

PEDIATRIC RADIOLOGY

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Imaging techniques in pediatrics are similar to that in adults. Ultrasound, X-Rays, Fluoroscopy, CT, and MRI are all modalities that can be used. It is important to remember that radiation exposure is cumulative over a person's lifetime and that children are more radiosensitive than adults. However, since kids are tiny, lower doses of radiation are needed.

Radiation Exposure

- Primary goal is to reduce radiation exposure
- ALARA (As Low As Reasonably Achievable)
 - Use appropriate shielding
 - Most radiosensitive organs=bone marrow, thyroid, breast
 - Gonads as well because of mutagenesis

CHEST RADIOGRAPHY

- **Chest X-ray** is the most frequent Pediatric radiological examination and is still important despite the development of powerful imaging techniques
- In many countries in the world **CXR**s have to be read by clinicians.

BASIC CXR VIEWS

- AP, PA, Lateral -/+ further views
- Depends on the ptn age and general condition

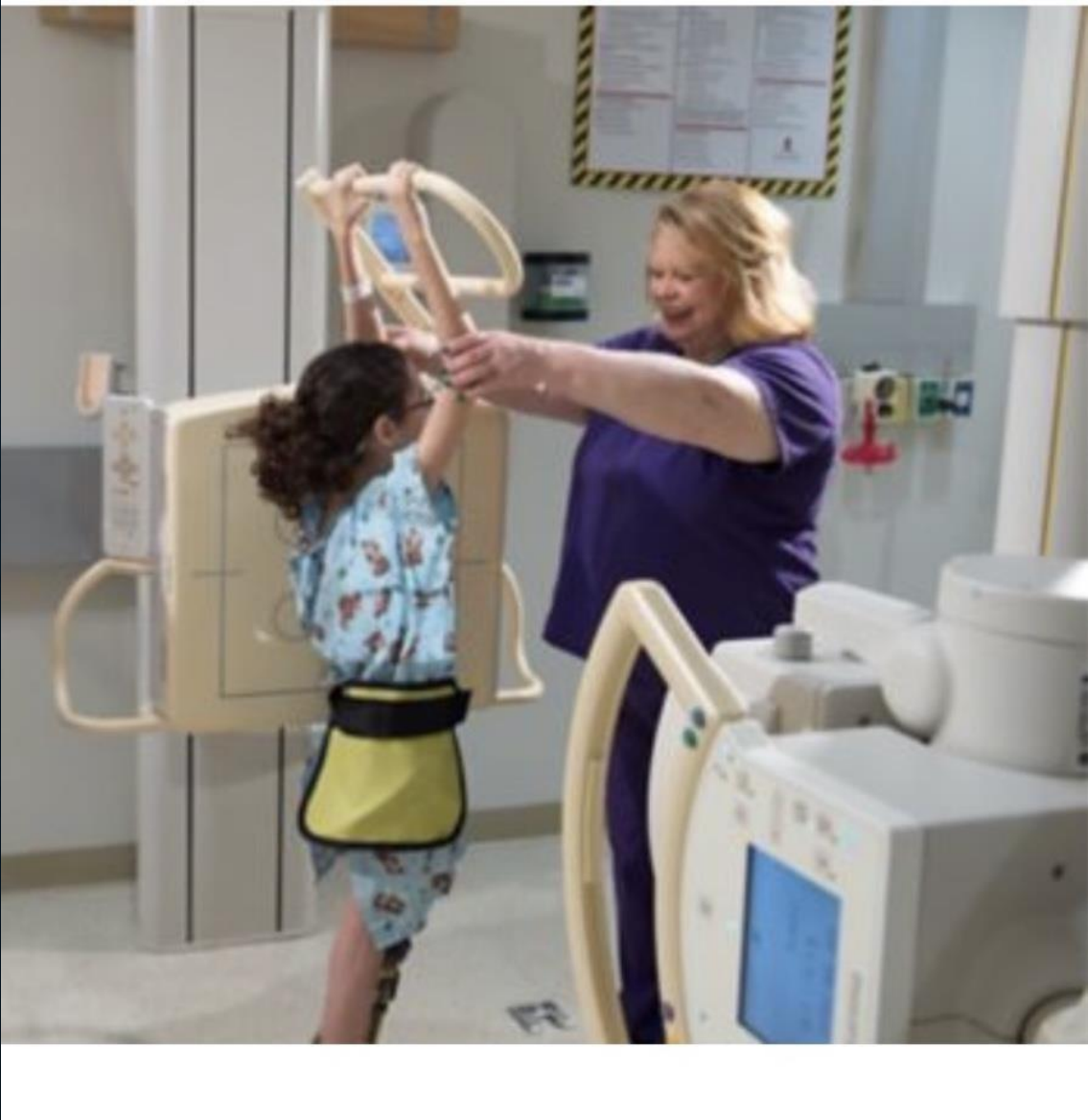
PA
(ELDER CHILD/ADOLESCENT)



