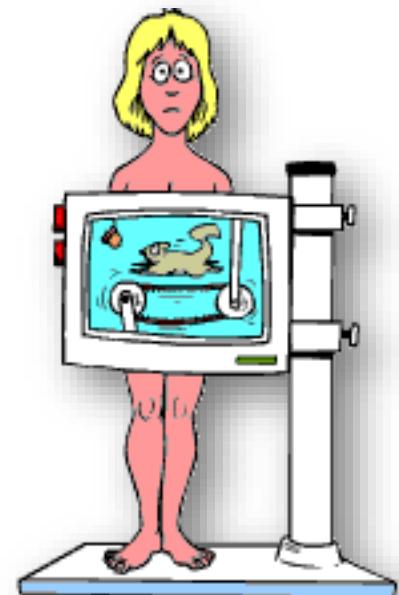


Neonatal Abdominal Manifestations

Radiological Findings



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

- A neonate with an acute abdomen usually presents with **vomiting**, **constipation** and **distention of the belly**.
- When the symptoms are present immediately after birth, the most common cause is **a gastrointestinal obstruction**.



Differential diagnosis

- *Imaging*
- Abdominal radiograph
- Upper GI study
- Colon enema
- Ultrasound

Normal progression of air

- Birth: stomach
- 1 hour: duodenum
- 3 hours: proximal small bowel
- 12 hours: all of the small bowel
- 24 hours: rectum

Abdominal radiograph

- In suspected neonatal obstruction the first step is *an abdominal radiograph*.
- On the radiograph an obstruction can only be diagnosed if the bowel has had sufficient time to become air-filled after birth.

1. Dilatation?

- *When the bowel measures more than the interpedicular width of L2, it is said to be dilated.*
- *Massive dilatation* is seen in complete obstruction and is accompanied by fluid levels on the dorsal decubitus radiograph.
- However, fluid levels alone do not necessarily correspond to dilatation, but rather reflect abnormal peristalsis.
- An unchanging bowel gas pattern over time indicates absence of peristalsis.

I-Congenital High Obstruction

- **Esophageal atresia**
- **Duodenal atresia**
- **Duodenal web**
- **Malrotation**
- **Jejunal atresia**

II-Congenital Low Obstruction

- **Ileal atresia**
- **Meconium ileus**
- **Meconium plug syndrome**
- **Hirschsprung disease**
- **Anal atresia**

III-Acquired causes of acute abdomen

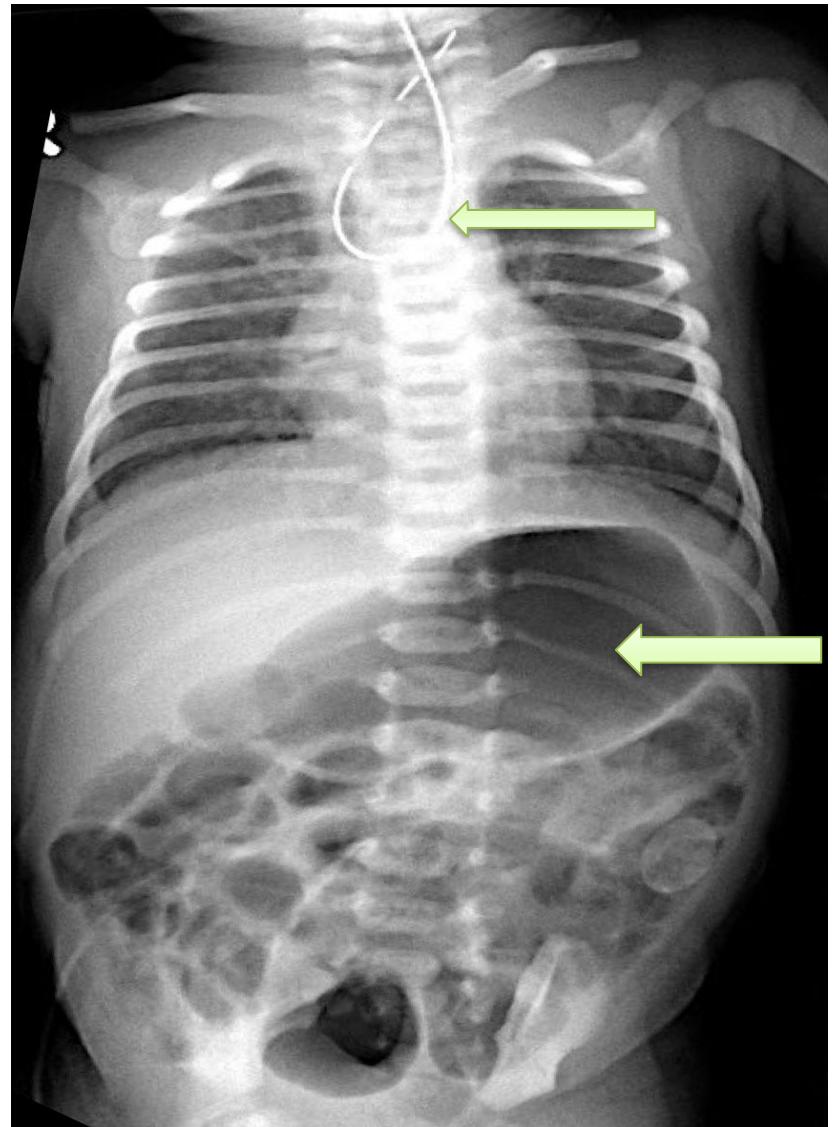
- **Necrotizing enterocolitis**
- **Hypertrophic pyloric stenosis**
- **Incarcerated hernia**

Congenital High Obstruction

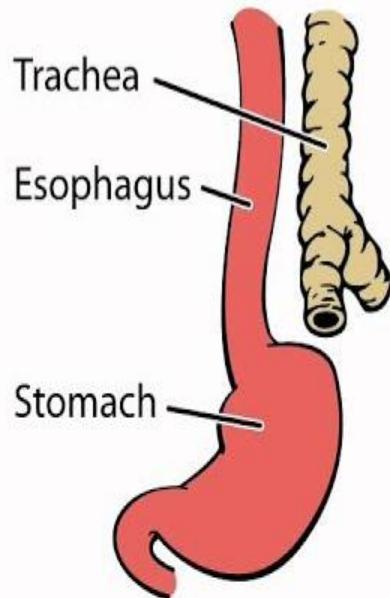
- Most high obstructions occur *at the level of the duodenum.*
- Vomiting will be non-bilious if the obstruction is localized proximal to the Vater ampulla, and bilious (the color or which is green) if it is localized distal to it.
- *Bilious vomiting is an indication for urgent imaging as a volvulus may be present.*

Esophageal atresia

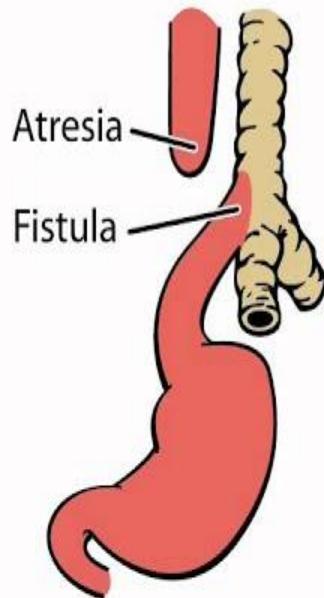
- The findings are:
- Feeding tube cannot be passed and lies in a dilated proximal esophagus
- Normal air in the abdomen.
- Diagnosis: *esophagus atresia with a distal tracheo-esophageal fistula*



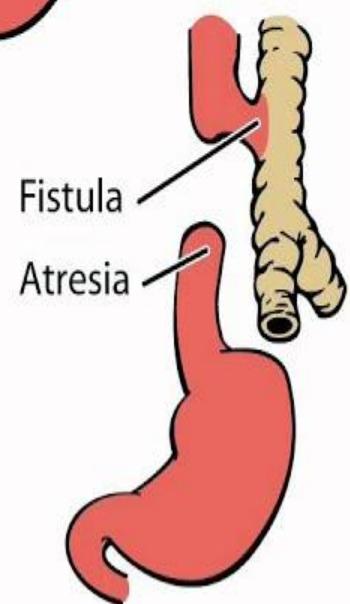
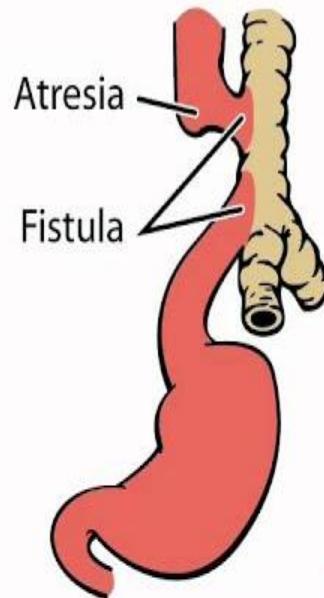
Normal Anatomy



Atresia with distal Fistula



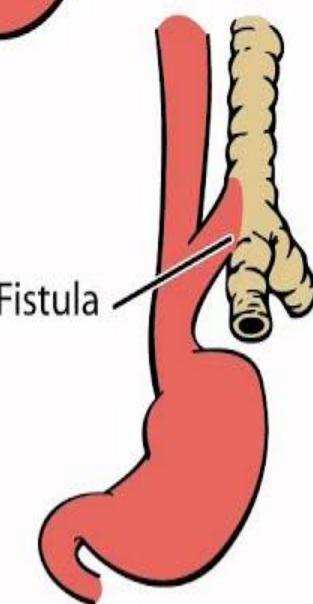
Atresia with double Fistula



Atresia with proximal Fistula

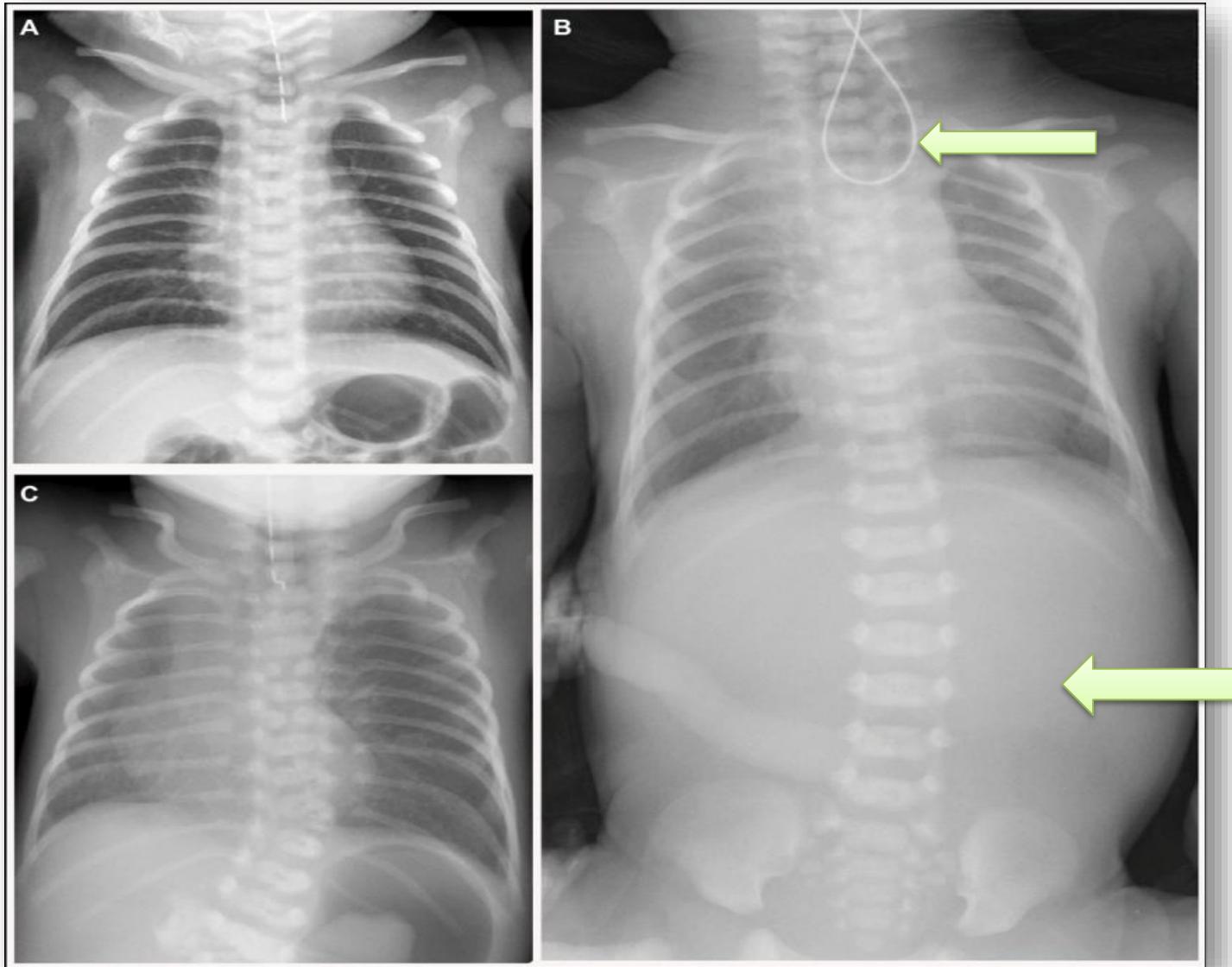


Atresia



Fistula

Esophageal atresia



Findings in duodenal atresia

Double bubble sign

No distal bowel gas

No further imaging is needed

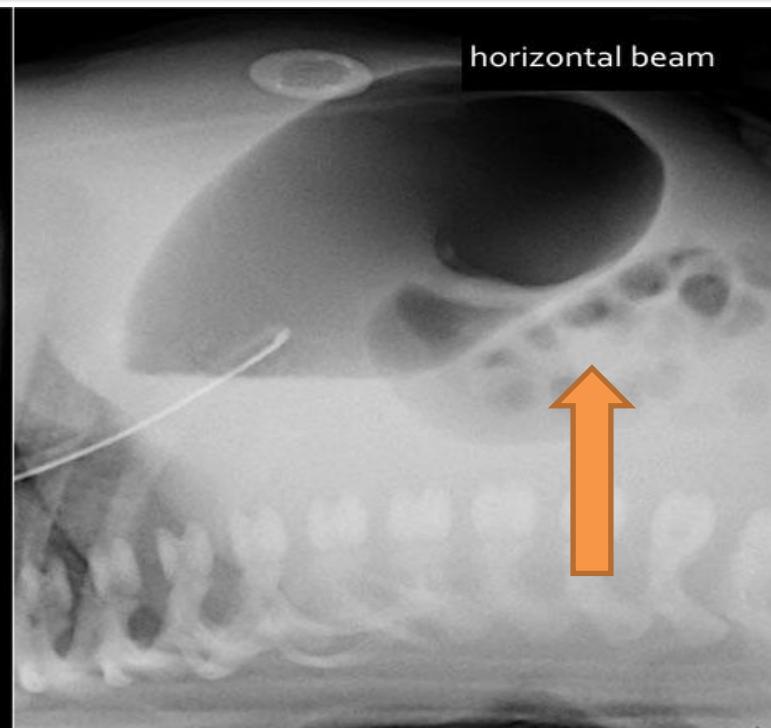
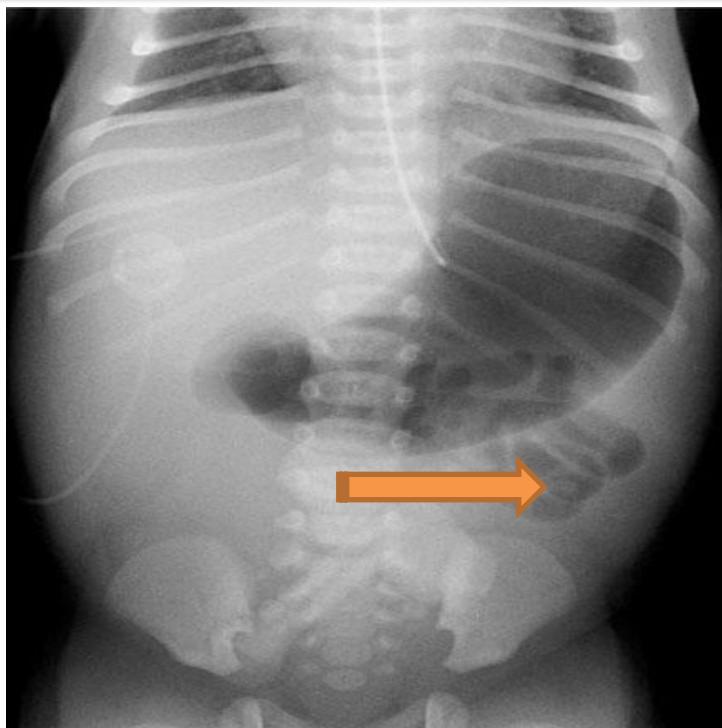
- About 30% of the patients with duodenal atresia have *Down syndrome* and there is an association with *VACTERL malformations*, *malrotation* and *biliary tree abnormalities*.

