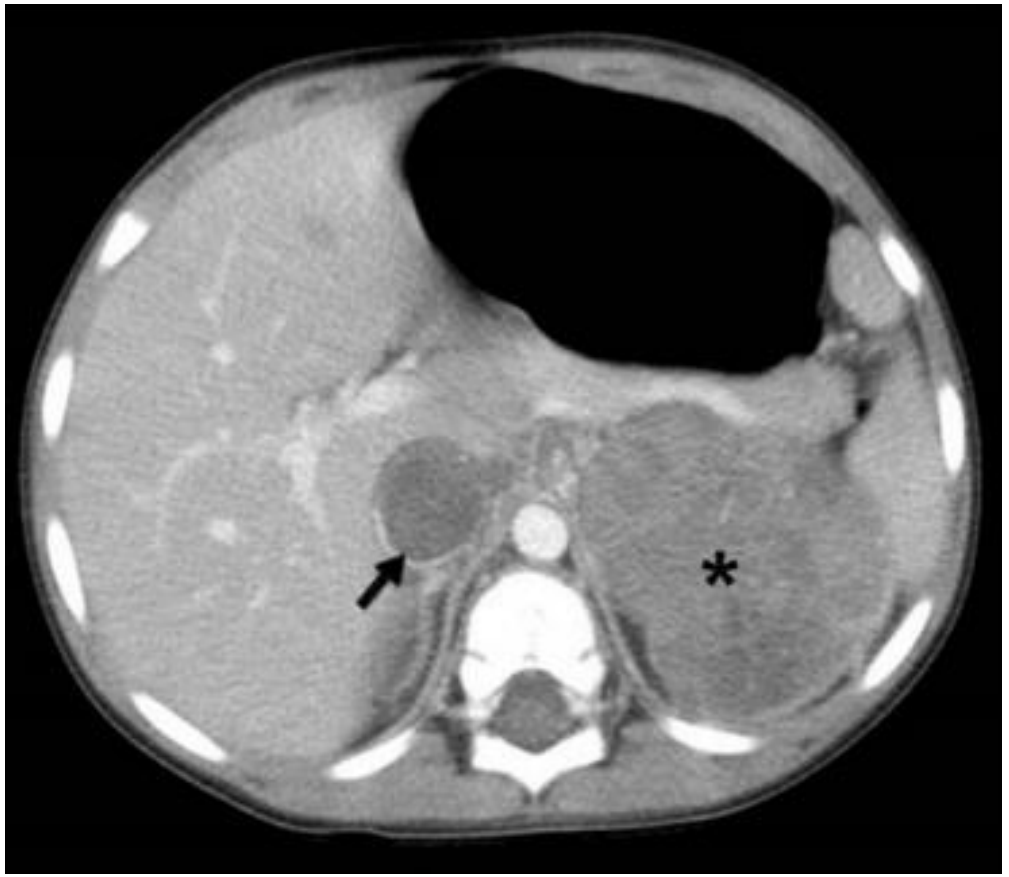
❑ Malignant renal tumor (the most common pediatric renal tumor)

❑ Better prognosis than **neuroblastoma**

❑ Mostly, **sporadic**, **solitary** (88%), and **unilateral** (93%). Bilateral Wilm's tumors are mostly synchronous [at the same time].

❑ Most important prognostic factors:

- Stage
- Histology
- Recurrence (↓ survival)
- Infancy (↓ survival)



Wilm's tumor (asterisk) extending into **IVC** (black arrow)

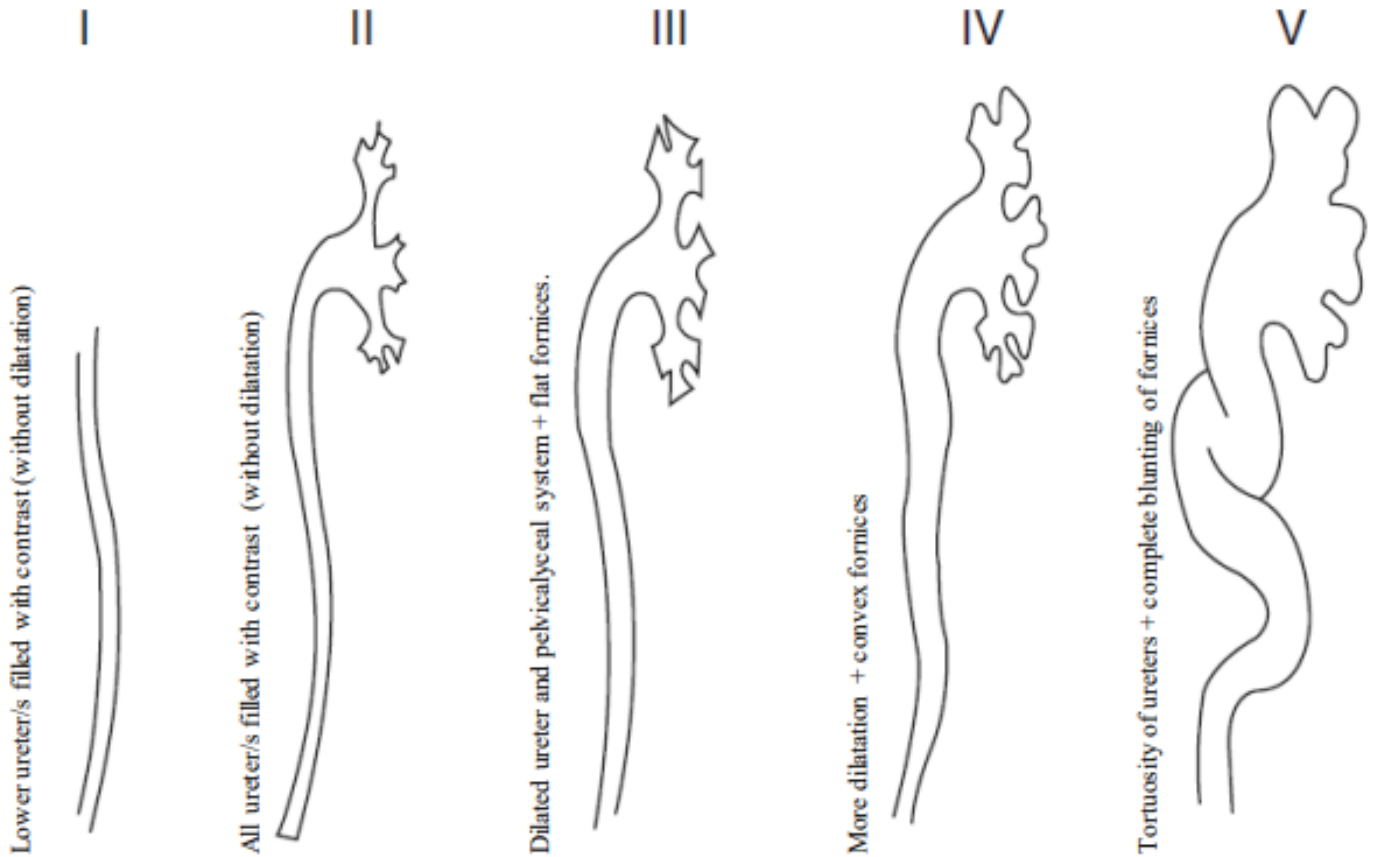
Vesicoureteral reflux (VUR)

Retrograde flow of urine from bladder into ureter.

Low grades [I, II, and III (if there is no damage to renal parenchyma)] **:**
The main concern is UTI.
Management is conservative:-
Prophylactic antibiotics and close surveillance.
Most resolve spontaneously.