AP
(INFANTS/YOUNG CHILDREN)

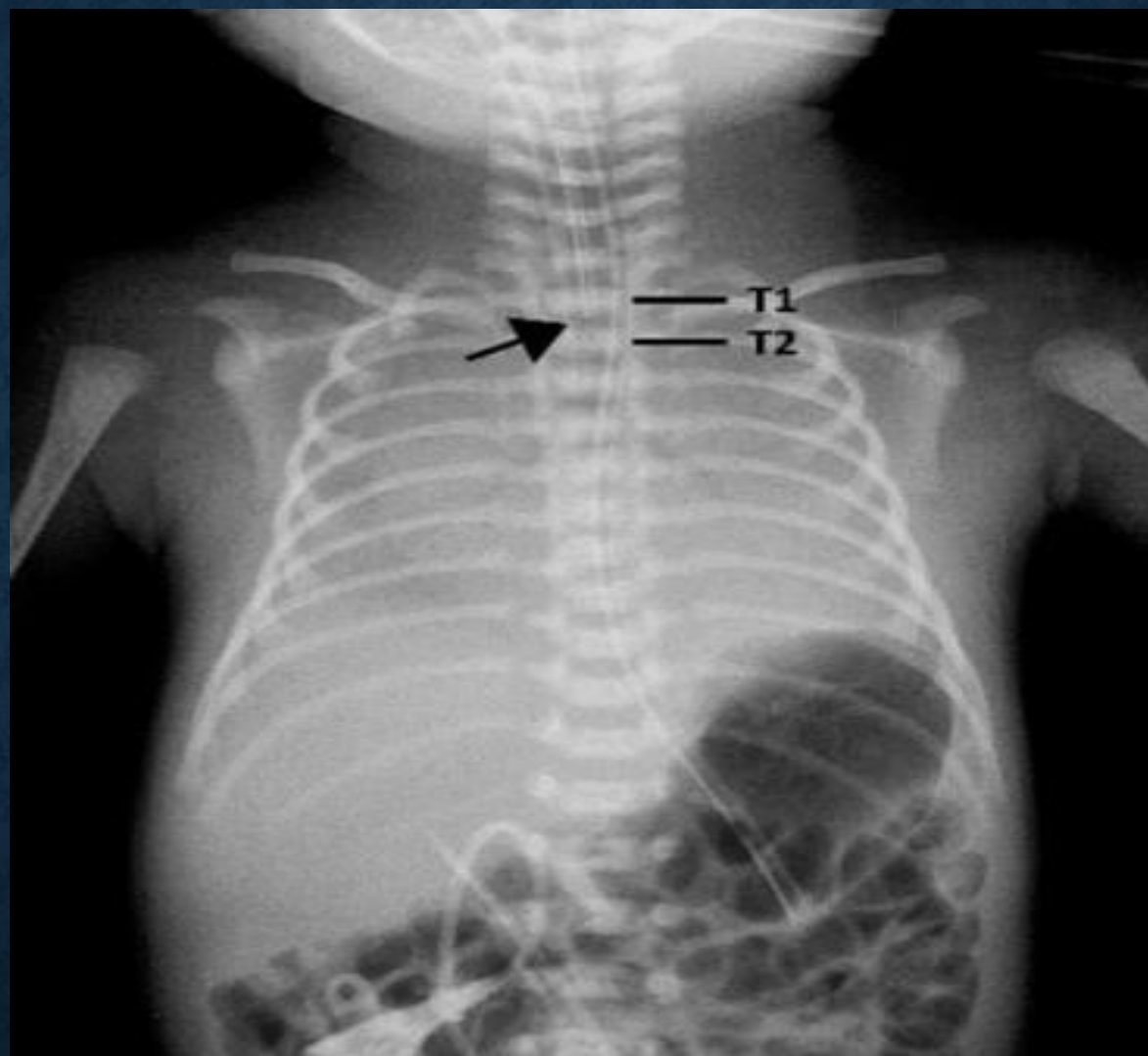


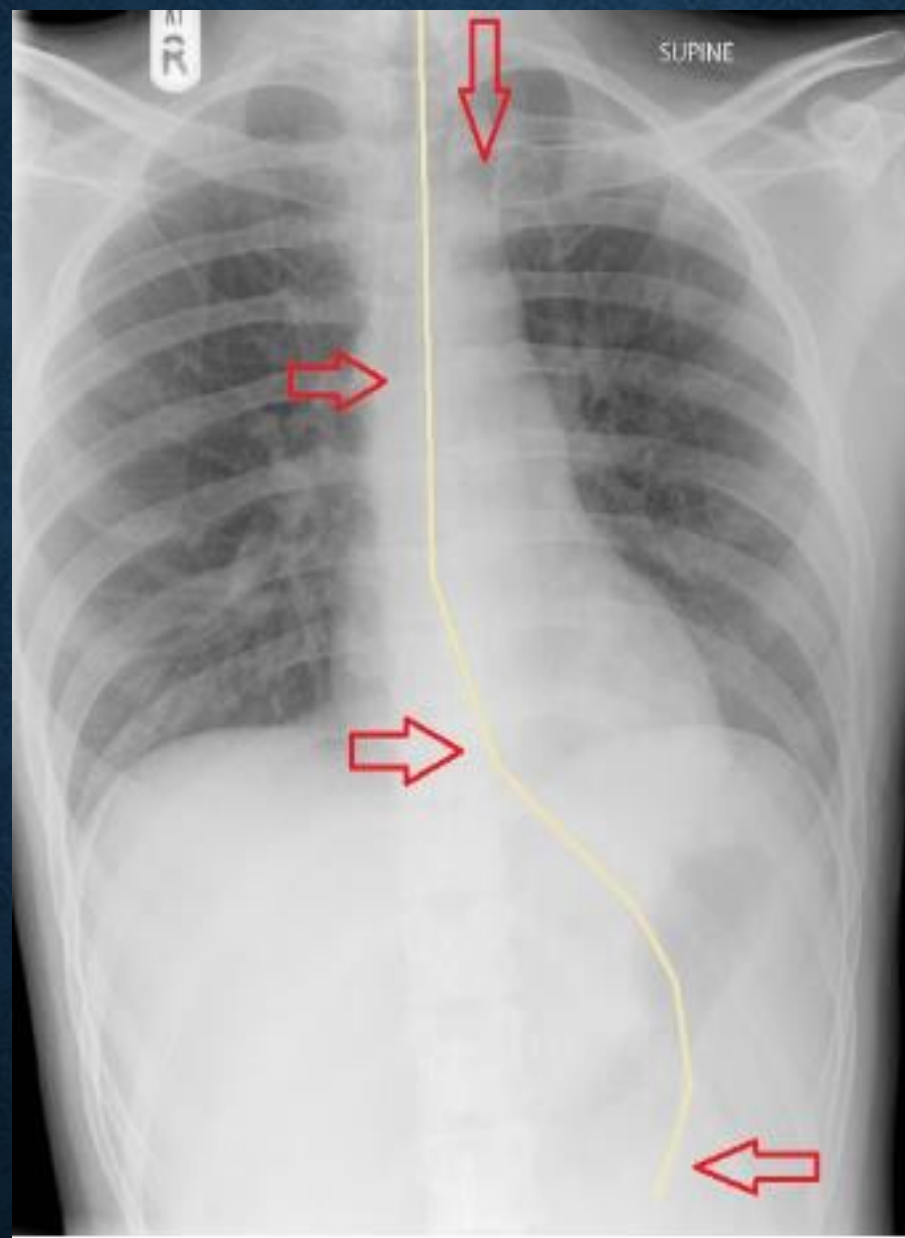
LATERAL



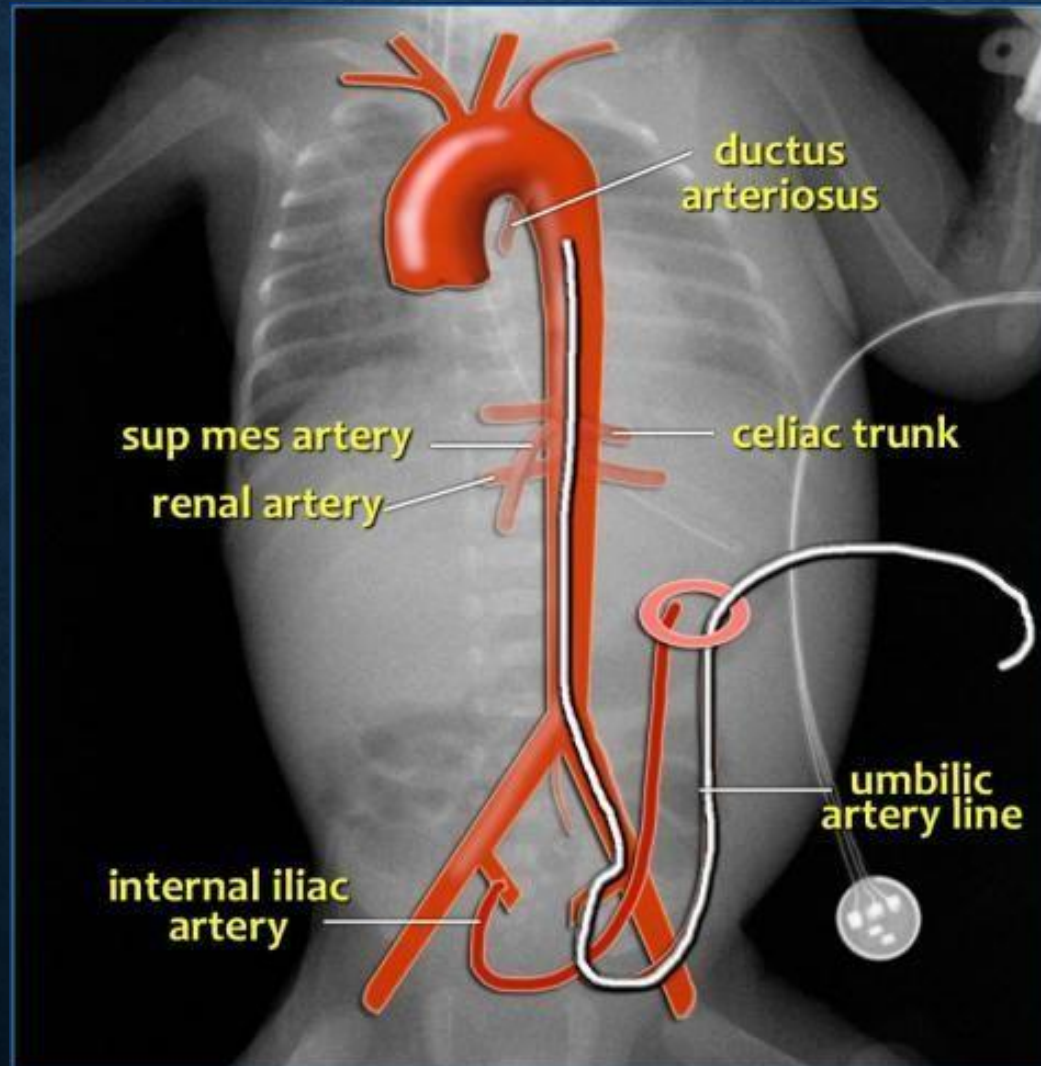
LINES AND TUBES