Duodenal atresia



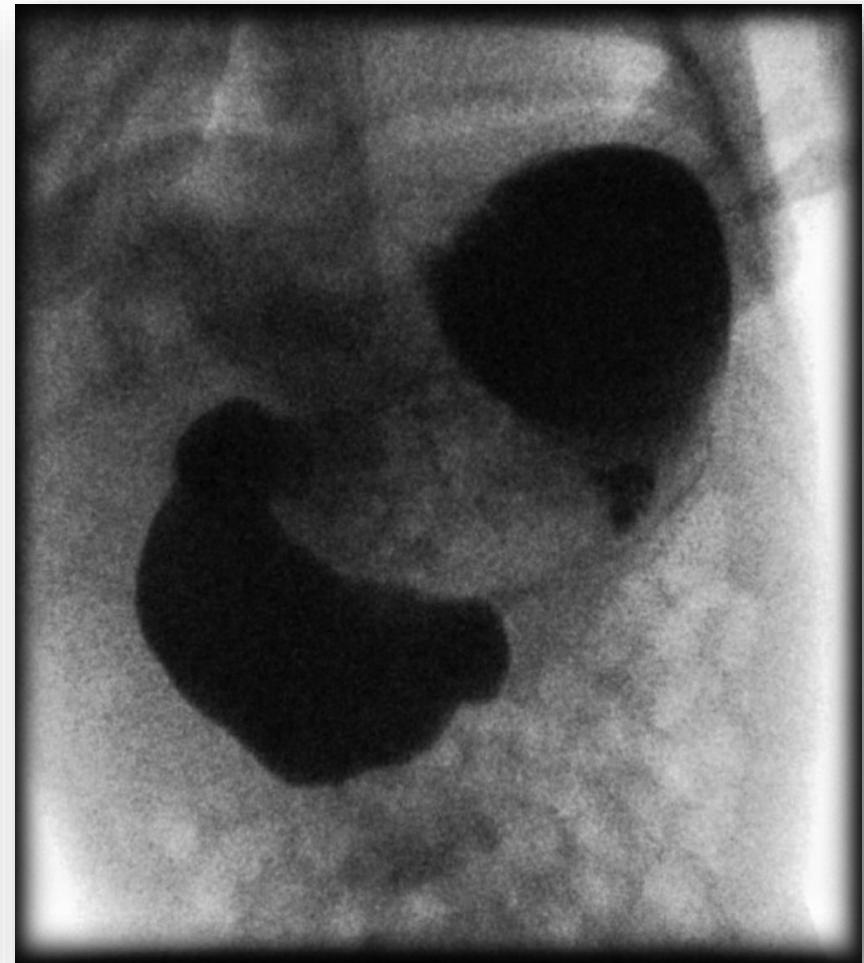
Duodenal web

- The findings are:
- Dilated stomach
- To a lesser extent dilated proximal duodenum
- *Distal bowel gas is present indicating an incomplete duodenal obstruction.*
- This radiograph was taken only a few hours after birth and air has not reached the distal small bowel and colon yet.



Duodenal web

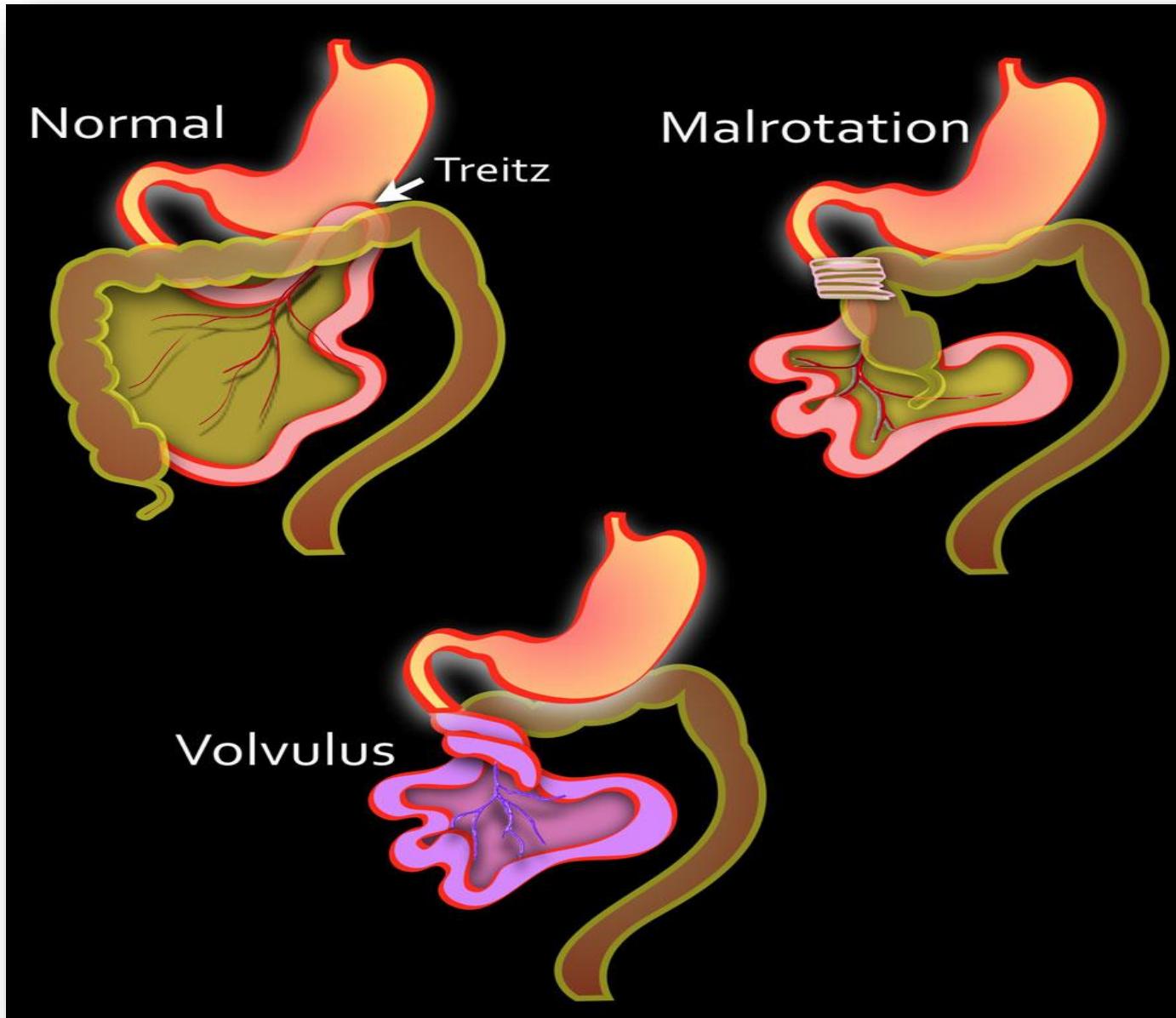
- **Bilious vomiting. Age: 10-day-old**



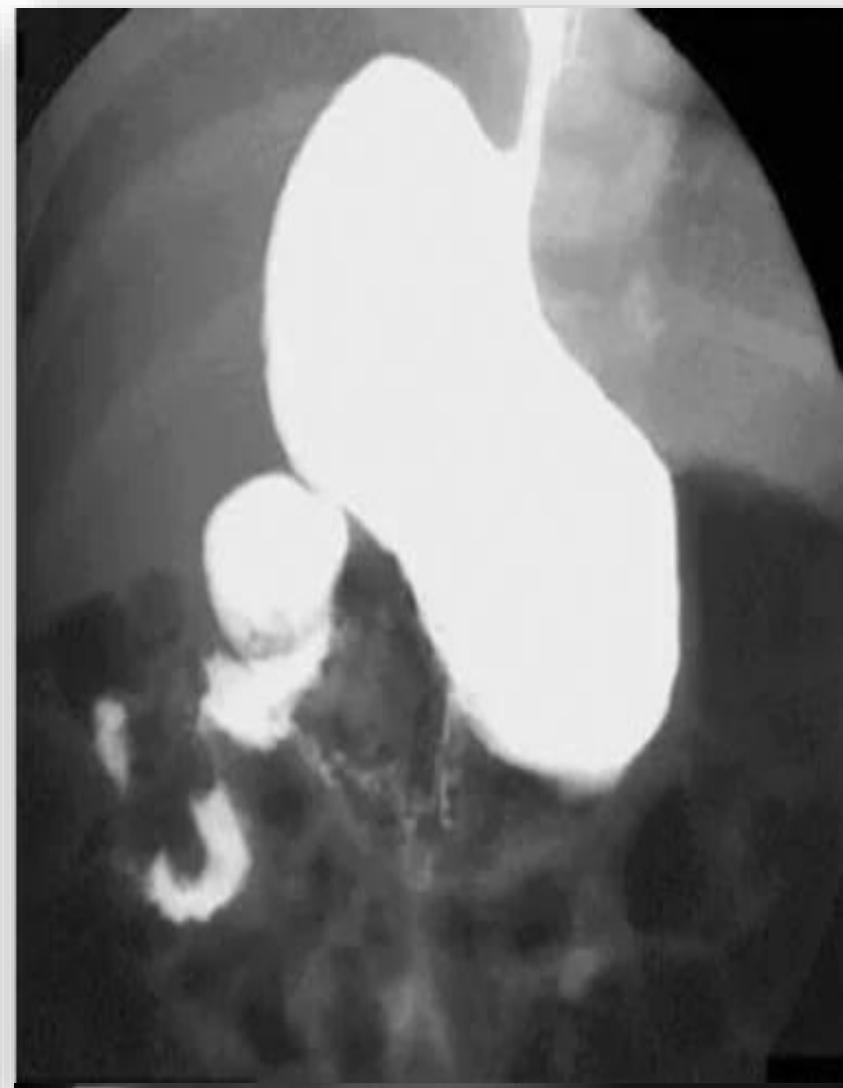
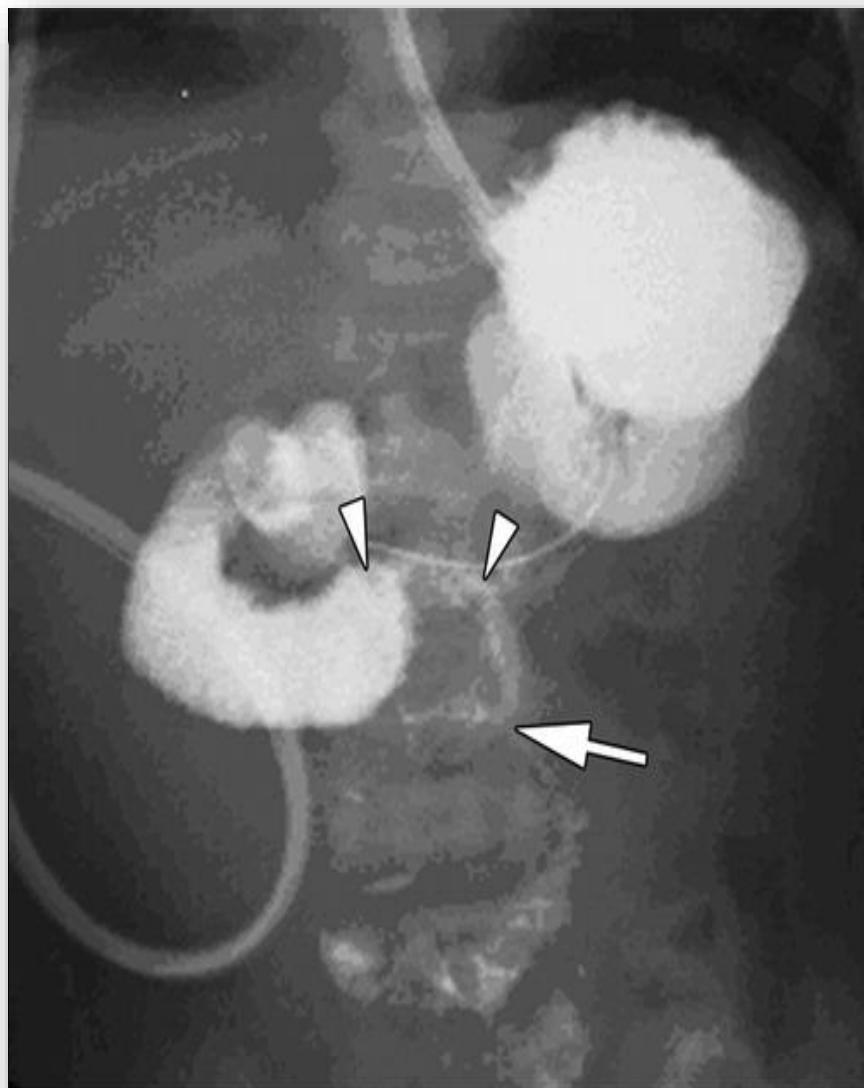
- **Duodenal web** has the same etiology as duodenal atresia, but the web is fenestrated and the obstruction is incomplete.
- Depending on the severity of the stenosis, patients may present in the neonatal period or at a later age.
- Radiographs may show **a double bubble, but with distal bowel gas being present.**

- *Both radiographs and upper GI series cannot differentiate between duodenal web and annular pancreas.*
- Annular pancreas however, is less common.
- It is often discovered incidentally or in adults when the associated abnormal biliary drainage causes pancreatitis.

Malrotation



Malrotation



- The malrotation will become symptomatic only when *a volvulus occurs due to the short mesentery* or *when the Ladd's band obstructs the duodenum.*
- Both presentations are most common in the neonatal period.
- However sometimes it can also present later in life, for example *when the volvulus is intermittent* or *when the Ladd's bands create relatively little obstruction.*
- *Acute volvulus is a life-threatening presentation and requires prompt surgical intervention.*



- Age: 5 days
- Gender: Male
- Biliary vomiting.