High grades [IV + V]:
The main concerns are UTI **and** pressure necrosis of renal parenchyma.
Management is surgical:-
1. Endoscopic **s**ub-**u**reteric **t**ransurethral **i**njection (STING).
2. If it fails → surgery (*ureteral reimplantation*)

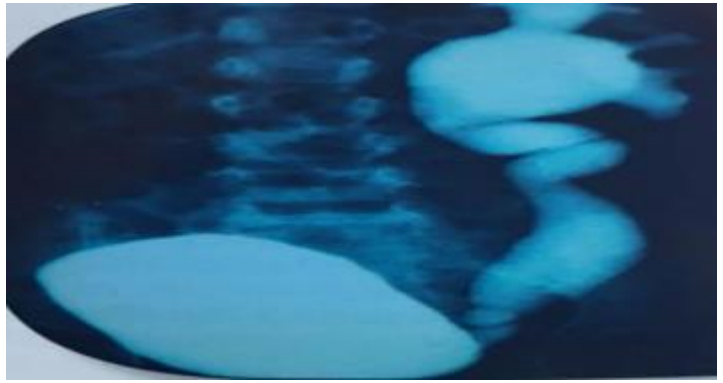
Other indications for surgery:
1) Breakthrough UTI (UTI despite adequate prophylactic antibiotics)
2) Progressive renal scarring or deterioration of renal function
3) VUR secondary to anatomic anomalies



Hydronephrosis

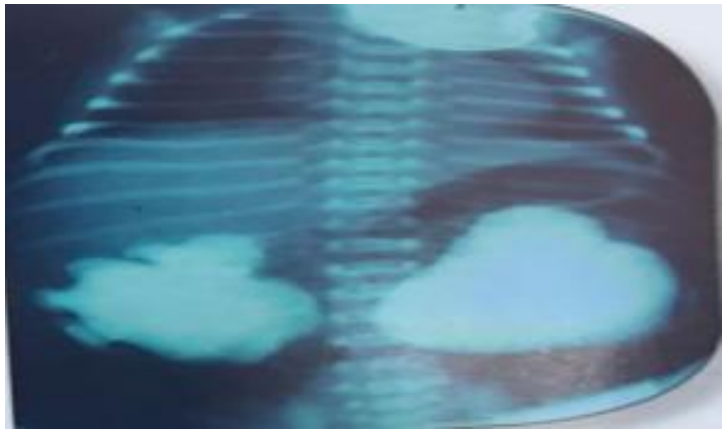
- Unilateral hydronephrosis

The most common congenital cause: **Ureteropelvic junction (UPJ) stenosis**



- Bilateral hydronephrosis

The most common congenital cause: **Bilateral VUR** (2ry to posterior urethral valves or neurogenic bladder)

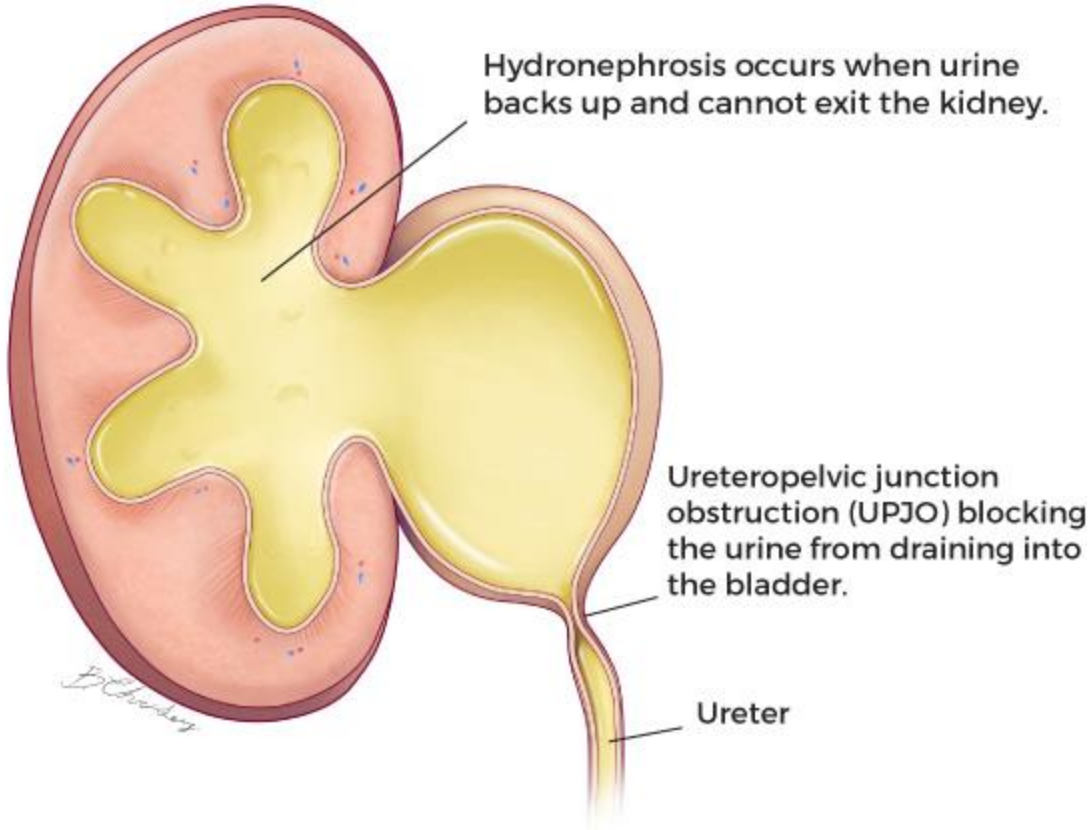


Often detected antenatally on ultrasound.

Postnatal ultrasound is the 1ry investigation tool for hydronephrosis.

Ureteropelvic junction (UJP) obstruction

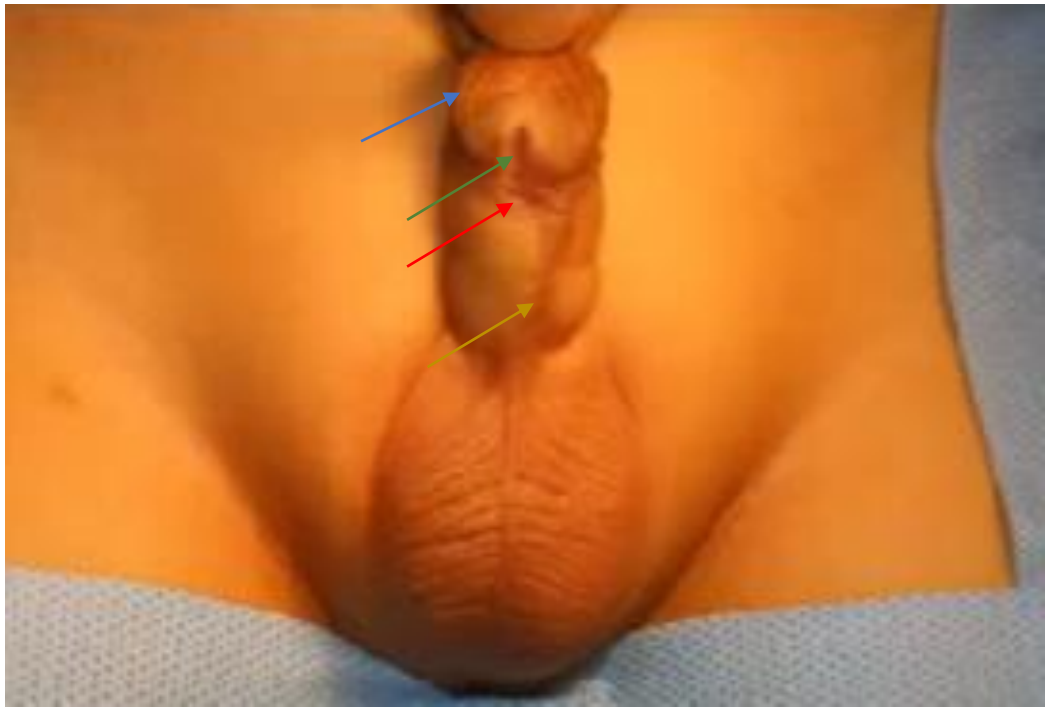
- The most common cause of hydronephrosis
- Radioisotope scan of choice is **MAG3** (vs. **DMSA** in VUR).
- **Tx**: Pyeloplasty