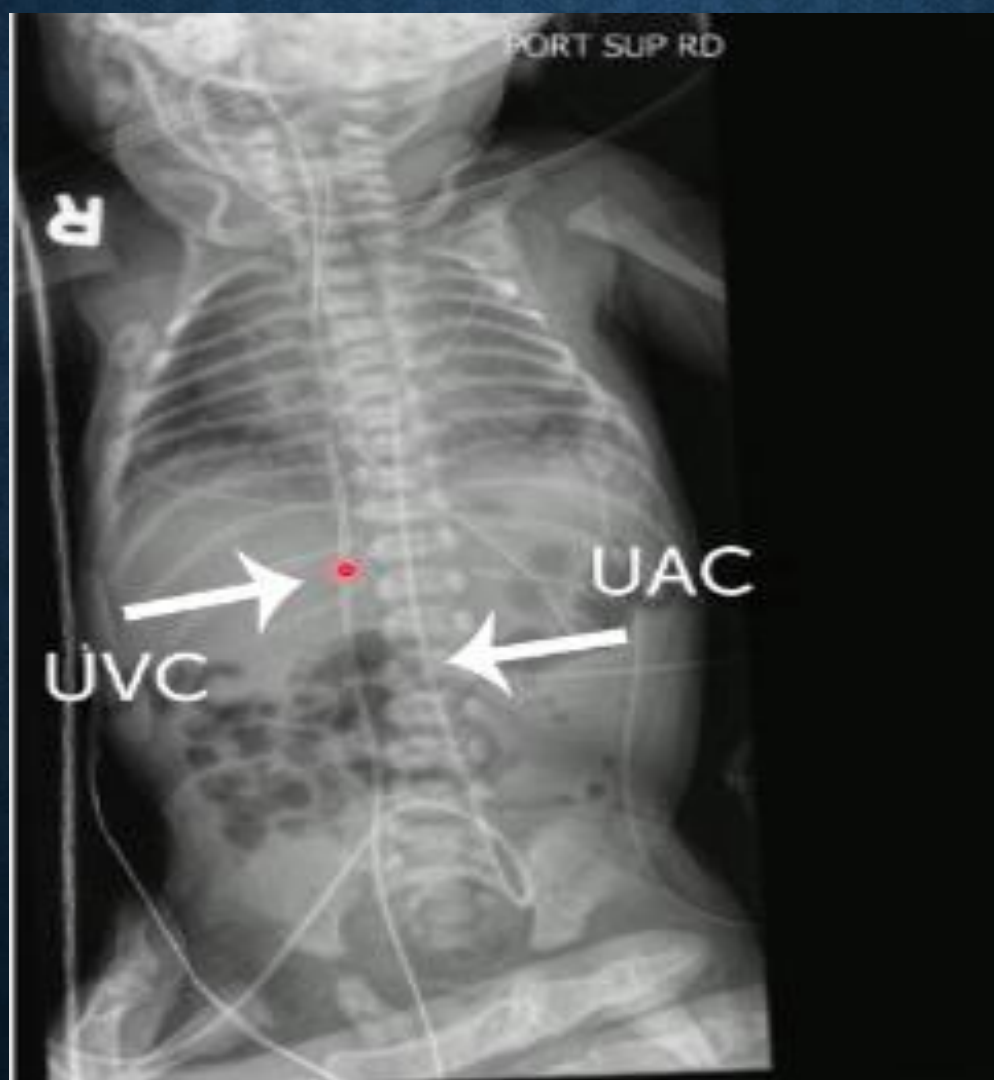
- **ETT** above carina, below inlet, varies with neck position (between thoracic inlet and carina). Ideally the tip should lie between C7 and T4, 1.2cm below the vocal cords, or 2cm above the level of carina.
- **OGT**- in stomach on left, it should not be positioned at the gastro-oesophageal junction or above because the fluid will reflux into the oesophagus with a risk of aspiration.
- Central venous line.
- **UAC**- high T7, low L3-L4
- **UVC**- IVC/RA, not in liver!