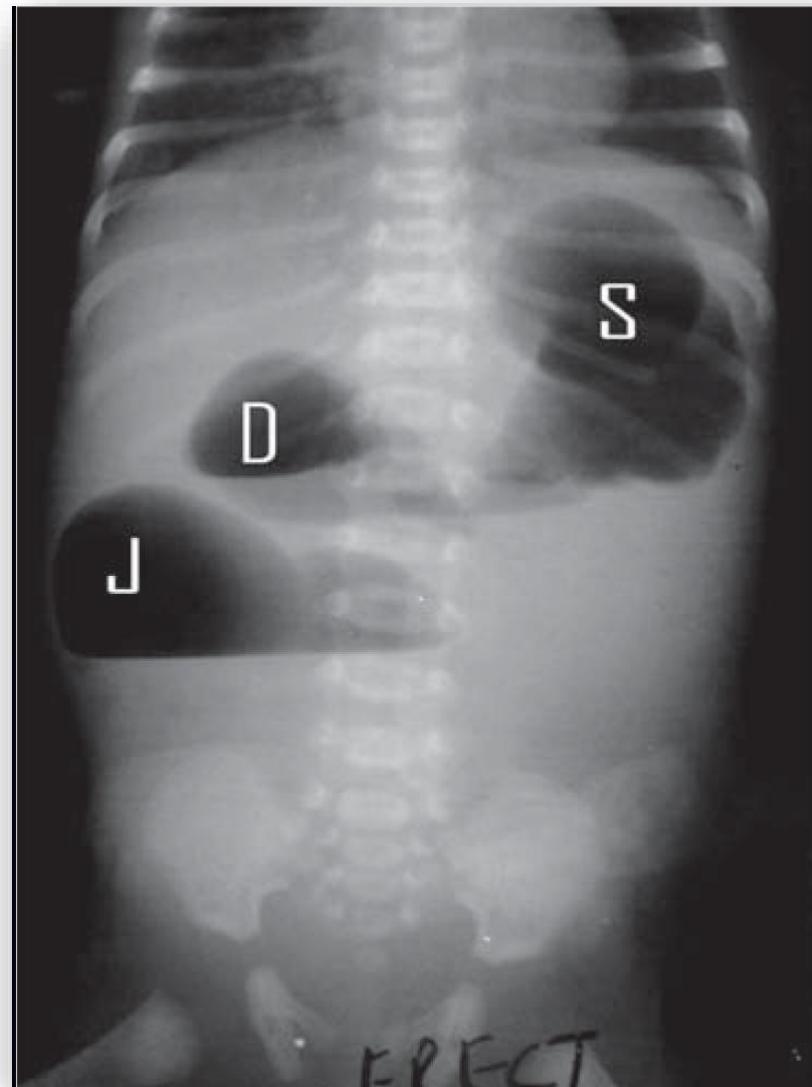
- In case of *a volvolus* the child is acutely sick and ultrasound is often the modality of choice.
- This will show *a whirlpool sign of the vessels which confirms the presence of a volvolus*.
- *The corkscrew sign* of the bowel on the upper GI is equivalent.
- Once a volvolus is diagnosed on ultrasound, the child should go straight to the operating room and no more time should be lost on further imaging.

Jejunal atresia

- *Jejunal atresia* is the most frequent cause of upper intestinal obstruction.
- It is caused by an ischemic event in utero.
- Antenatally a polyhydramnion will be present.
- More atretic foci can be present simultaneously.



Jejunal atresia



II-Congenital Low Obstruction

- **Ileal atresia**
- **Meconium ileus**
- **Meconium plug syndrome**
- **Hirschsprung disease**
- **Anal atresia**

Congenital low obstruction

Constipation main symptom

Abdominal radiograph > 3 dilated small bowel loops

Microcolon = unused colon

= obstruction proximal to the colon

Ileal atresia

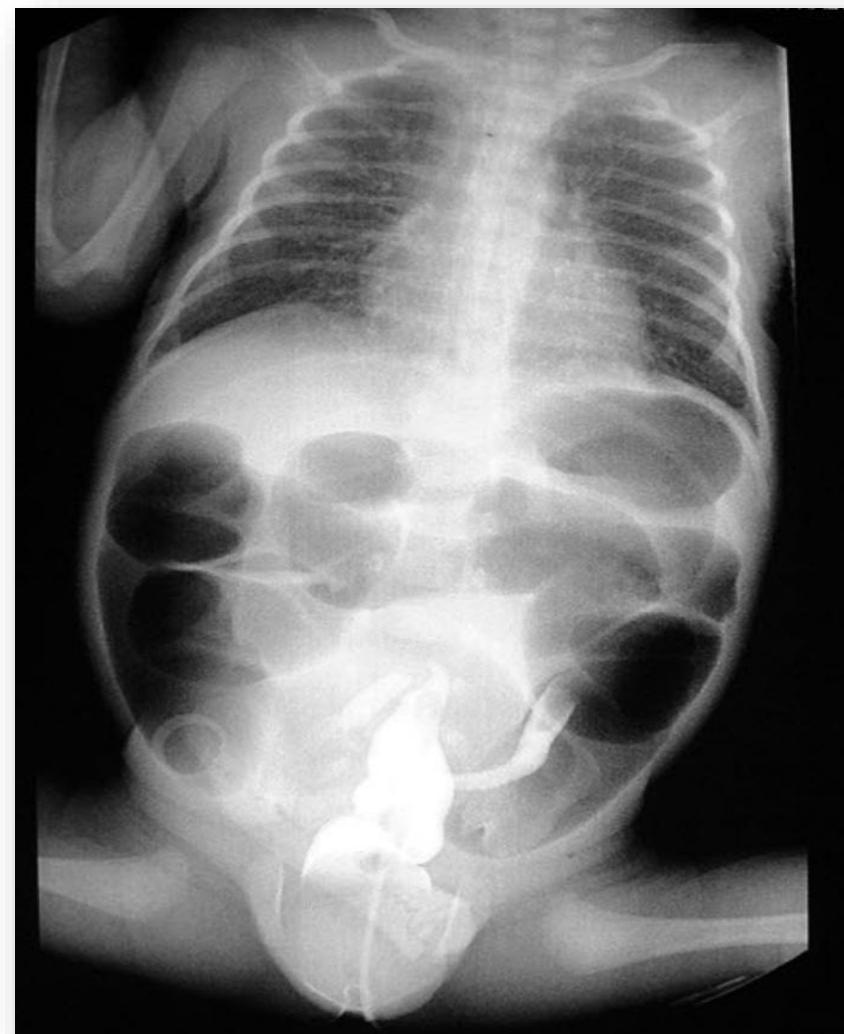
- As with jejunal atresia, *ileal atresia results from an in utero ischemic event.*
- *More atretic foci can be present simultaneously, but the distal ileum is the most common site to be involved.*
- Radiographs will show multiple dilated bowel loops and absence of air in the colon.
- A colon enema will show a microcolon with contrast filling ending blind in the ileum.

Meconium ileus

- ***Meconium ileus*** occurs nearly exclusively in patients with ***cystic fibrosis***.
- In 10% of patients it is the first presentation of the disease.
- Due to the exocrine dysfunction of the pancreas and abnormal intestinal secretions, the meconium is abnormally thick and becomes impacted in the ileum.

Premature child with failure to pass meconium, abdominal distension and vomiting

- There is marked dilatation of small bowel loops. Contrast enema reveals small entire colon with radiolucent filling defects representing meconium seen scattered at right colon and distal ileum.
- *Meconium ileus*



- There is marked dilatation of small bowel loops. Contrast enema reveals small entire colon with radiolucent filling defects representing meconium seen scattered at right colon and distal ileum.



Meconium plug syndrome

- *Meconium plug syndrome* is also known as small left colon syndrome.

- Meconium plugging in the left colon occurs when the colon is functionally immature with little motility.
- There is an association with maternal diabetes and drug use in pregnancy. The condition is temporarily and when the meconium plugs resolve, the colon distends normally and functions normally.
- The neonate is otherwise healthy and there is no association with cystic fibrosis.

Hirschsprung disease

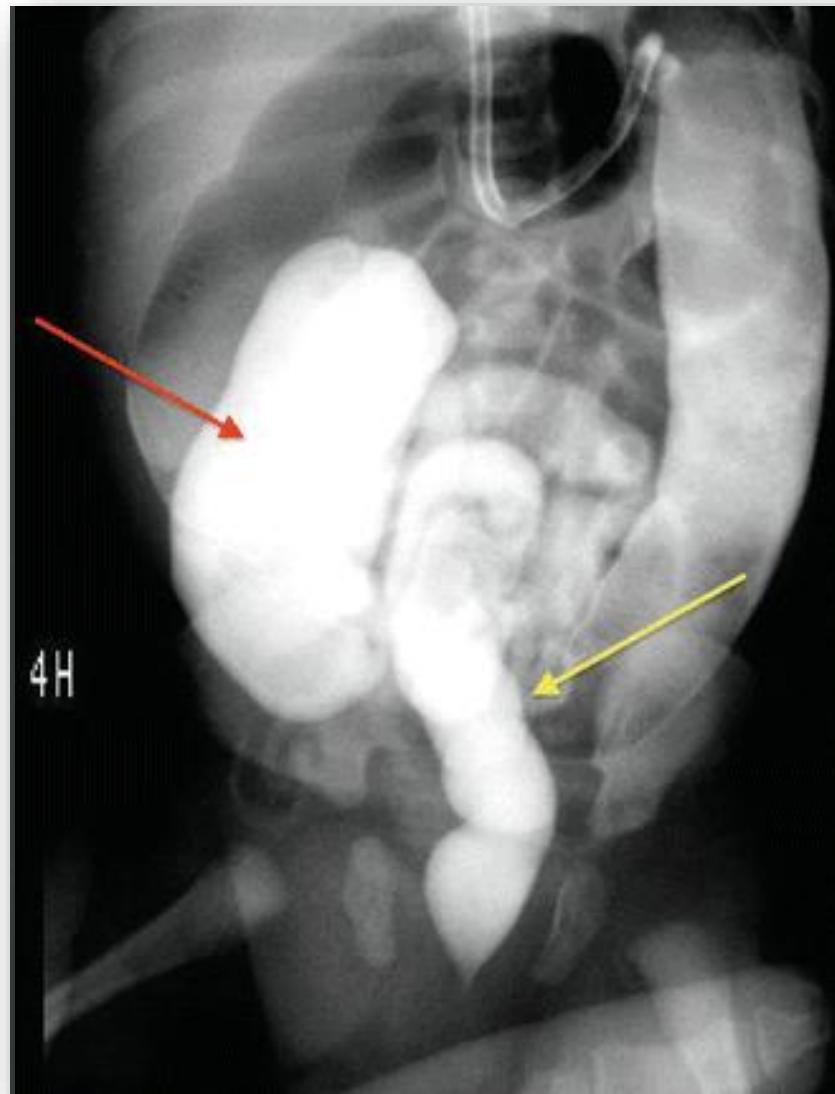
- 75% short segment: rectum or rectosigmoid
- 20% long segment: extends orally in the colon
- 5% total aganglionosis: entire colon, sometimes involvement of small bowel

- In Hirschsprung disease ganglion cells are absent in the distal part of the colon.
- Because the intestinal ganglion cells migrate in a craniocaudal direction, the area of aganglionosis always involves the rectum.
- More extensive disease extends orally in a contiguous fashion.
- The involved bowel has a small diameter and the bowel proximal to the affected segment is dilated.

Saw tooth contractions in Hirschsprung disease

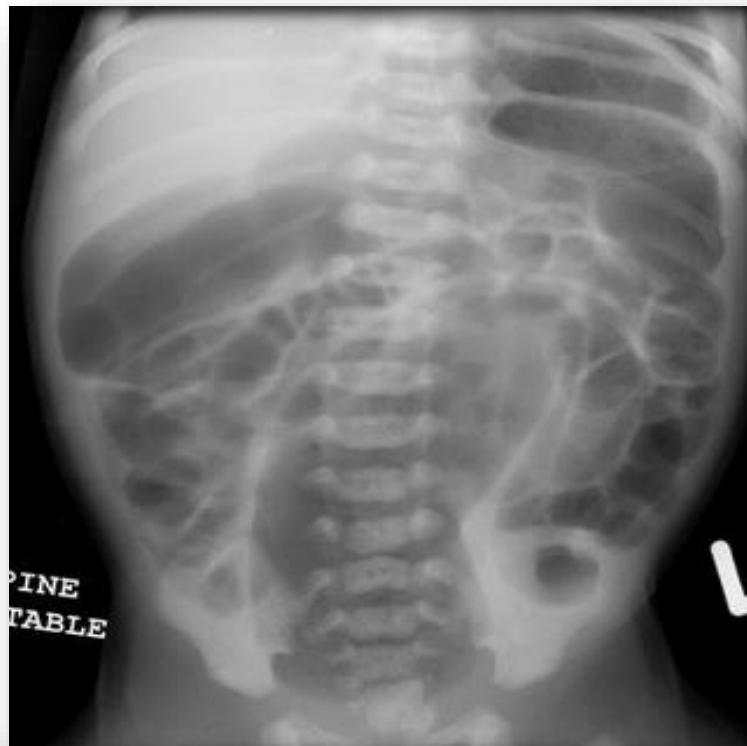
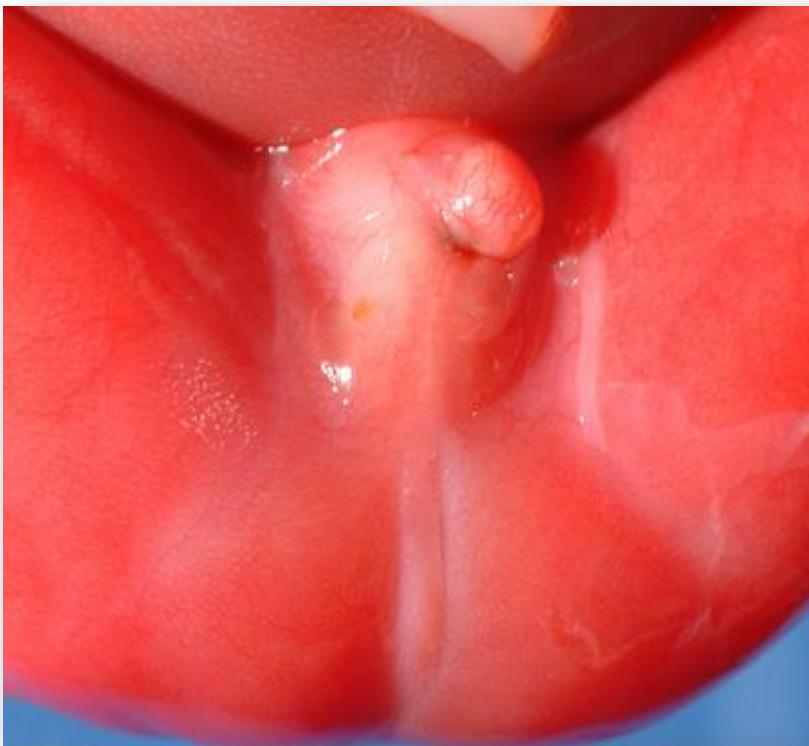