Hypospadias

- The definition of hypospadias includes multiple elements:

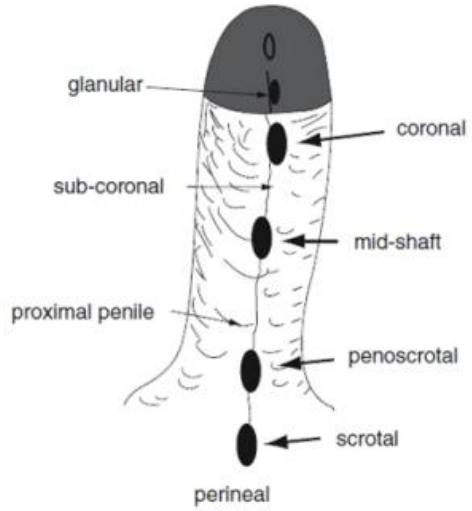
1. An **abnormally** (ventrally) located **urethral meatus** [red arrow]
2. **Glans** penis is splayed **open** [green arrow]. (Tx: Tube urethroplasty)
3. An incompletely formed and **dorsally** hooded **foreskin** (more foreskin on the top of the penis than the bottom) [blue arrow]
4. Penile torsion (spiral median raphe) [yellow arrow]
5. Ventral **chordee** (downward curvature of the penis) [not shown]
6. Underdeveloped distal corpus spongiosum [not shown]



- Main issues: Abnormal voiding; ineffective insemination.
- Classification:

1. **Distal** (glanular [the most common], coronal, and subcoronal) (50%)
2. **Middle** (distal penile, midshaft, and proximal penile) (30%)
3. **Proximal** (penoscrotal, scrotal, and perineal) (20%)

- The repair of hypospadias should be completed before 18 months of age



Hypospadias

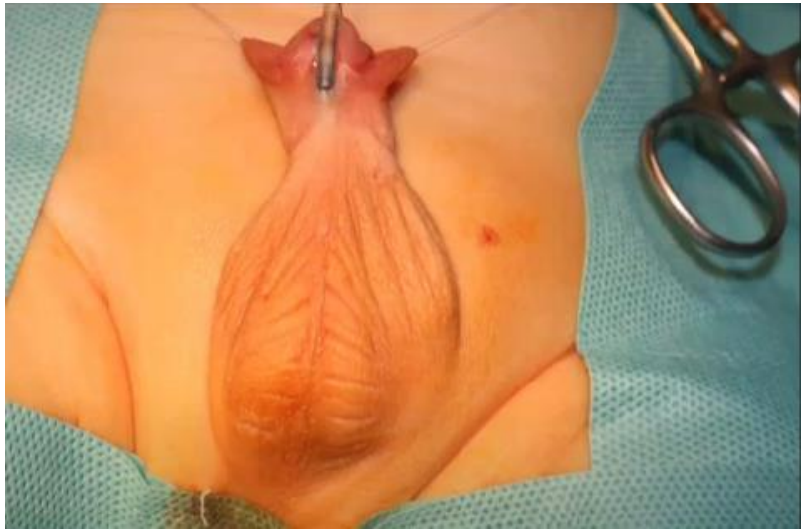
Hypospadias repair surgery complications:

- Early:

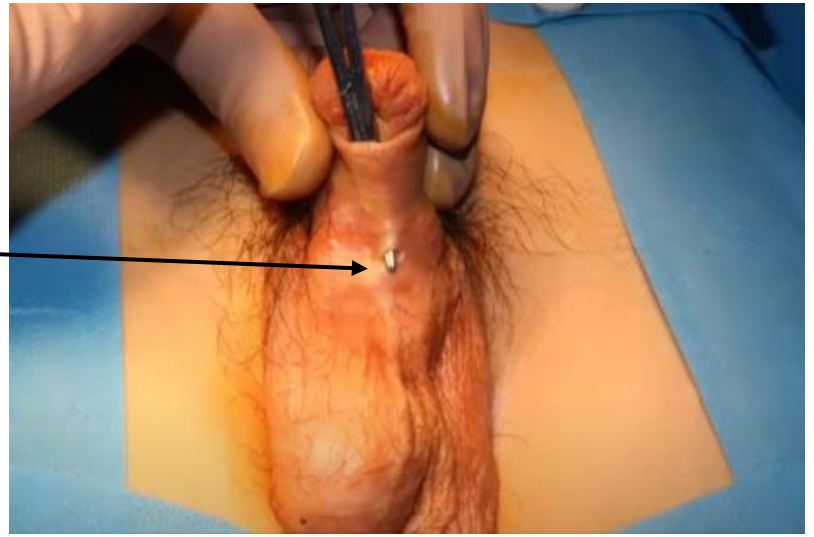
1. Bleeding
2. Hematoma
3. Infection
4. Breakdown of repair

- Late:

1. Persistent chordee
2. Meatal stenosis
3. **Urethrocutaneous fistula (UCF)**
4. Urethral stricture
5. Urethral diverticulum



Tube urethroplasty



Circumcision

- The most common indication: **Religious**/cultural
- The most common medical indication: **Phimosis**
- The 2nd most common medical indication: **Paraphimosis** *(surgical emergency)*
- Contraindications:

- <u>Absolute</u>:

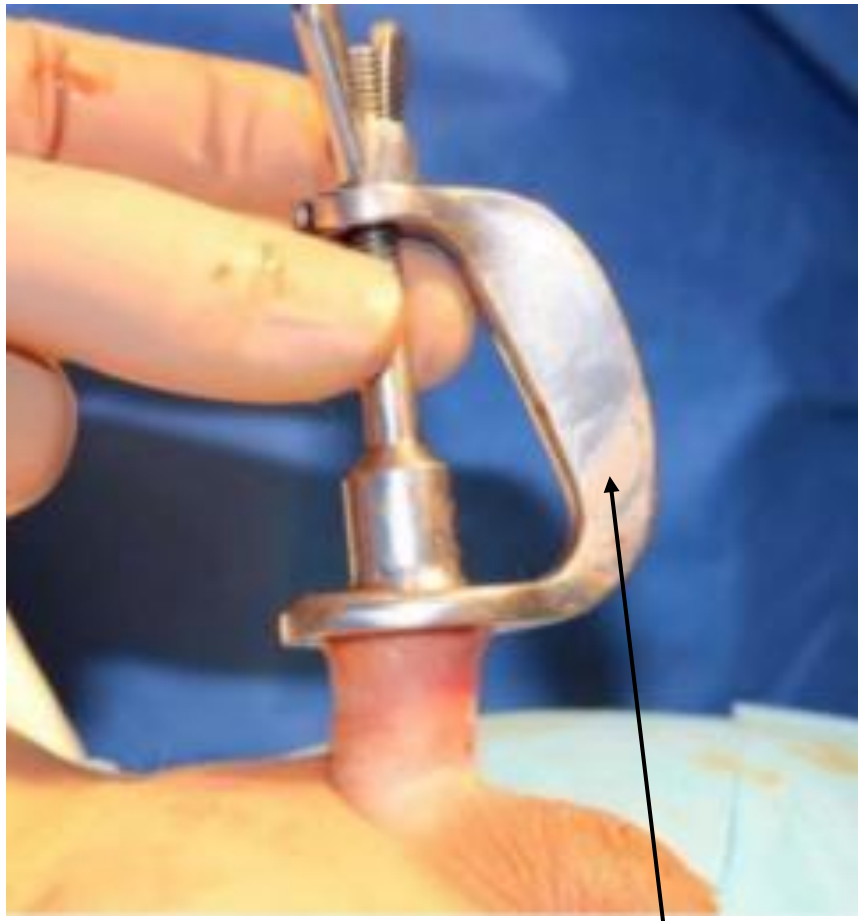
1. Family history of bleeding disorders
2. The newborn has known bleeding disorder or pathological jaundice

- <u>Relative</u>:

Hypospadias (as foreskin helps in the surgical repair of hypospadias)

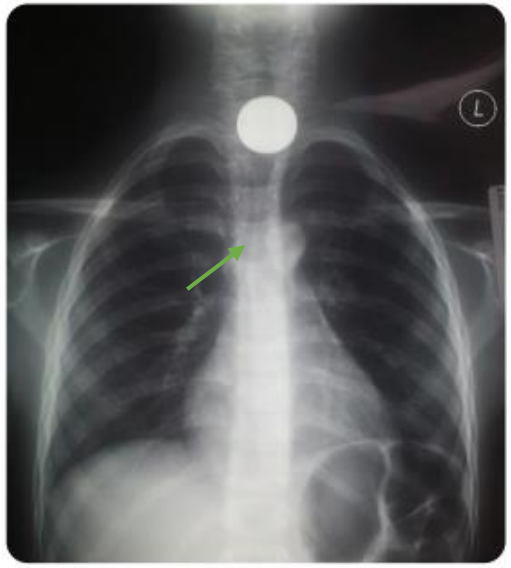
- Complications:

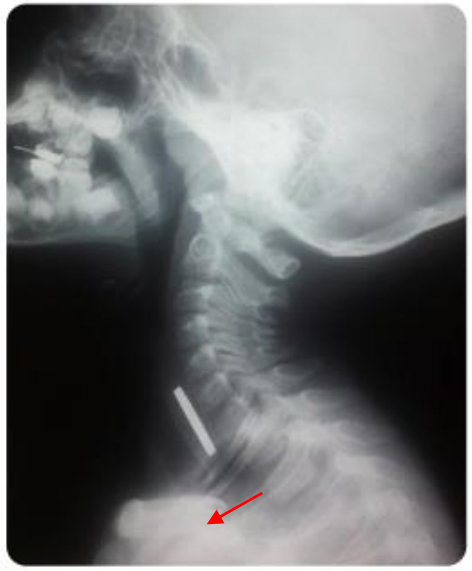
1. Bleeding
2. Infection
3. Meatal stenosis
4. Insufficient/excessive foreskin removed
5. Adhesions, skin bridges, or inclusion cysts
6. Entrapped penis or secondary phimosis
7. Urethral injury (iatrogenic hypospadias)
8. Necrosis of the penis
9. Amputation of the glans (partial or complete)
10. Death (mainly due to unnoticed bleeding)



Circumcision clamp

Foreign body ingestion (esophageal)

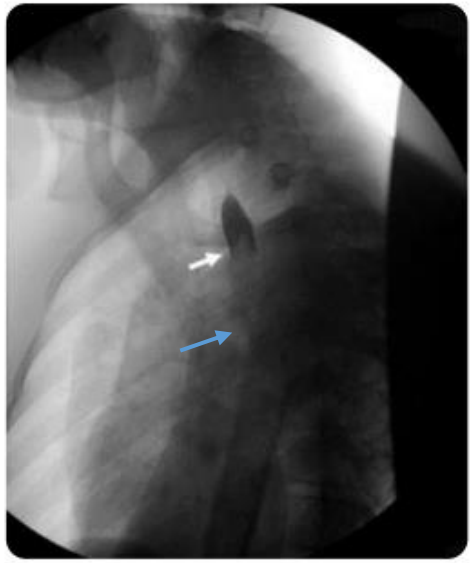




X-ray esophagus without contrast [for radiopaque objects]: It shows a lodged coin

Most lodged coins are seen **facing forwards** on AP X-ray (**green arrow**) and appear from the sides on lateral X-ray (**red arrow**). Most are in the **proximal** esophagus.

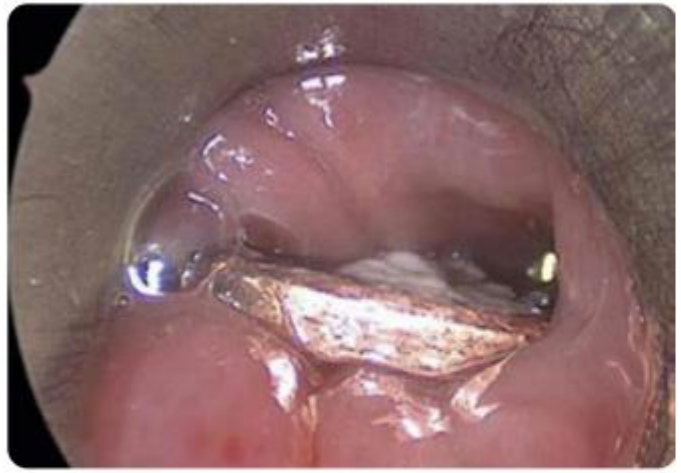
Tx: Nonemergent endoscopy or Foley balloon extraction with fluoroscopy

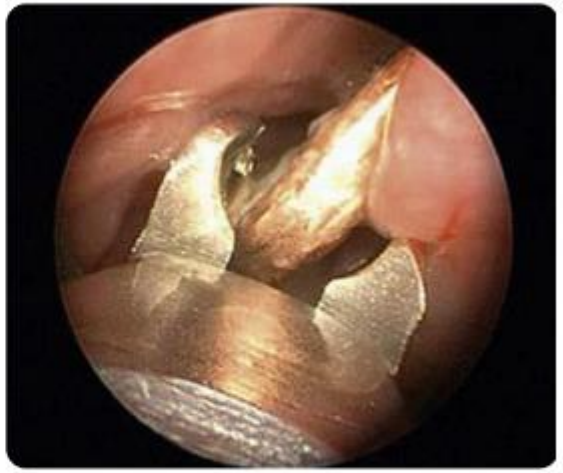


X-ray esophagus with contrast (gastrografin) [for non-opaque bodies]: It shows filling defect (impacted chicken – white arrow) and accumulation of contrast material above the filling defect (**blue arrow**)

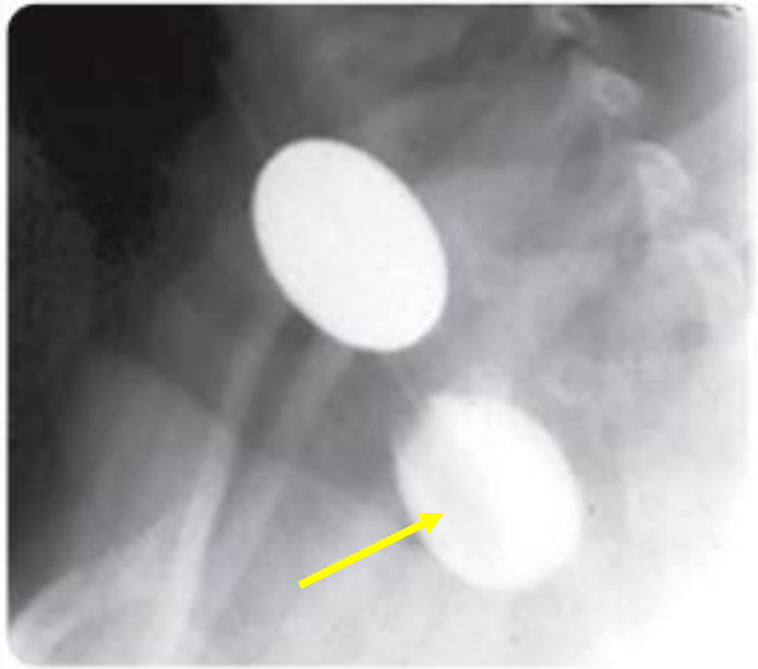
- Most common type of ingested FB:-
- US and Europe → coins
- Marine areas → fishbone
- The esophagus is the narrowest portion of the alimentary tract (a common site for FB impaction)
- Complications: **Penetration** through esophageal wall → Mediastinitis; Aorto-enteric fistula; Peritonitis