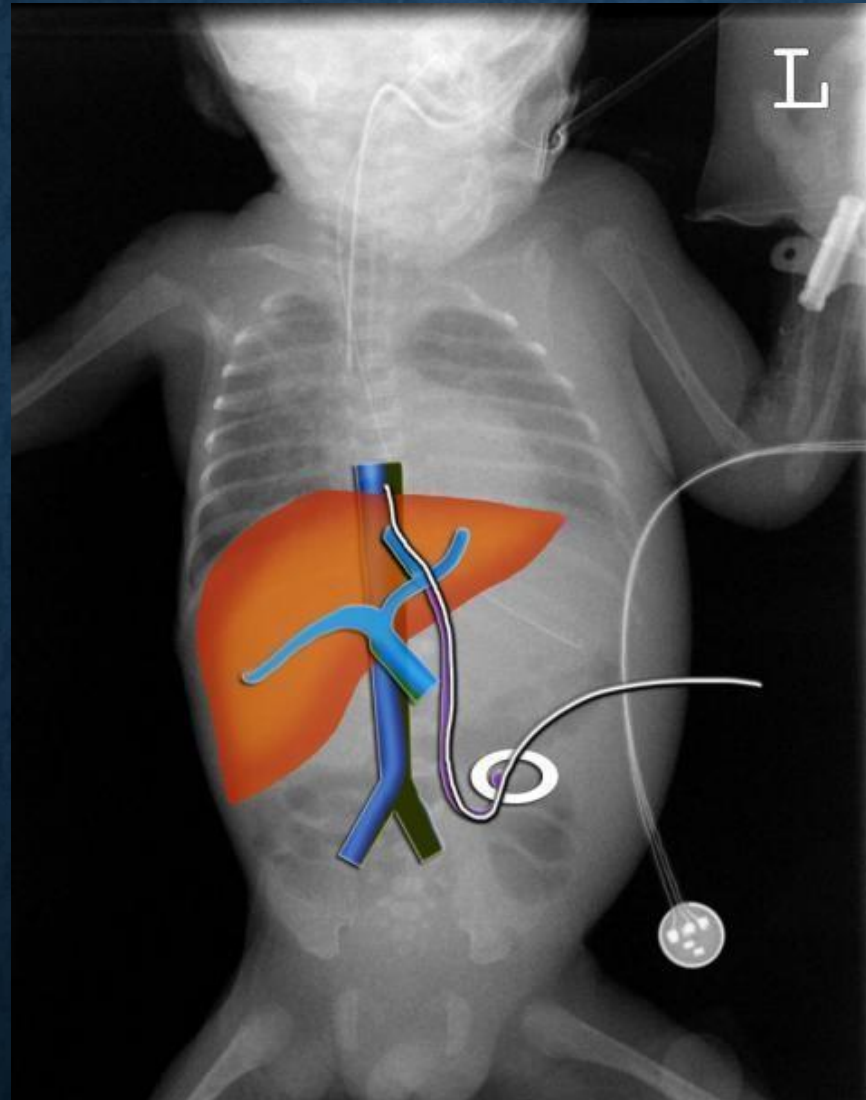


UAC

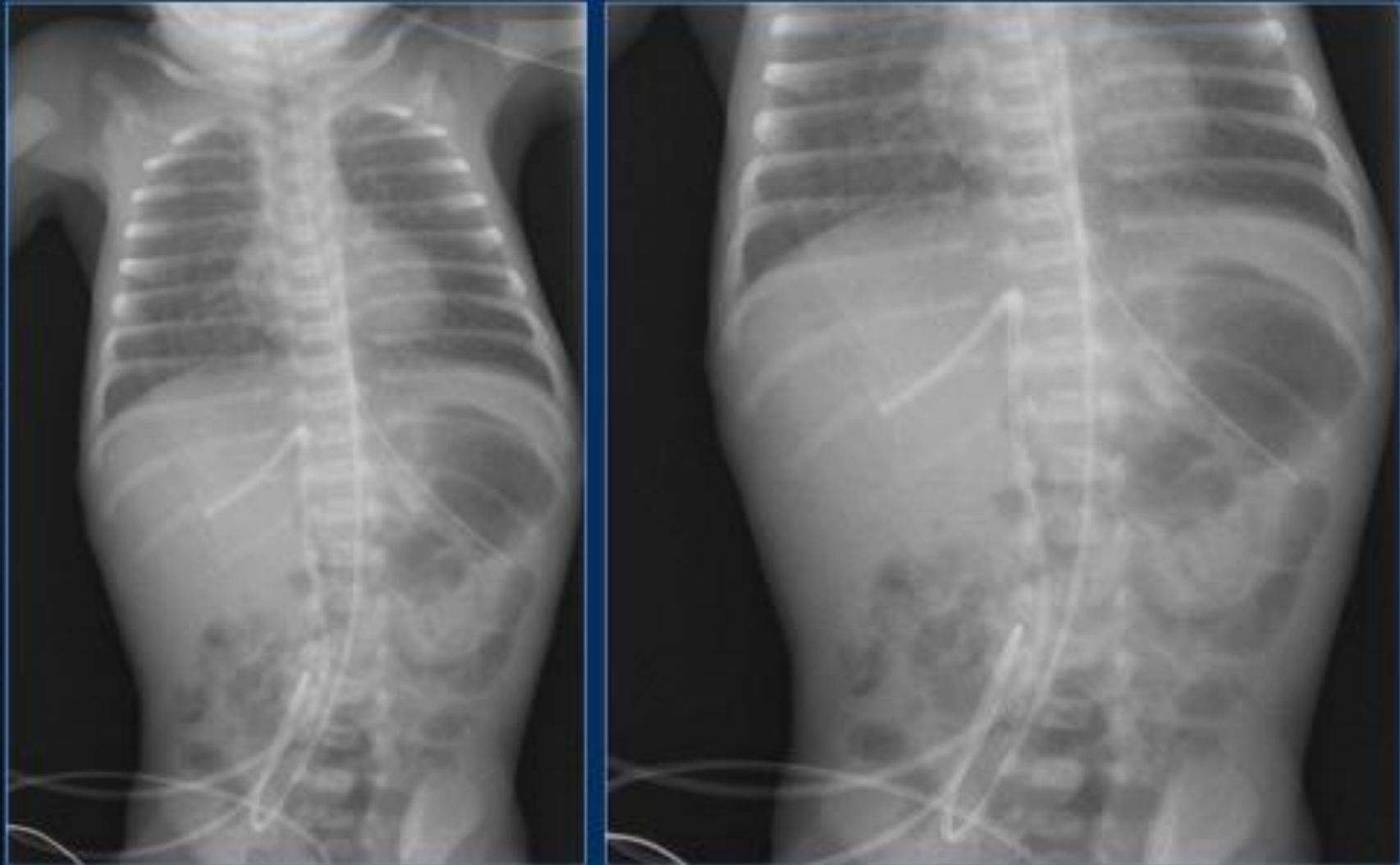




UVC



GOOD POSITION OF UAC BUT WHERE IS THE UVC!



CXR-SYSTEMATIC APPROACH



FIRST CIRCLE

- Soft part of the chest wall
- Diaphragmatic areas
- Bony thorax abnormalities