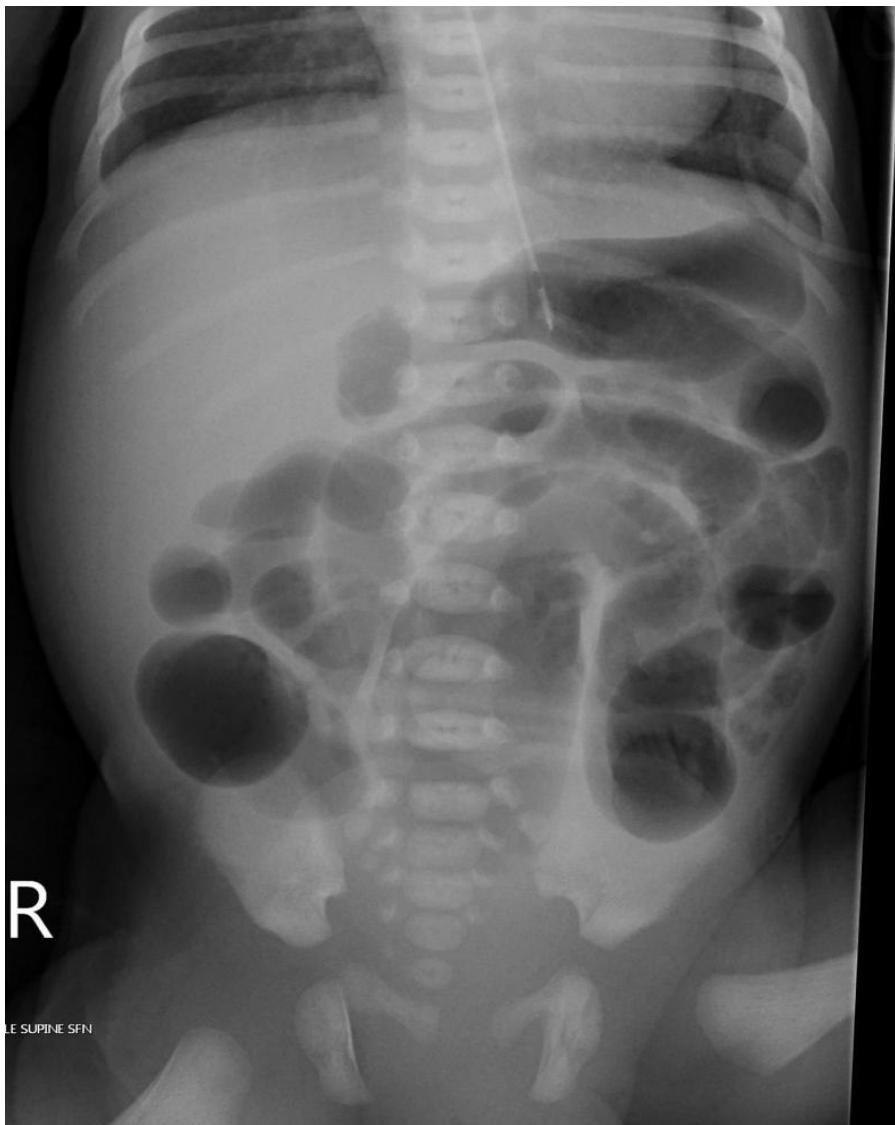
Neonatal Hirschsprung disease



Anal atresia

- The diagnosis of anal atresia is usually clinically straightforward by inspection and digital palpation.
- Anal atresia is part of the spectrum of anorectal and cloacal malformations and is a complex disorder.
- Imaging and treatment should be performed in specialized centers.
- Initially plain films and ultrasound can be used to show the position of the malformation and the need for a colostomy.





LE SUPINE SFN

III-Acquired causes of acute abdomen

- **Necrotizing enterocolitis**
- **Hypertrophic pyloric stenosis**
- **Incarcerated hernia**

Acquired causes of acute abdomen

Different stages of necrotizing enterocolitis

- Bowel dilatation ± bowel wall thickening
- Pneumatosis intestinalis ± portal venous air
- Perforation with pneumoperitoneum

Necrotizing enterocolitis

- *Necrotizing enterocolitis* is a severe bowel inflammation.
- The etiology is not entirely clear and seems to be a combination of immature bowel mucosa, infection and ischemia.
- The most feared complication is *perforation*.

Hypertrophic pyloric stenosis

- Projectile vomiting is the key feature in patients with hypertrophic pyloric stenosis.
- The cause of the muscle hypertrophy which causes the gastric outlet obstruction is unknown.
- There is a familial predisposition and it is more common in boys.
- Hypertrophic pyloric stenosis typically presents after the neonatal period, at the age of 4-8 weeks.
- However early presentation can also occur.

Incarcerated hernia

- Neonates and especially prematures have a relatively weak abdominal wall and inguinal hernias are common, especially in boys.

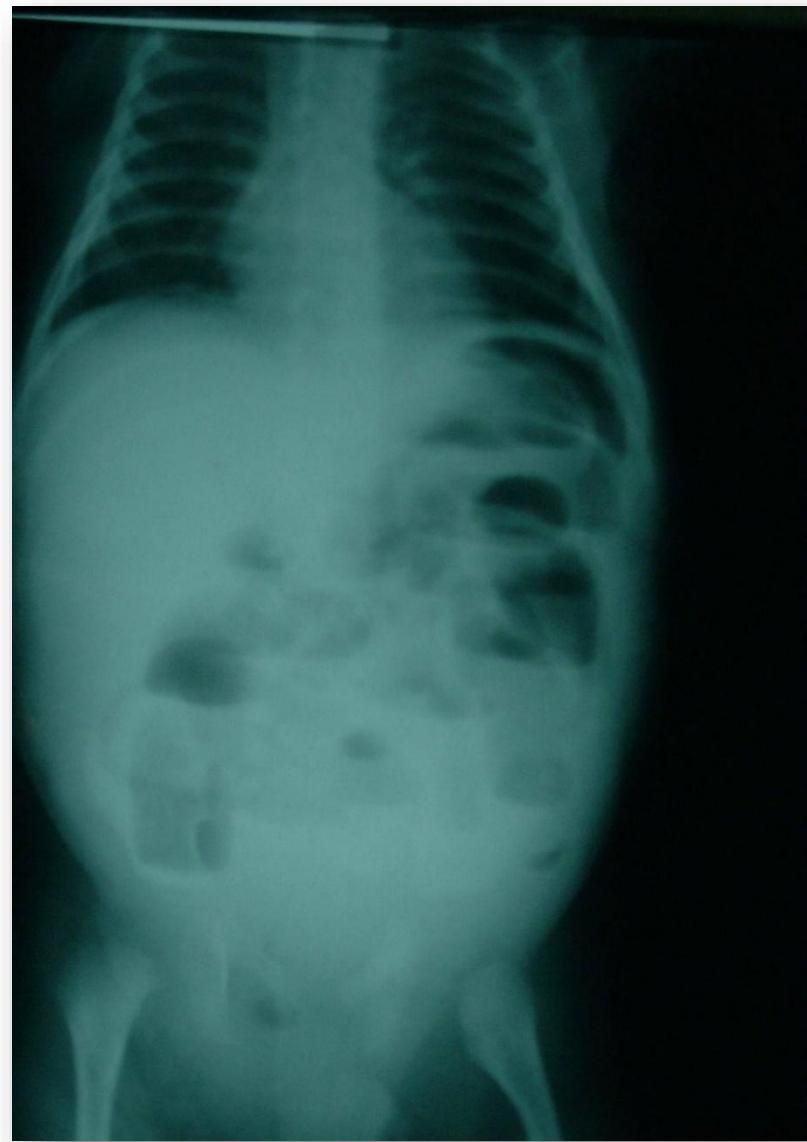


- The findings are:
- Multiple dilated bowel loops indicating a distal obstruction.
- Bowel loop in the left groin
- This was *an incarcerated inguinal hernia.*



Incarcerated hernia





Abdominal wall defect

- An abdominal wall defect is an opening in the abdomen through which various abdominal organs can protrude. This opening varies in size and can usually be diagnosed early in fetal development, typically between the tenth and fourteenth weeks of pregnancy. There are two main types of abdominal wall defects: *omphalocele* and *gastroschisis*.

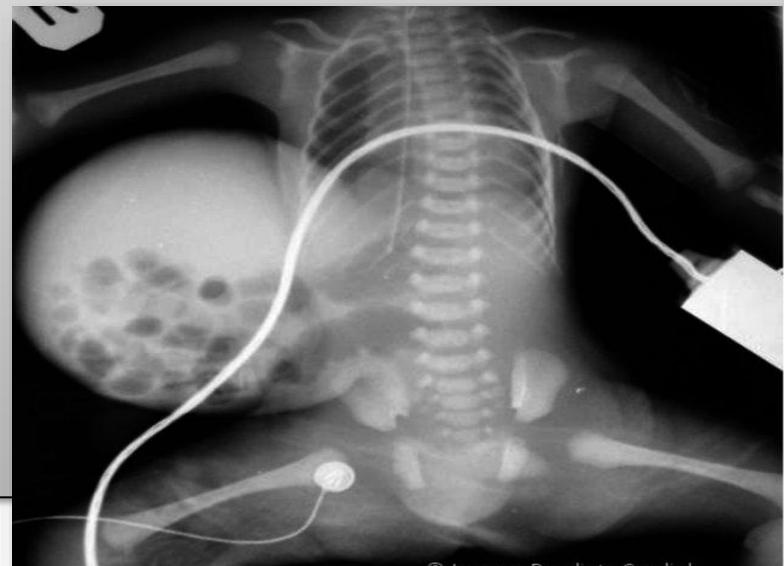


Omphalocele

- **An omphalocele** is caused by a defect in the middle of the abdominal wall at the umbilicus. The skin, muscle, and fibrous tissue are missing. The intestines herniate out through the opening and are covered by a thin sac. The umbilical cord is in the center of the defect.
- **An omphalocele** commonly occurs along with other birth defects (such as heart defects and kidney defects) and with specific genetic syndromes (such as Down syndrome, trisomy 18, and trisomy 13).



- **Omphaloceles** are associated with other anomalies and syndromes, such as Beckwith-Wiedemann, conjoined twins, trisomy 18, meningomyelocele, and imperforate anus.



© Images Paediatric Cardiol

Gastroschisis

- **Gastroschisis** also is an abnormal opening of the abdominal wall. In gastroschisis, the opening is near the umbilicus (usually to the right) but not directly over it, like in omphalocele. Like in omphalocele, the opening allows the intestines to herniate out but unlike omphalocele, the intestines are not covered by a thin sac.
- Before birth, because the intestines are not covered by a sac, they may be damaged by exposure to amniotic fluid, which causes inflammation. The inflammation irritates the intestine, which can result in complications such as problems with movements of the digestive system, scar tissue, and intestinal obstruction.



Gastroschisis

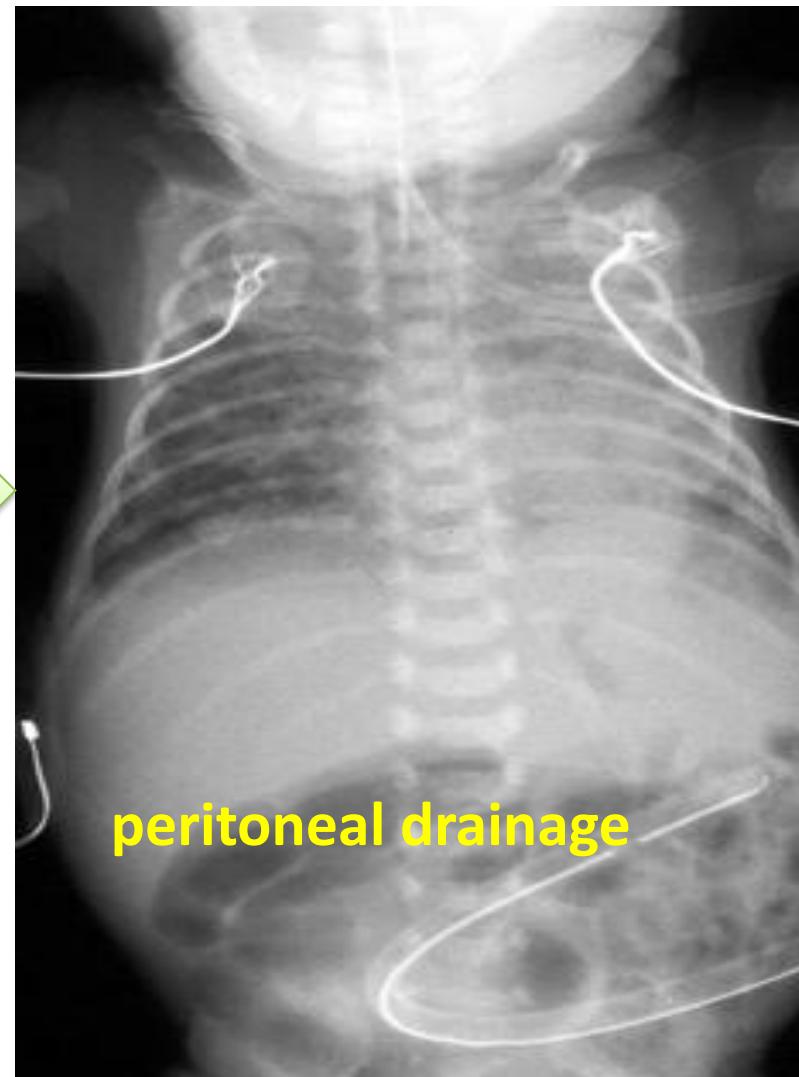




"CPAP Belly"



Bowel Perforation

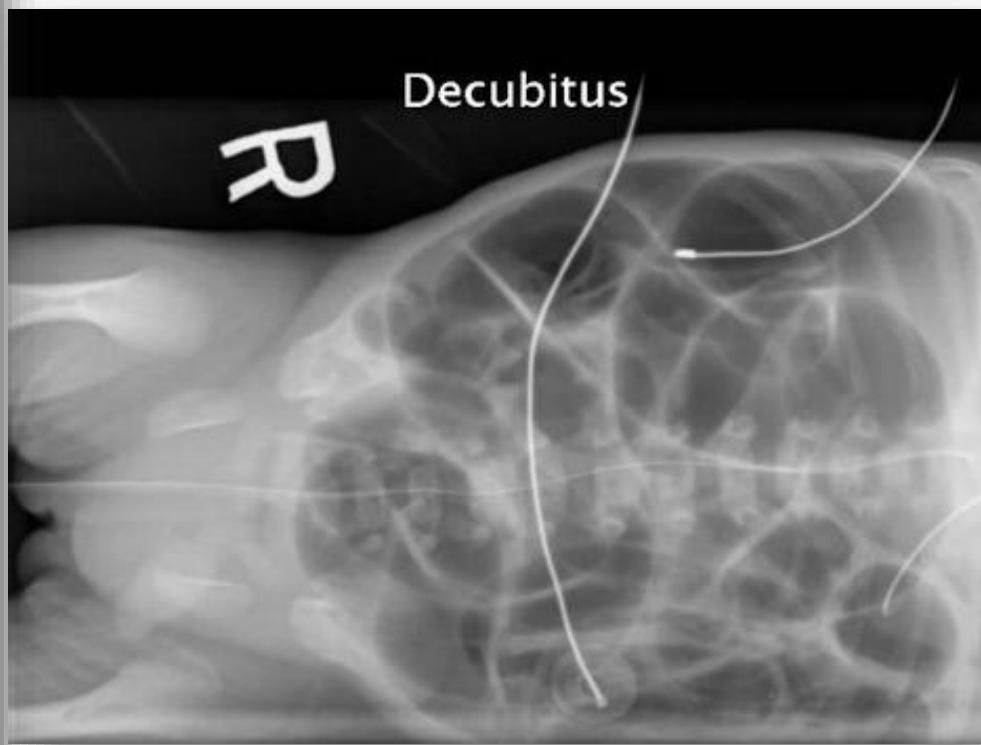


peritoneal drainage

Intestinal Malrotation



Meconium Ileus



Meconium Peritonitis



Hirschsprung's Disease



Thank
you!