Foreign body ingestion (esophageal) – treatment options





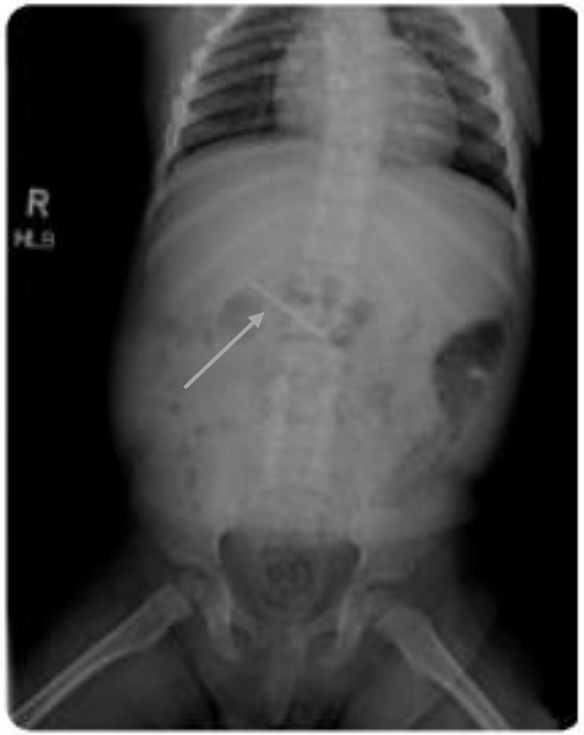
Rigid esophagoscopy ➔ optical grasper used ➔ coin extraction
(safety and success rate approaches 100% with minimal complications)



Foley catheter technique:
Once the catheter is advanced beyond the foreign body, the *balloon* (yellow arrow) is filled with contrast material, and then pulled to the outside. Done under fluoroscopy. Need to be careful to avoid *aspiration*. Very cost-efficient.

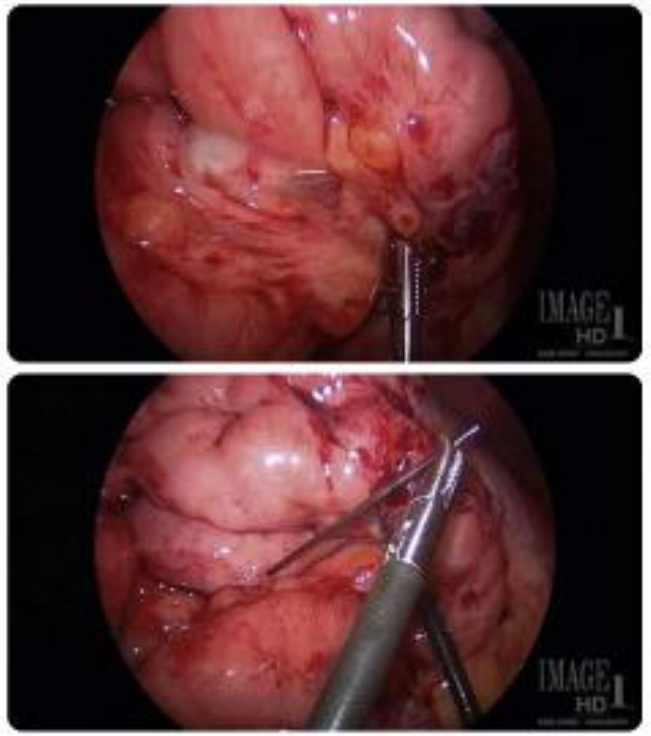
Foreign body ingestion (gastrointestinal)

- FB ingestions distal to the esophagus are *usually* **asymptomatic**
- *Most* FBs that pass into the stomach will usually **pass** through the remainder of the gastrointestinal (GI) tract without intervention (treated as an outpatient).
- If did not pass on its own → **endoscopy** is usually deferred for 4–6 weeks.
- If the endoscope is not long enough to reach the FB → **laparoscopy**



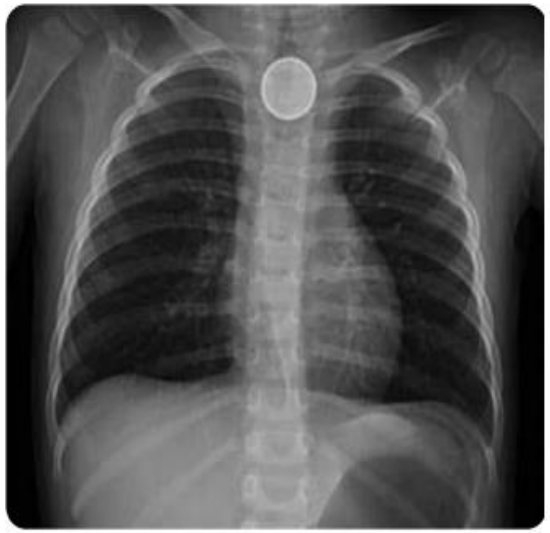
Grey arrow: sewing needle in jejunum

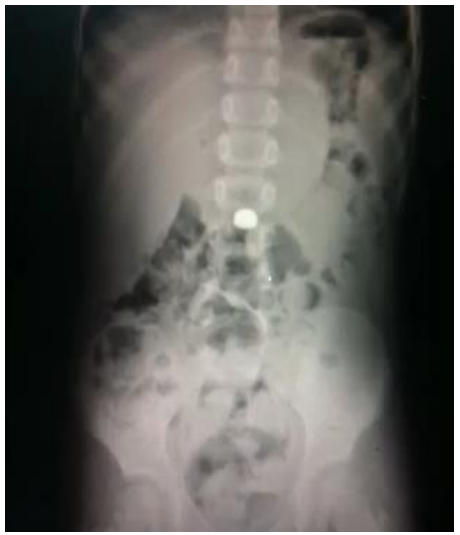
did not pass



Extraction by laparoscopy

Foreign body ingestion (special FBs – button battery)



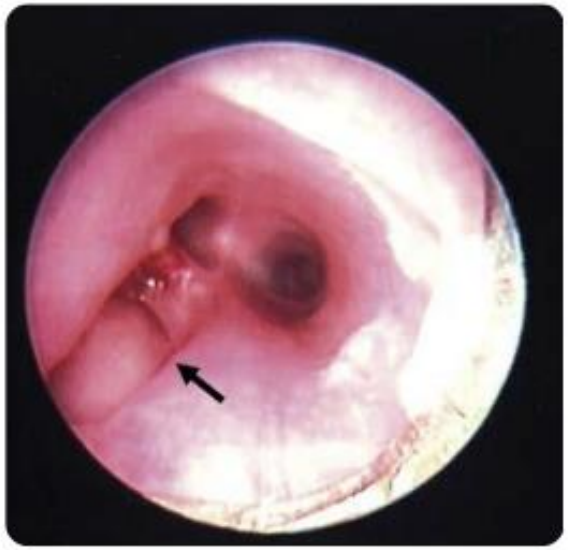


double contour rim (button battery)

The main factor that determines the risk of esophageal injury: **contact time**
Very dangerous (if in the esophagus [Left], should be *immediately* removed if seen or suspected. If distal to esophagus [Right] + asymptomatic → observe)

Mechanisms of tissue injury:
- pressure necrosis
- release of a low-voltage electric current
- leakage of an alkali solution (liquefaction necrosis)

Complications: tracheoesophageal fistula, stricture & stenosis, esophageal perforation, death



Lithium battery was removed
→ 1 week later, respiratory distress → bronchoscopy: tracheoesophageal fistula

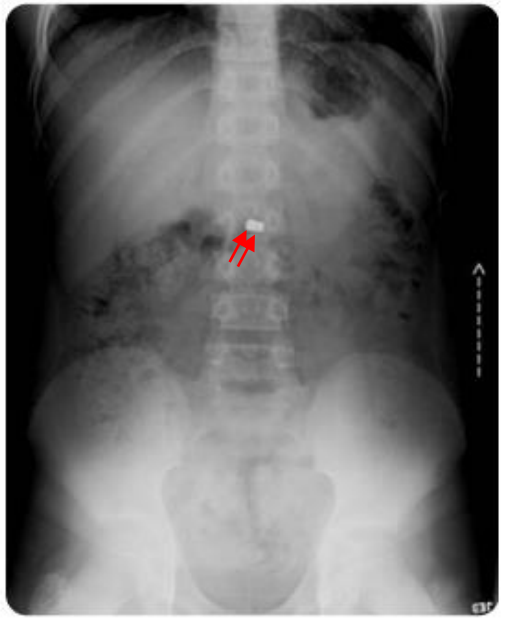
Foreign body ingestion (special FBs - magnets)