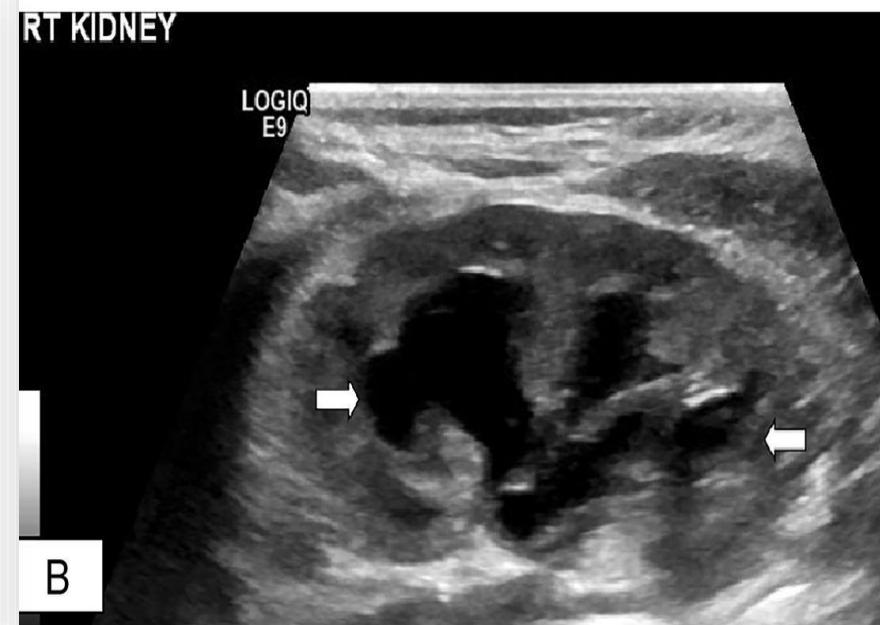
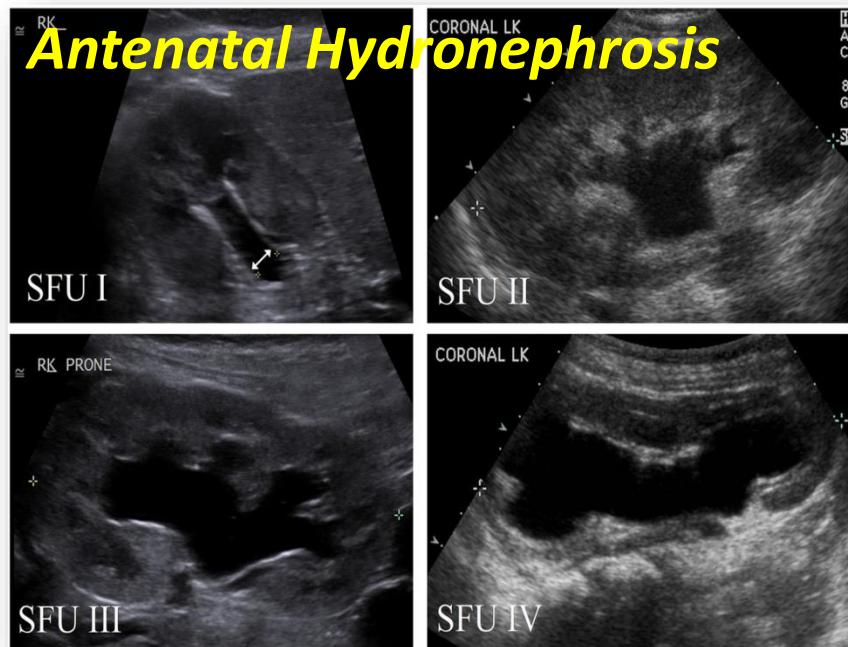
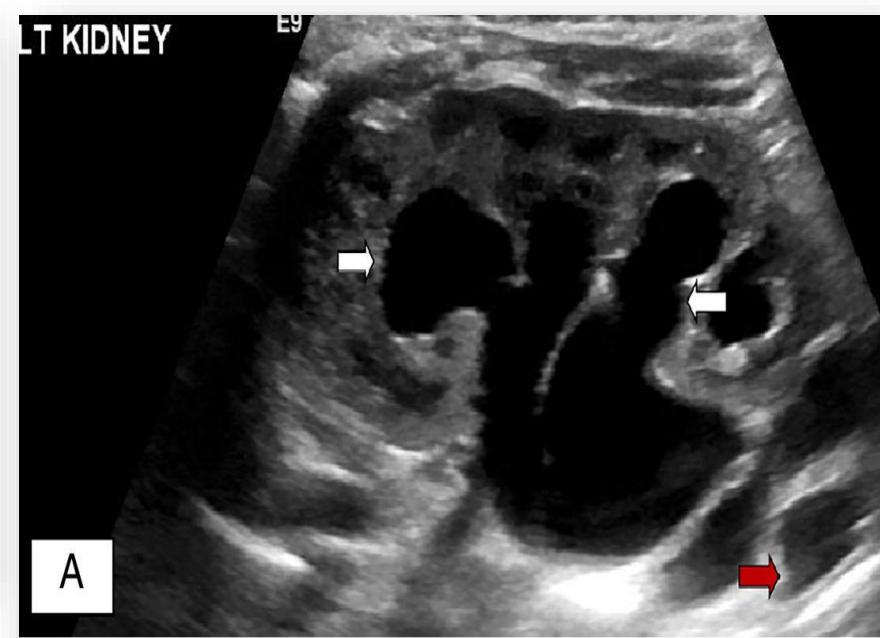
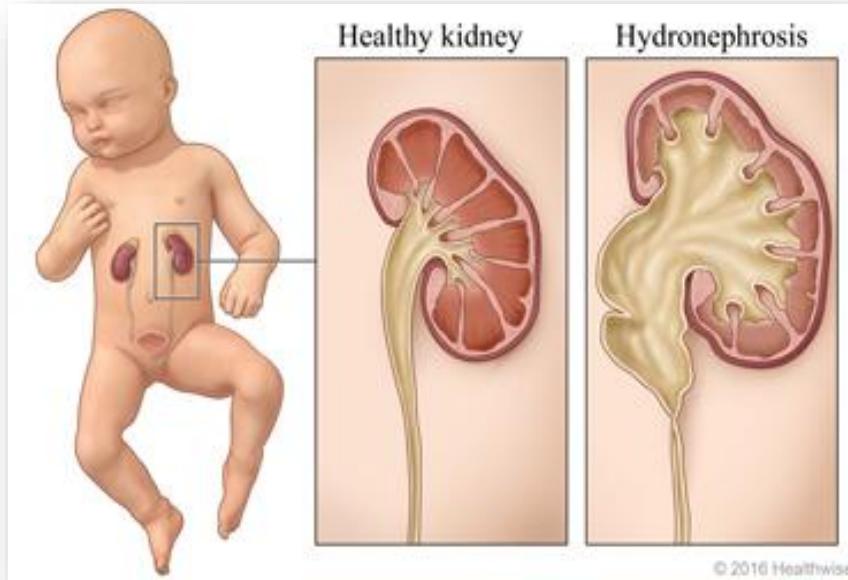


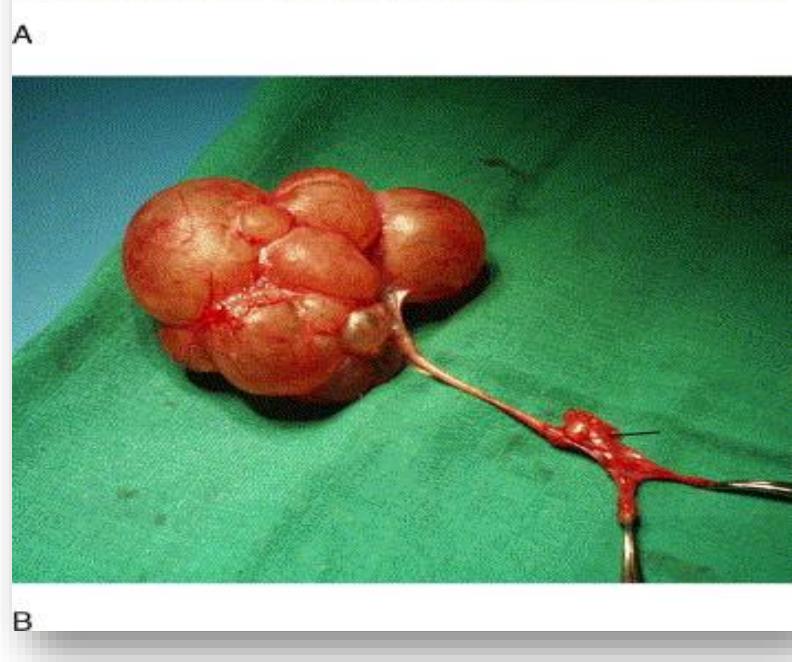
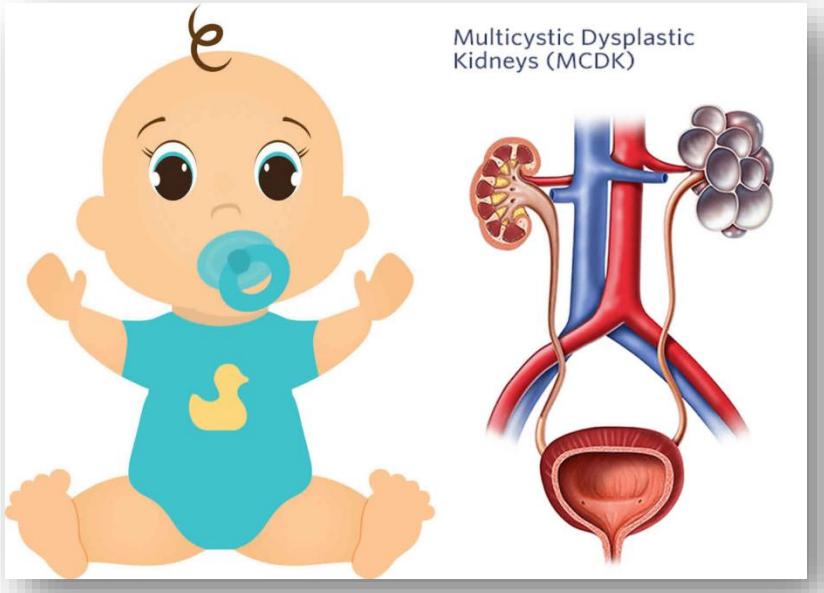
Abdomen

- The liver is usually palpable, sometimes as much as 2 cm below the rib margin. Less often, the tip of the spleen may be felt. The approximate size and location of each kidney can usually be determined on deep palpation. At no other period of life does the amount of air in the gastrointestinal tract vary so much, nor is it usually so great under normal circumstances.

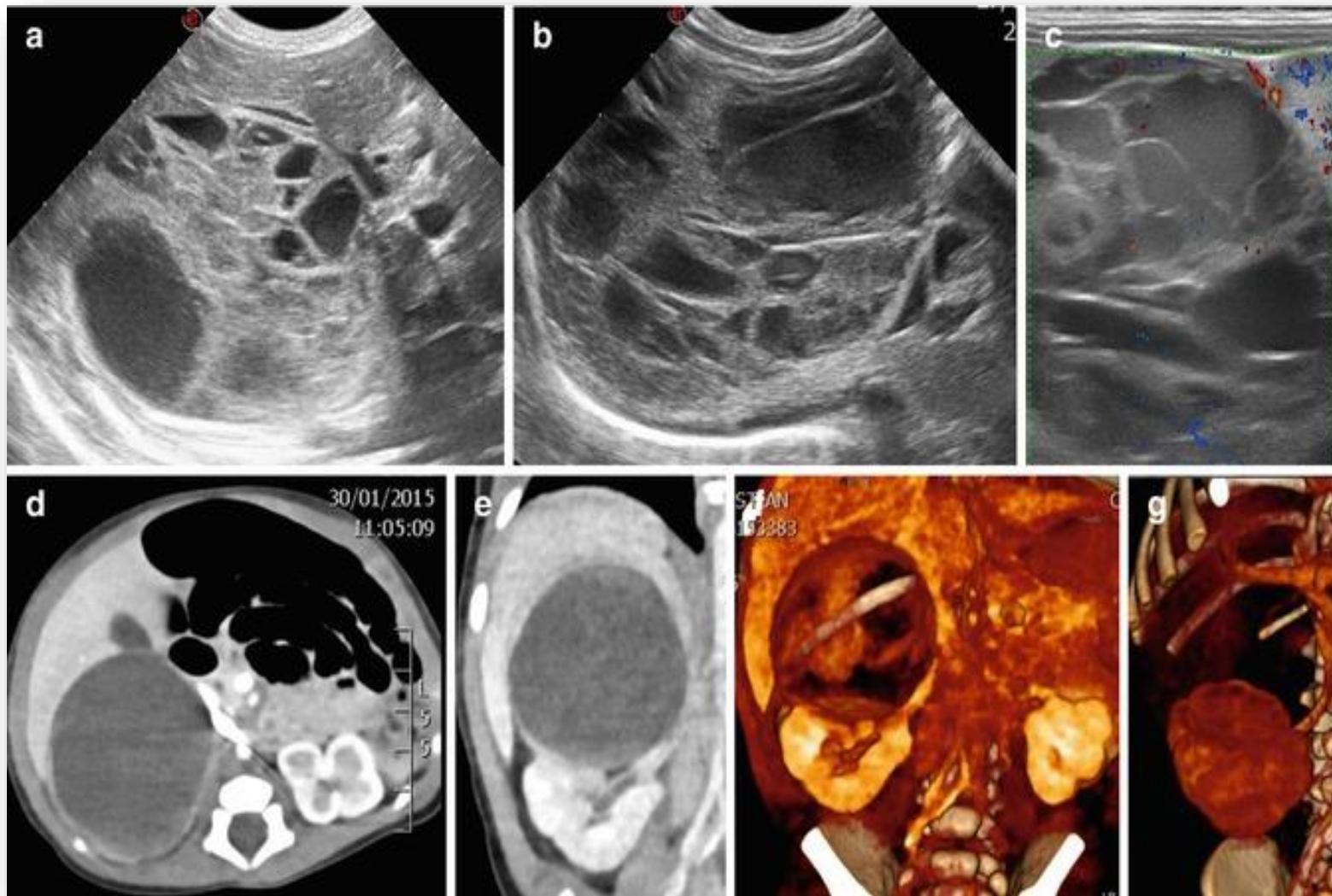
- The intestinal tract is gasless at birth. Gas is swallowed soon after birth, and gas should normally be present in the rectum on radiograph by 24 hr of age. The abdominal wall is normally weak (especially in premature infants), and diastasis recti and umbilical hernias are common, particularly among black infants.

- Unusual masses should be investigated immediately with ultrasonography. Renal pathology is the cause of most neonatal abdominal masses. *Cystic abdominal masses* include hydronephrosis, multicystic-dysplastic kidneys, adrenal hemorrhage, hydrometrocolpos, intestinal duplication, and choledochal, ovarian, omental, or pancreatic cysts.





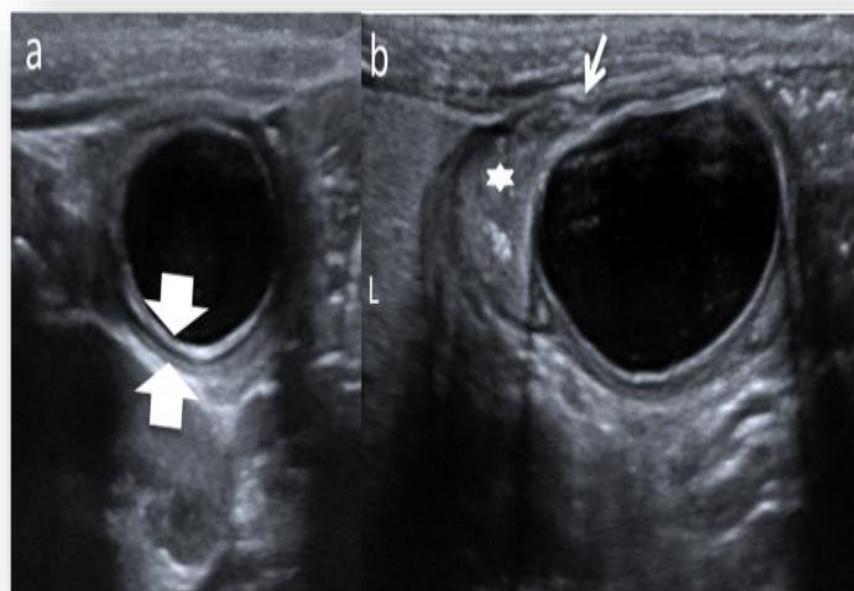
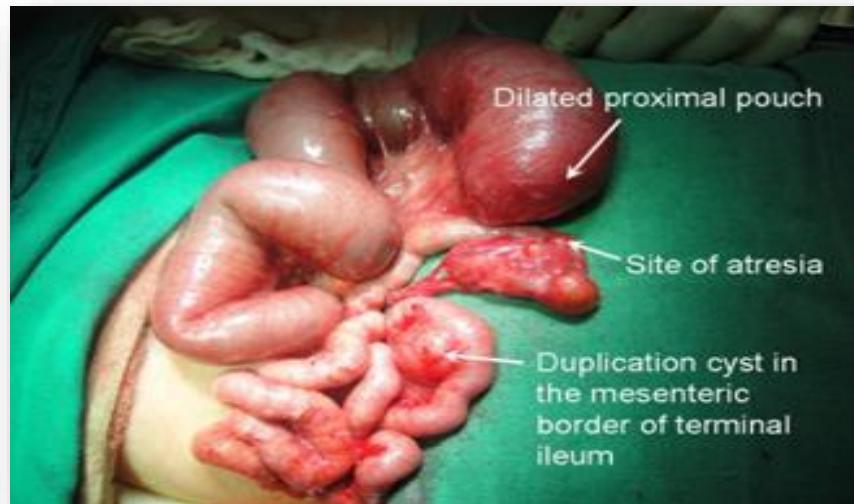
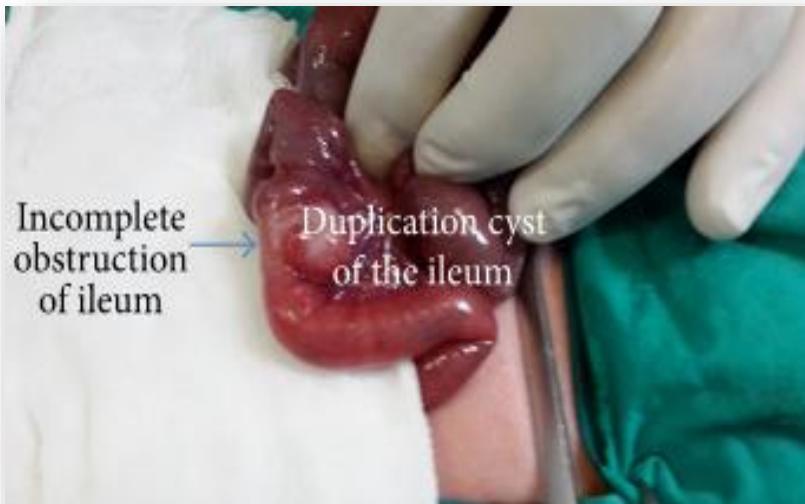
Neonatal Adrenal Hemorrhage



Hydrometrocolpos



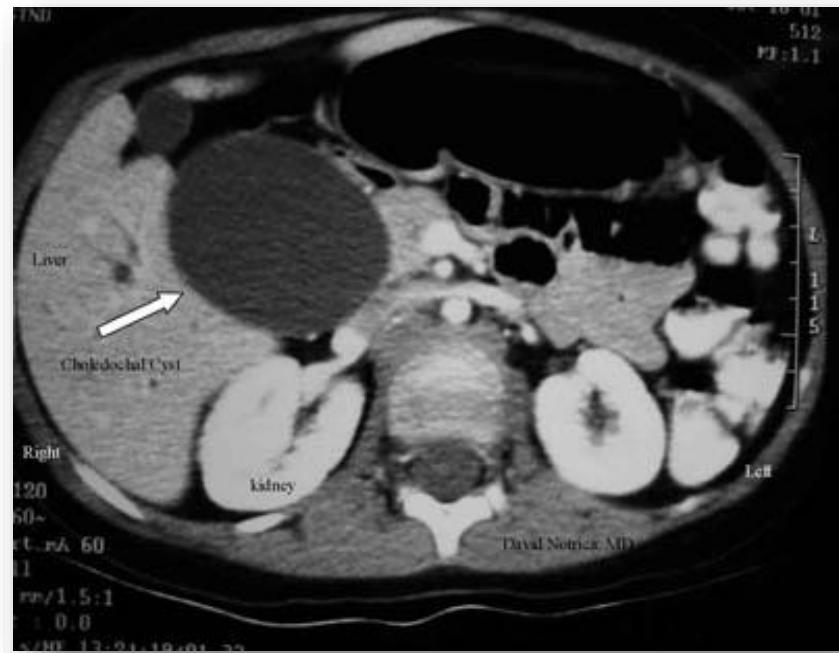
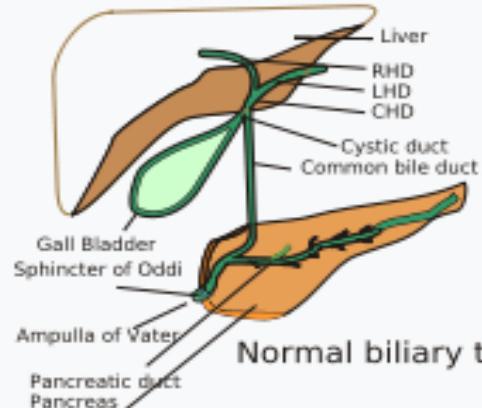
Duplication Cyst



Choledochal cysts

Other names

Bile duct cyst

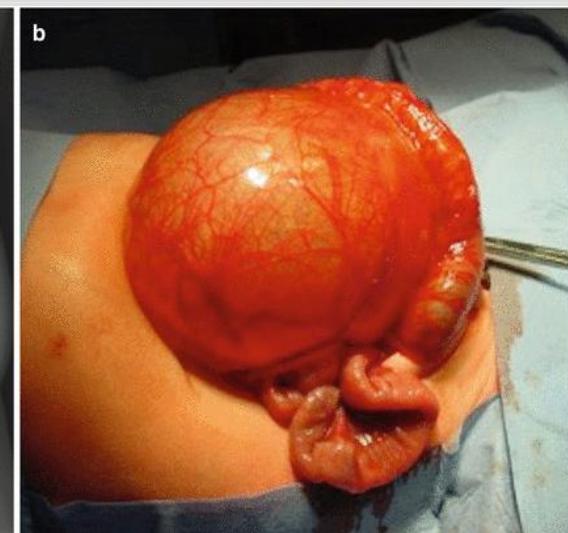
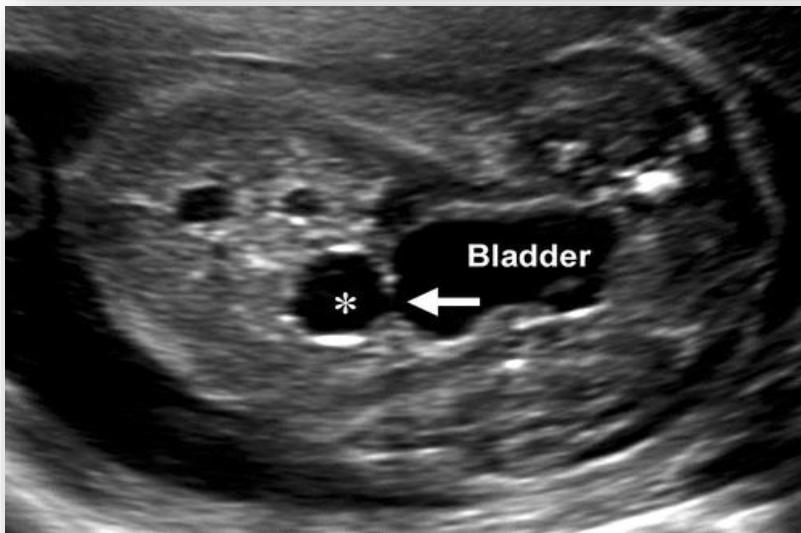
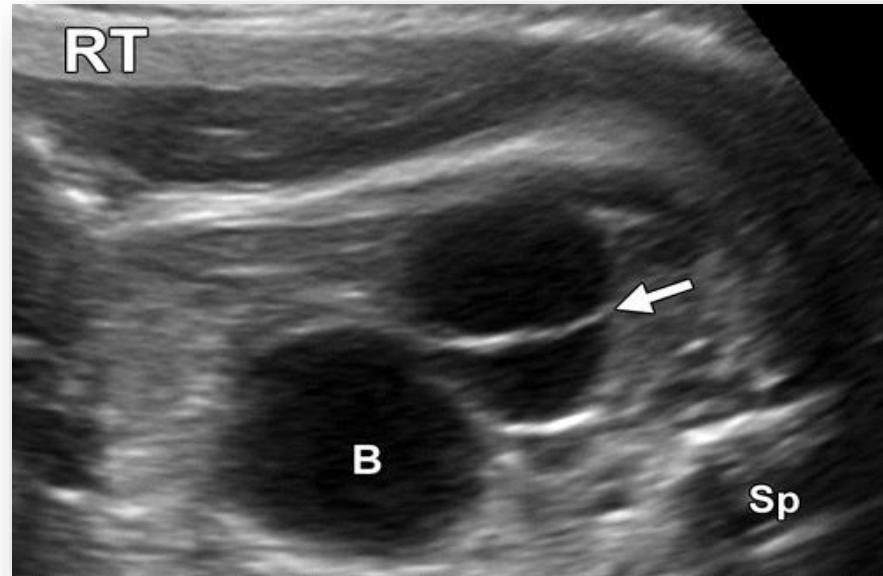