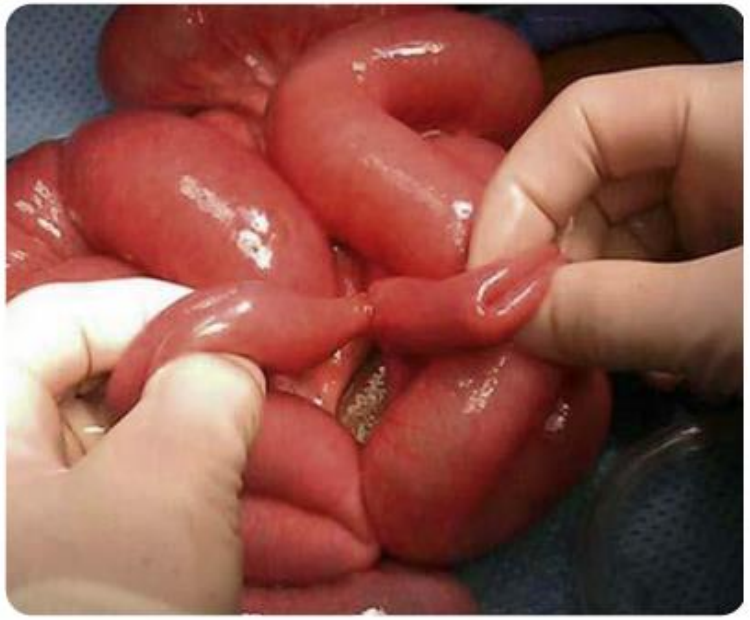
If <u>one magnet</u> → non-urgent (like any other FB) → outpatient observation

If <u>2 magnets</u>, <u>1 magnet + metallic FB</u>, or <u>in doubt</u> → They may attach to each other and lead to significant morbidity **(obstruction**, **volvulus**, **perforation**, or **fistula)** → close inpatient observation.

Most common sx: **Abdominal pain**

Most common diagnostic tool: **Plain X-ray**



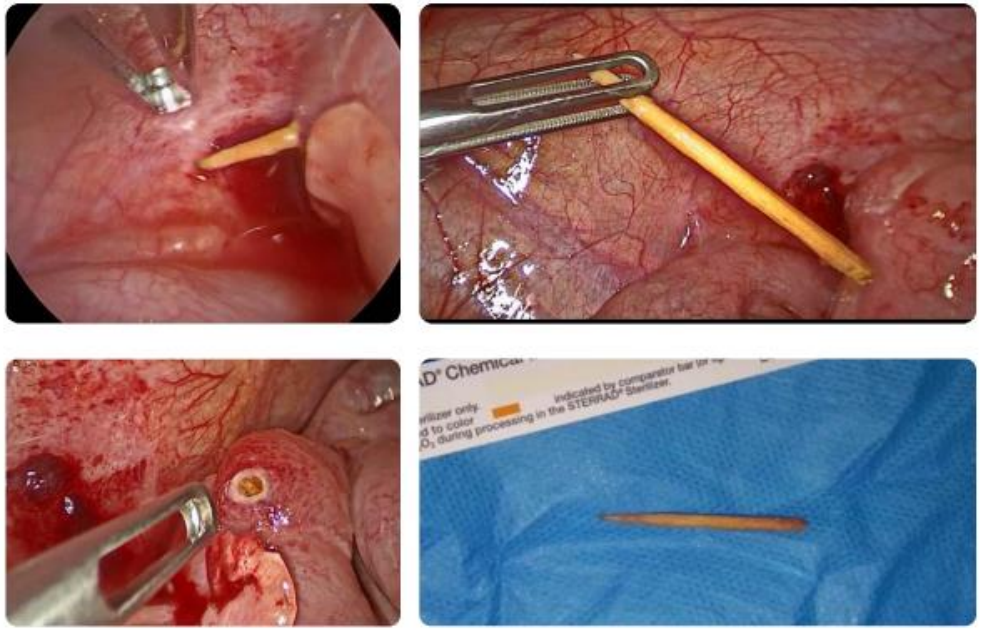


(2 red arrows)
two small magnets → exploratory laparotomy → in two separate bowel lumens causing the bowel obstruction and fistulization

Foreign body ingestion
(special FBs - sharp foreign bodies, bezoars)

Sharp foreign bodies:

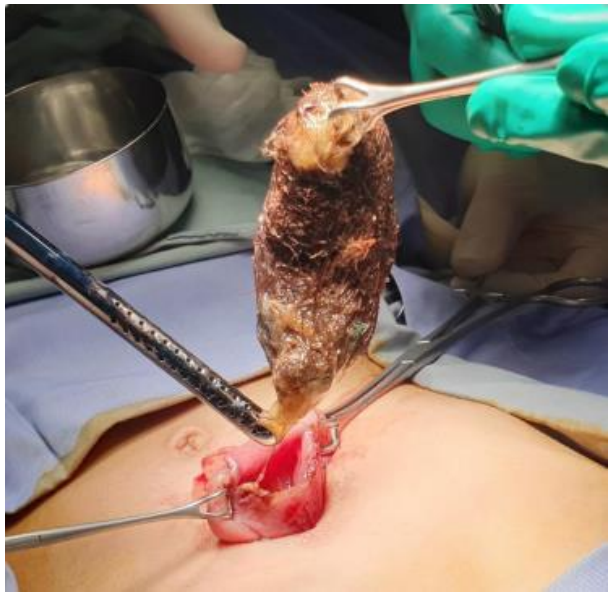
- 15–35% risk of perforation
- Most common location of perforation: **Ileocecal valve**

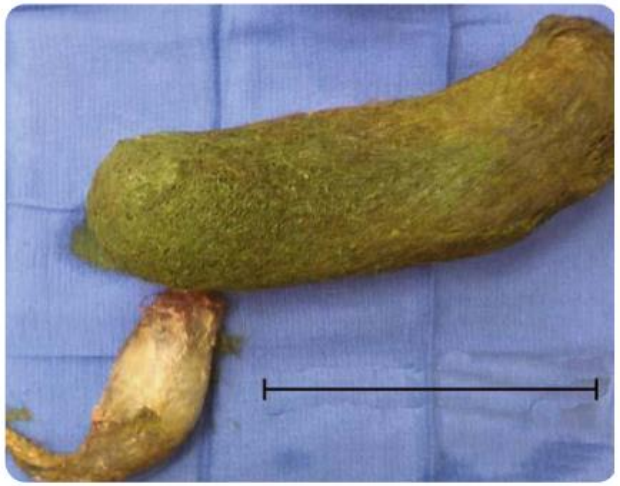


Tooth stick causing cecal perforation

Bezoars:

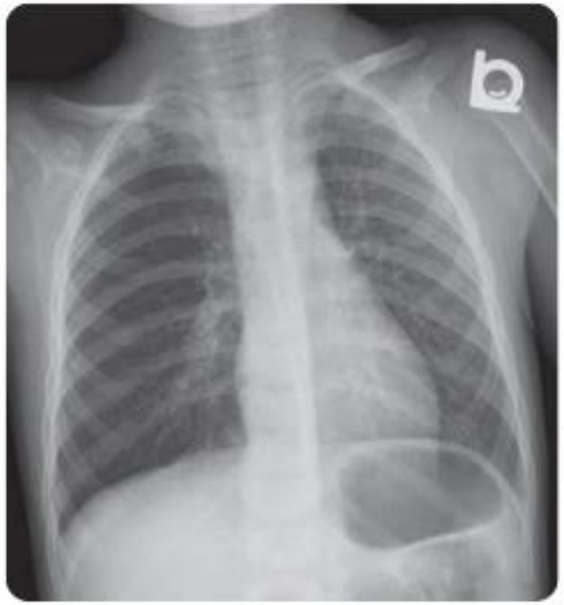
- Tight collection of undigested material
  - ➢ Hair (trichobezoars) → surgery **only;** refer to a psychiatrist to treat **trichotillomania**. When it obstructs the stomach + small bowel = *Rapunzel syndrome*
  - ➢ Milk (lactobezoars): obstruction at gastric outlet (mimics HPS) → endoscopy
  - ➢ Plants (phytobezoars) → surgery **only**



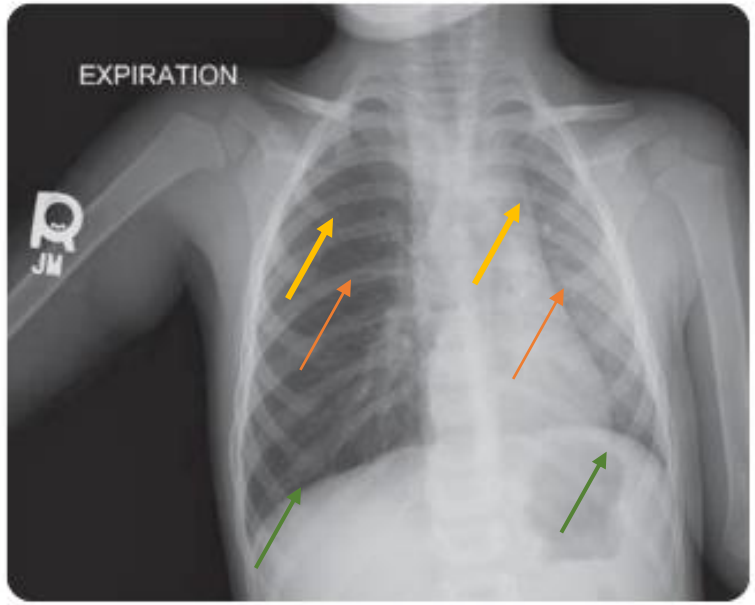


Gastric bezoar with extension into the proximal duodenum

Foreign body aspiration



slight hyperexpansion of the right lung



expiratory film, with hyperlucency of the right lung due to air trapping

Other possible findings:
Normal chest X-ray (the most common)
Unilateral atelectasis
Pulmonary infiltrates

Risk factors:

- **Young children** (shorter airway, smaller in caliber; anteriorly-positioned larynx [increases difficulty with oral intubation]; the subglottic region is the narrowest part
- **Males** (M:F = 2:1)
- **Child abuse**

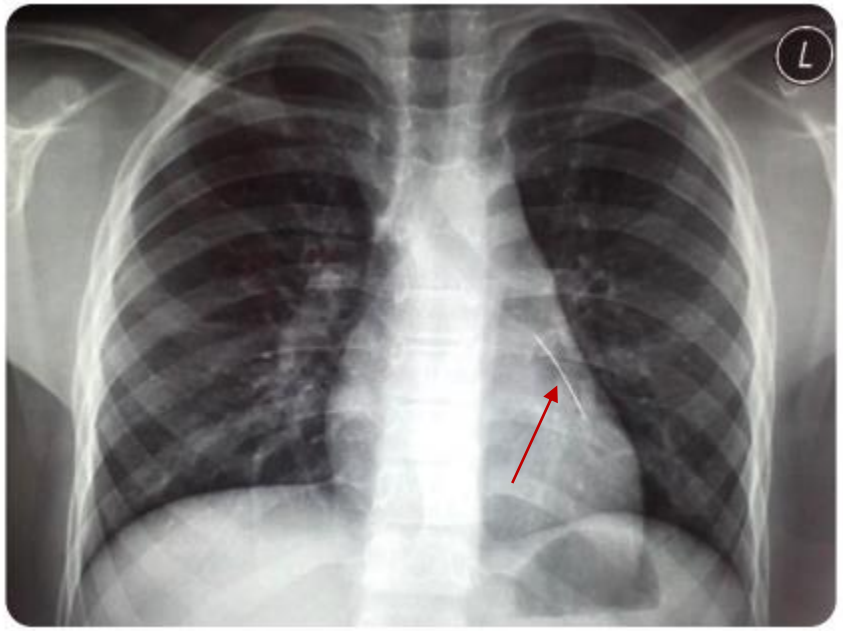
Most common foreign bodies: Sunflower seeds; Watermelon seeds; **Nuts** (the most common)

Hyperinflation (air trapping) – important sign

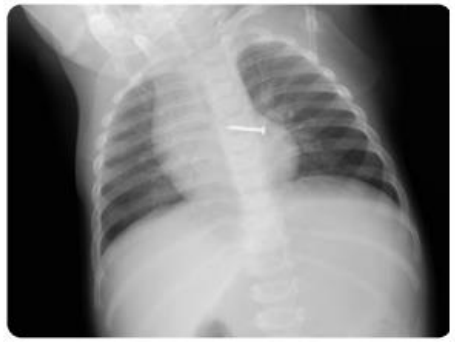
1. Horizontal (vs. the normally oblique) ribs
2. Flattened (vs. the normal dome-shaped) diaphragm
3. Wider intercostal space
4. More radiolucent

Contrast the right side (air trapping) with the left side (normal)

Foreign body aspiration

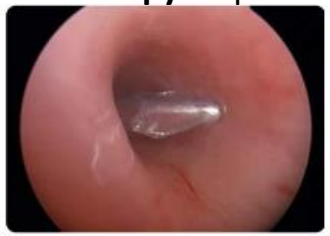


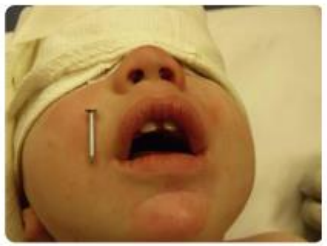
Radiopaque foreign body (Left main bronchus)
Management: Extraction by bronchoscopy



X-ray: Aspirated nail

Bronchoscopy: Aspirated nail



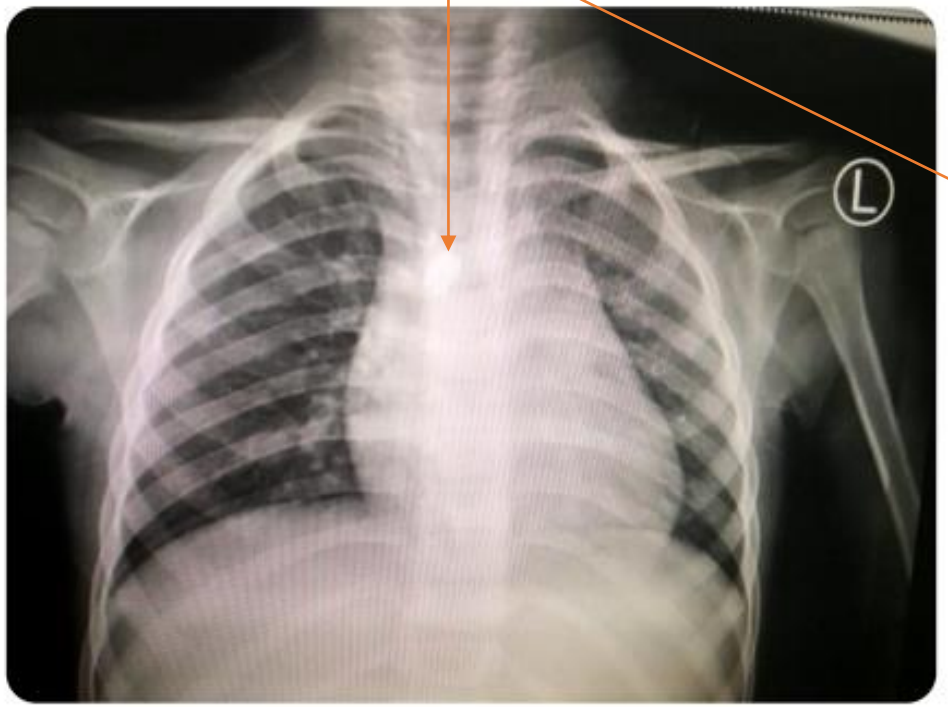


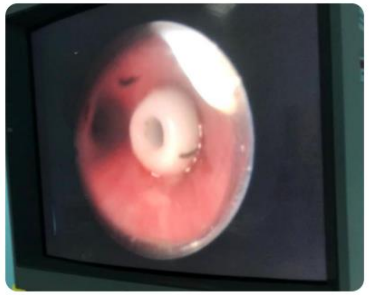
Flexible bronchoscope (diagnostic)