Prenatal diagnosis of a giant choledochal cyst

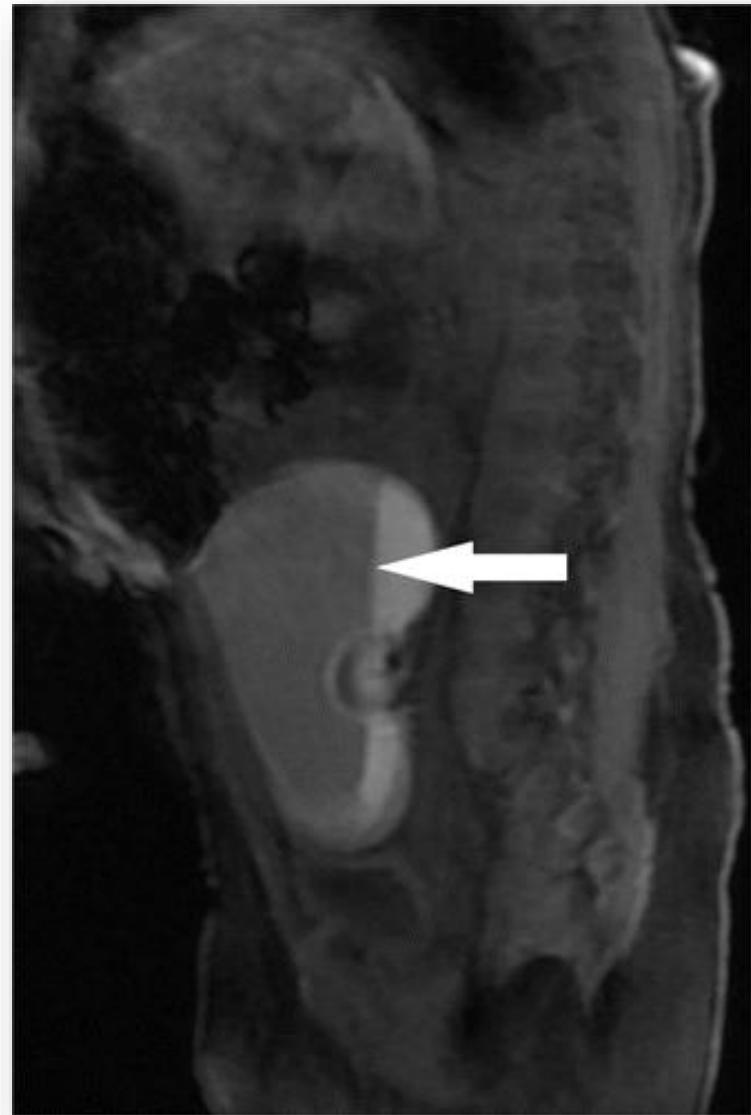


Different types of choledochal cysts

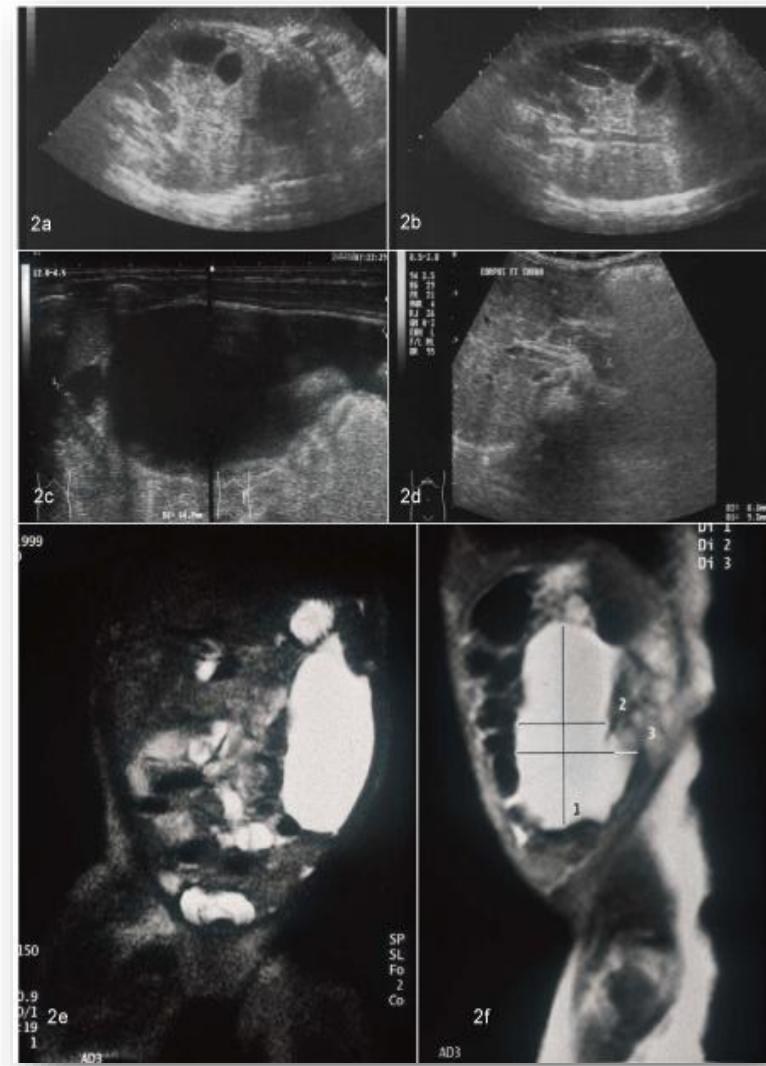
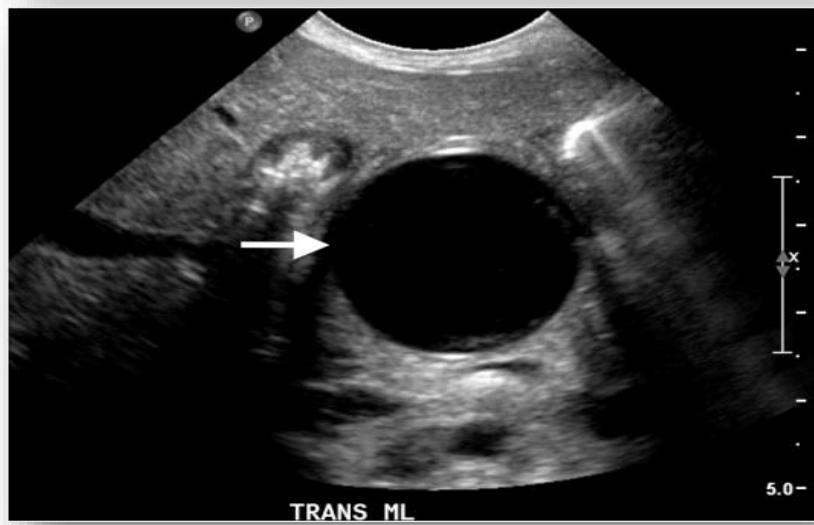
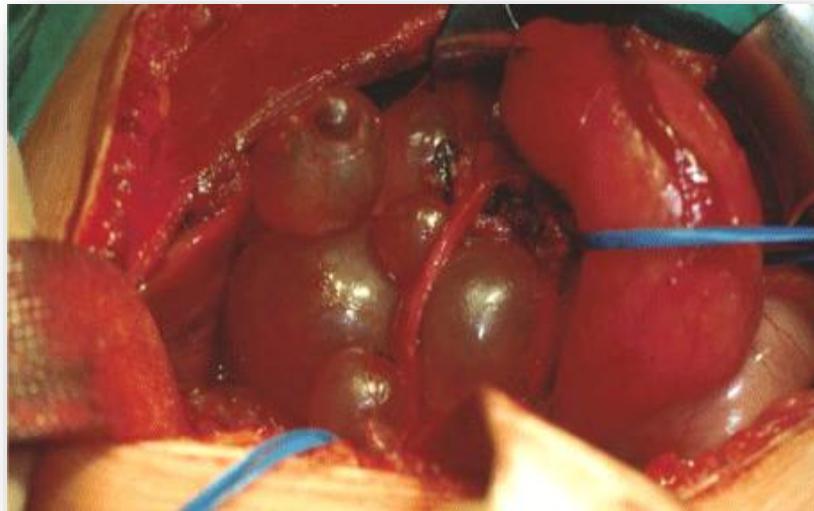
Neonatal ovarian cyst



Omental cysts



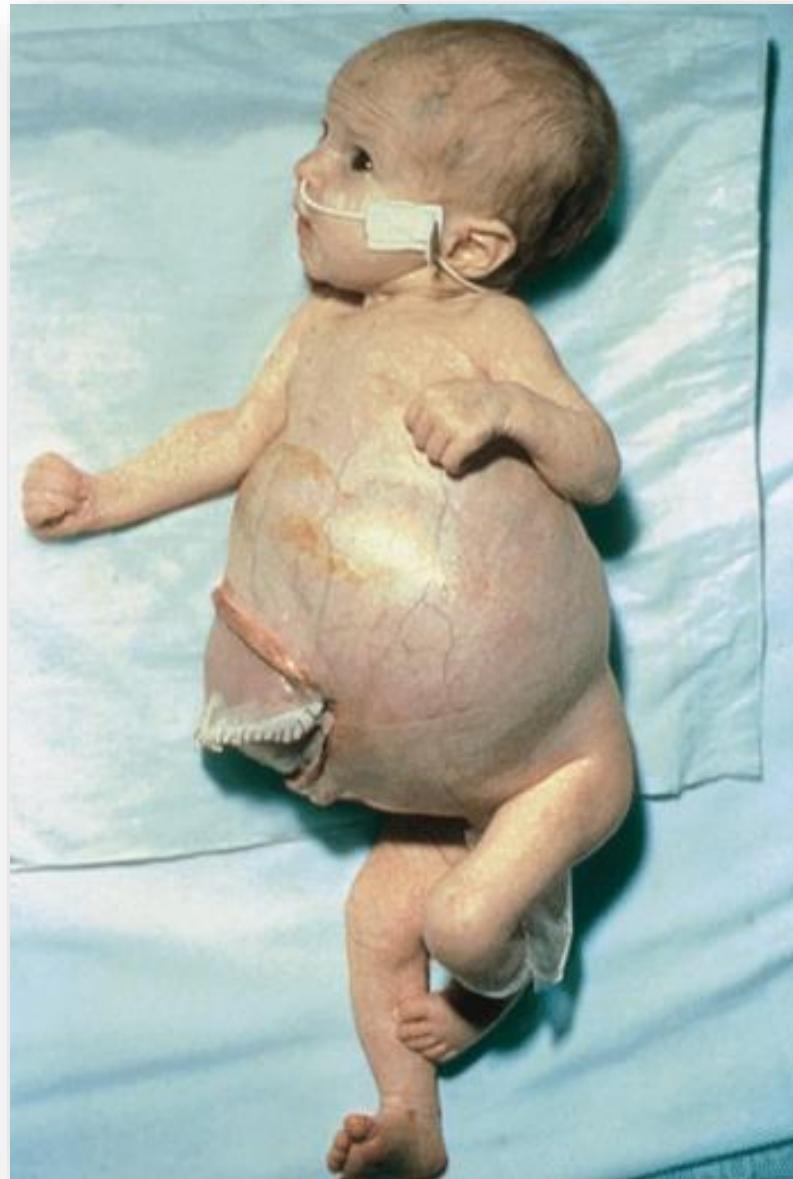
True Congenital Cysts of the Pancreas in the Newborn and Infant



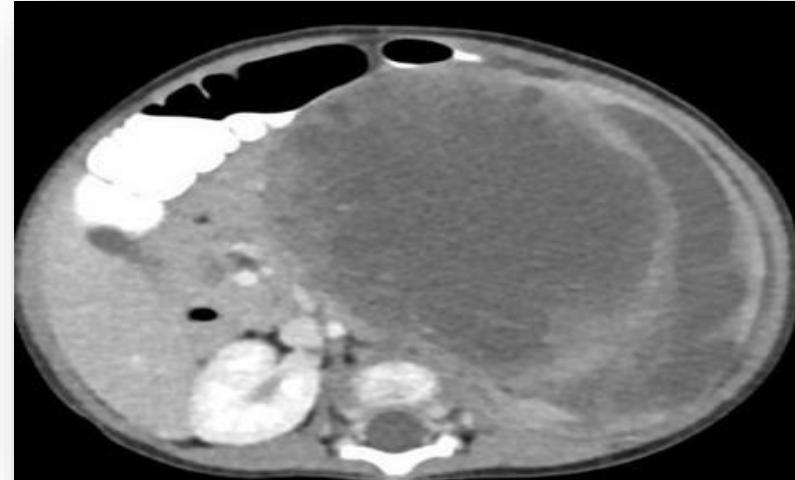
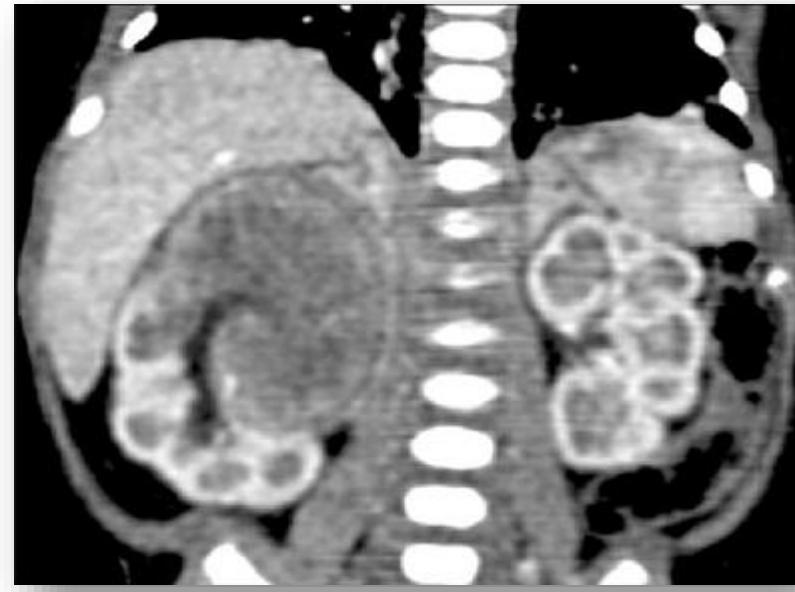
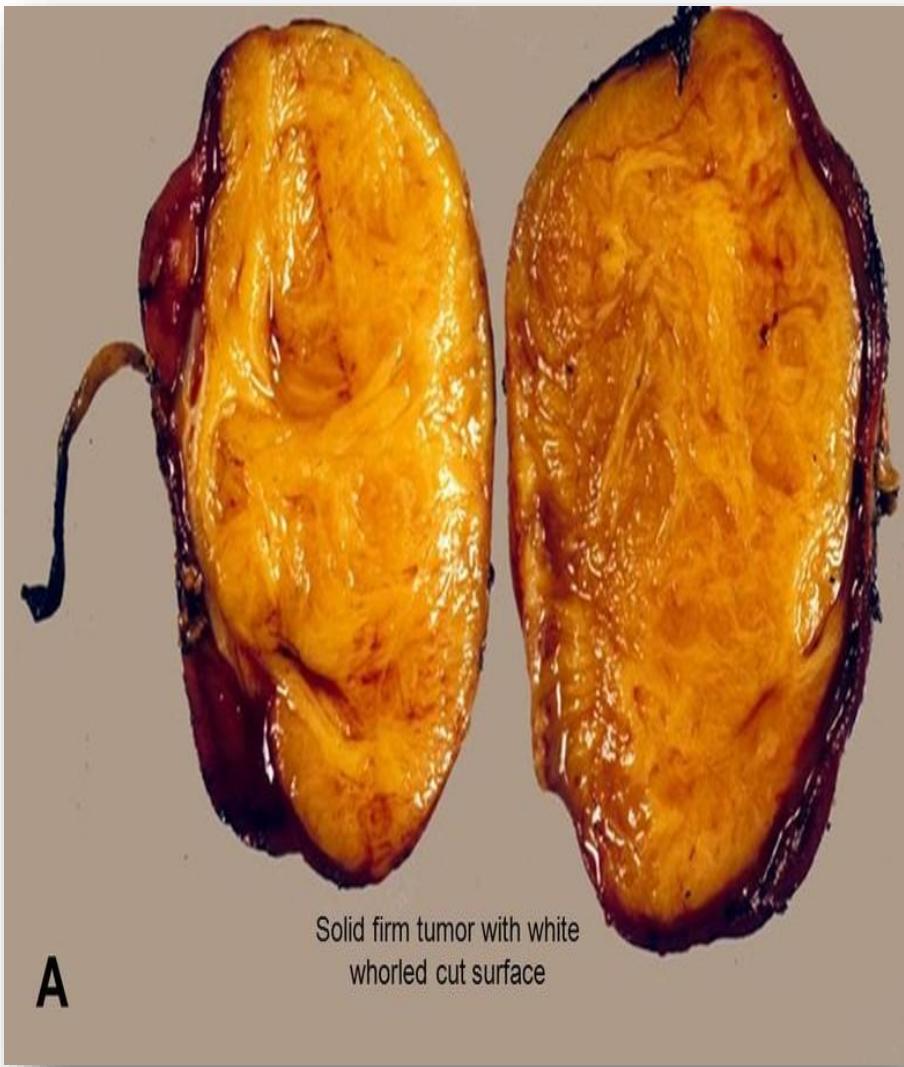
- ***Solid masses*** include neuroblastoma, congenital mesoblastic nephroma, hepatoblastoma, and teratoma. A solid flank mass may be caused by renal vein thrombosis , which becomes clinically apparent with hematuria, hypertension, and thrombocytopenia.