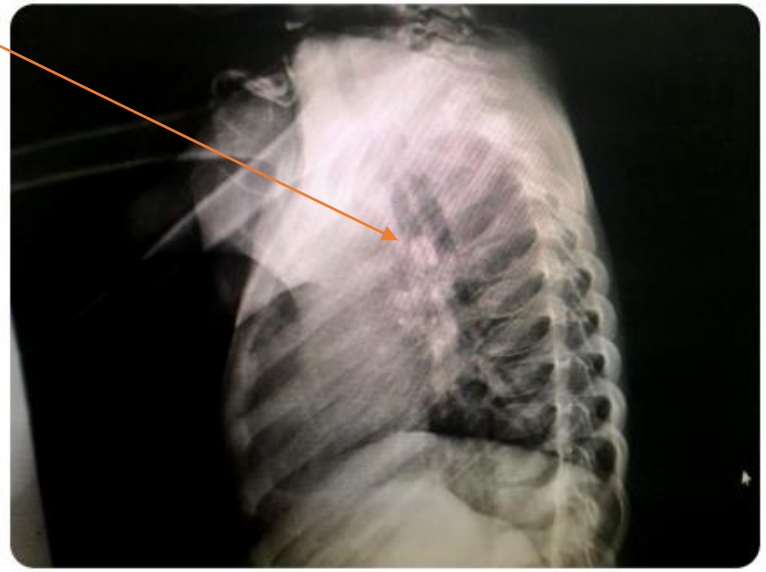
Rigid bronchoscope (diagnostic + therapeutic)

Foreign body aspiration

- In difficult cases, **Fogarty catheter** is used. Rarely, thoracotomy with bronchotomy or lobectomy is required.







Fogarty catheter

Appendicitis

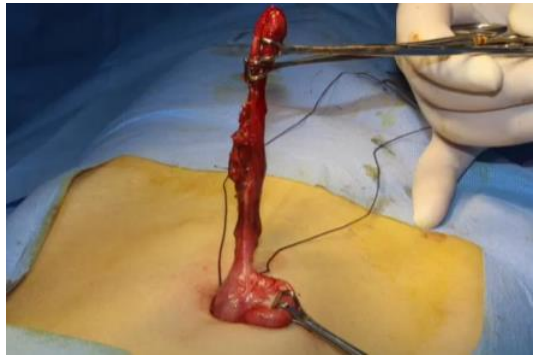
- Ultrasound:
  - Non-compressible, thick-walled, dilated appendix **(>6 mm** outer diameter).
  - Periappendiceal fluid collection.
  - Fecalith.
- Appendicitis stages:

1- Early inflammation (catarrhal appendicitis)

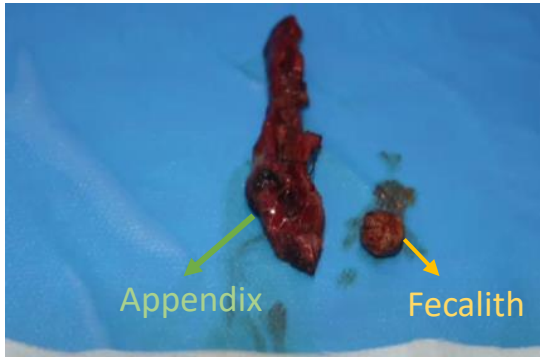
2- Definite inflammation (suppurative appendicitis)

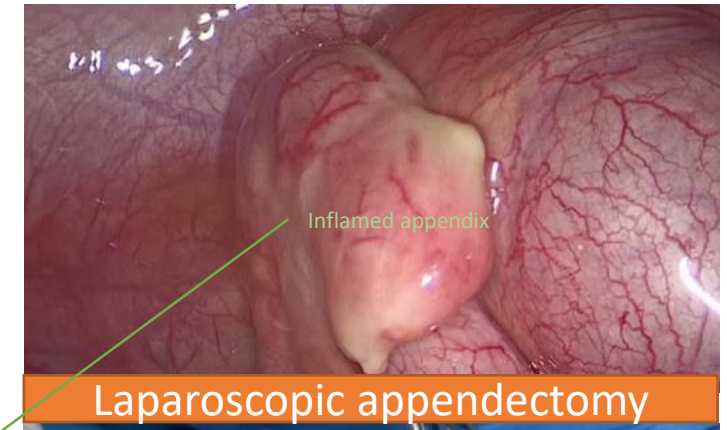
3- Ischemic changes (gangrenous appendicitis)

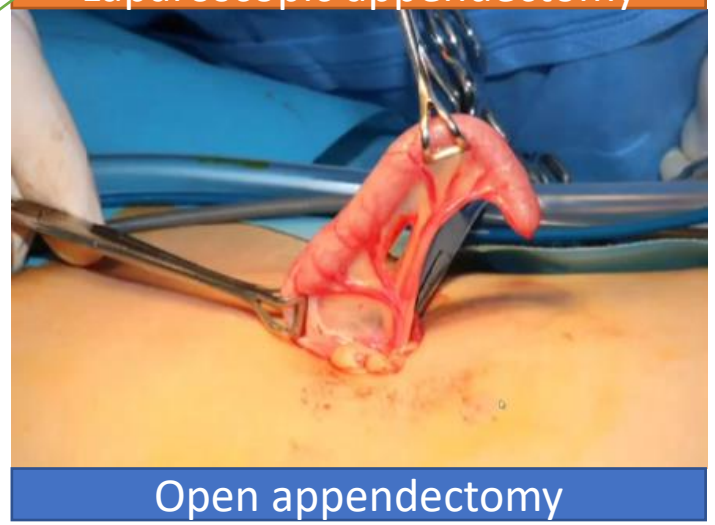
4- Perforated appendicitis



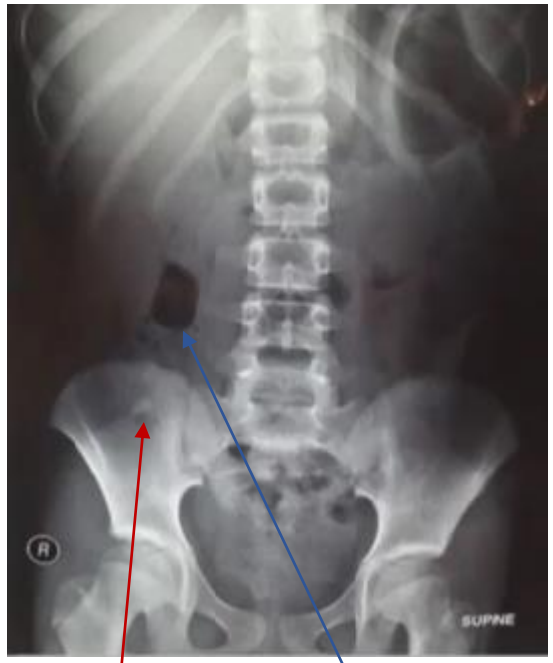
Appendectomy







Appendicitis on X ray



Others:

- Opacity due to phlegmon
- Absence of psoas shadow
- Fat stranding
- AUD (if perforated)
- Scoliosis (reducing contact of inflamed appendix with abdominal wall)