Neonatal Neuroblastoma with Inferior Vena Cava Syndrome

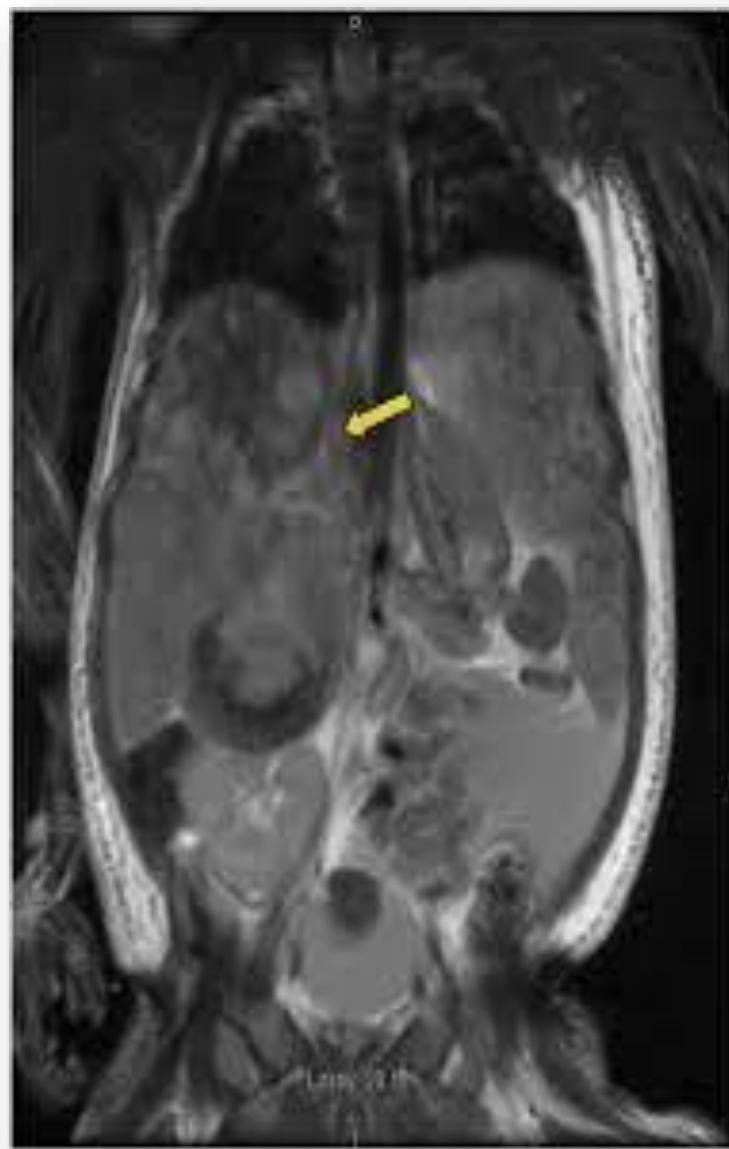
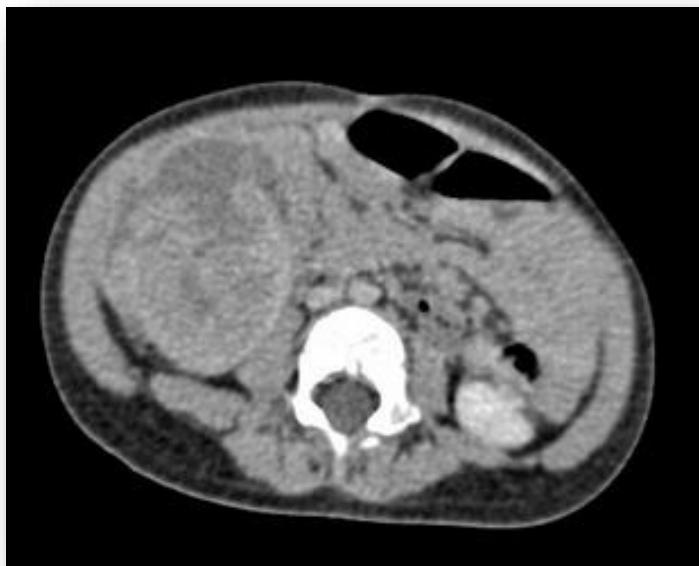




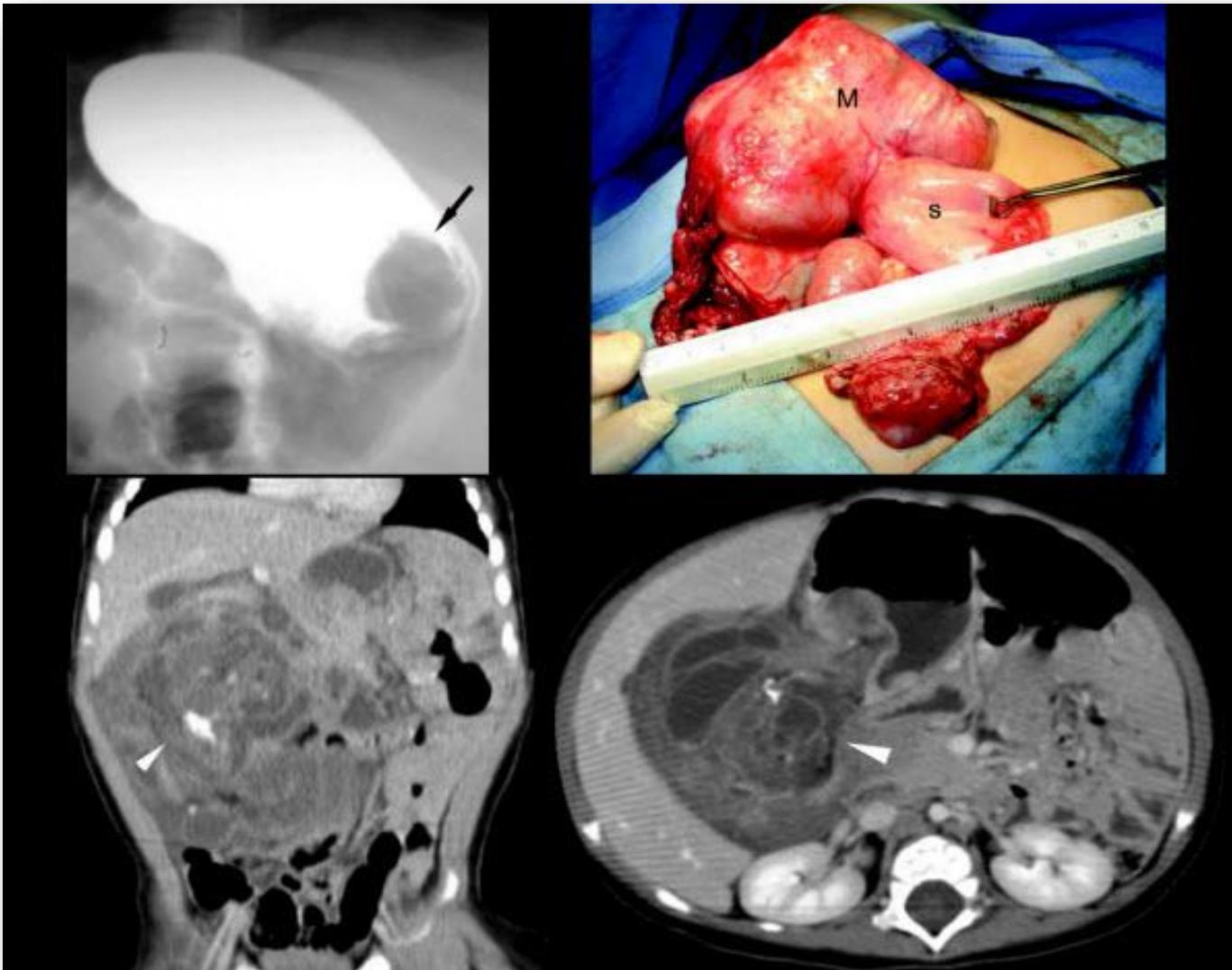
Mesoblastic Nephroma



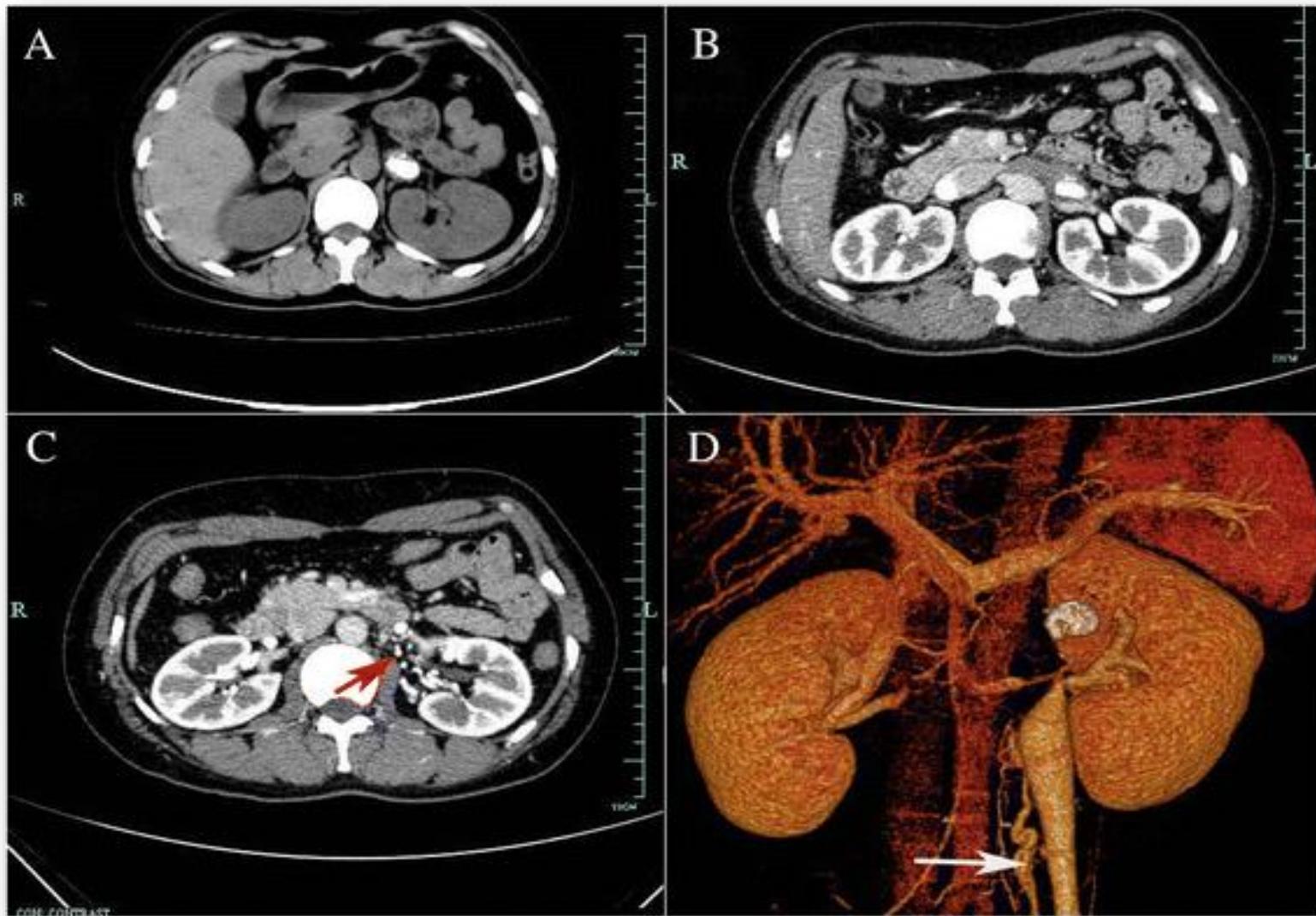
Hepatoblastoma



Gastric Teratoma



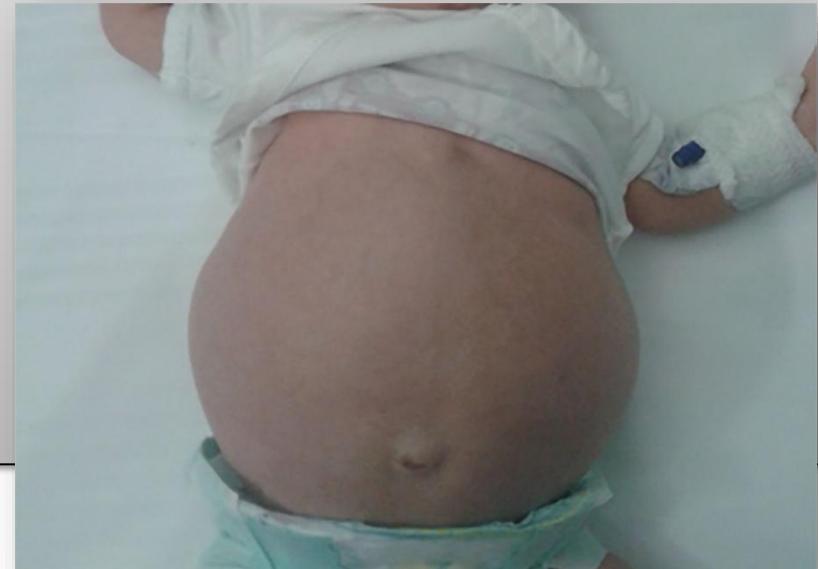
Renal vein thrombosis



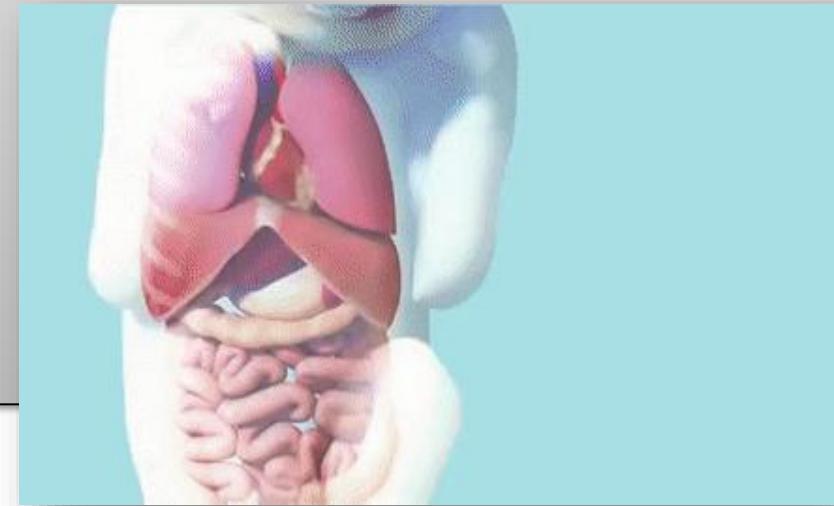
- ***Renal vein thrombosis*** in infants is associated with **polycythemia, dehydration, maternal diabetes, asphyxia, sepsis, nephrosis, and hypercoagulable states such as antithrombin III and protein C deficiency.**



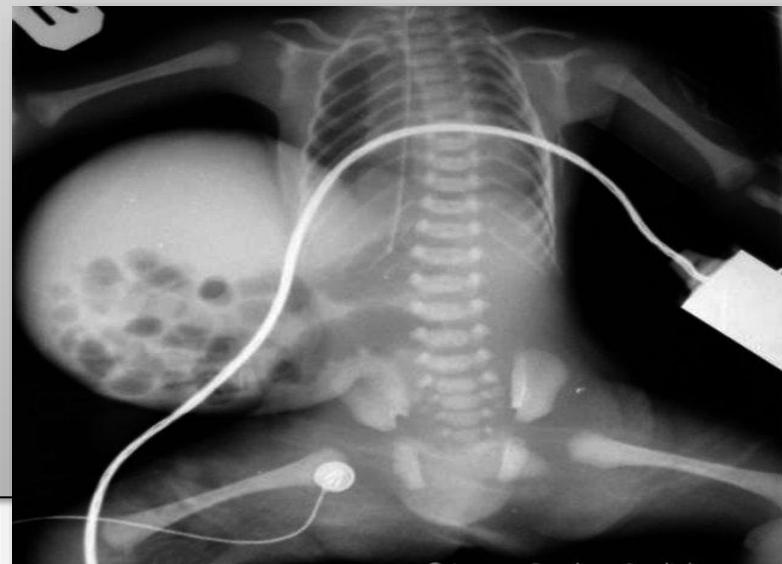
- ***Abdominal distention*** at birth or shortly afterward suggests either obstruction or perforation of the gastrointestinal tract, often as a result of meconium ileus; later distention suggests lower bowel obstruction, sepsis, or peritonitis.



- A **scaphoid abdomen** in a newborn suggests **diaphragmatic hernia**. Abdominal wall defects produce an **omphalocele** when they occur through the umbilicus and **gastroschisis** when they occur lateral to the midline.



- **Omphaloceles** are associated with other anomalies and syndromes, such as Beckwith-Wiedemann, conjoined twins, trisomy 18, meningomyelocele, and imperforate anus.



Gastroschisis





THANK YOU!