**BLUNTED LEFT COSTOPHRENIC ANGLE DDX
SMALL PLEURAL EFFUSION OR ATELECTASIS.**



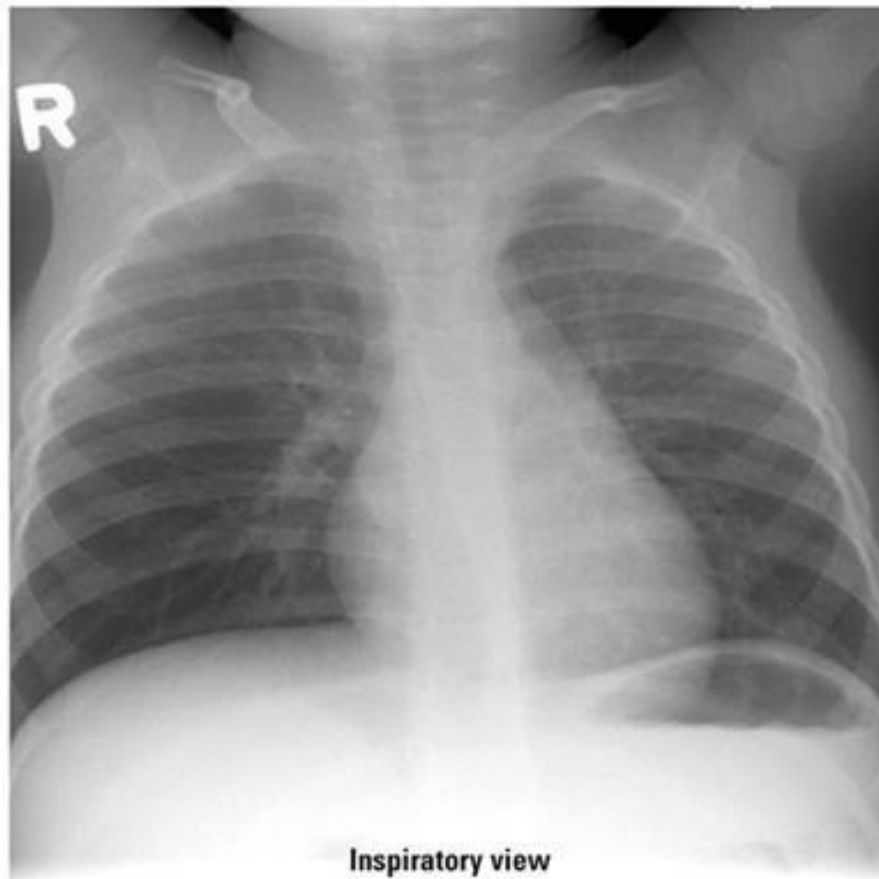
Multiple rib fractures and right clavicular fracture where we should suspect child abuse in the proper settings.

SECOND CIRCLE

- Lung parenchyma and vascularity



ENDOBRONCHIAL FOREIGN BODY

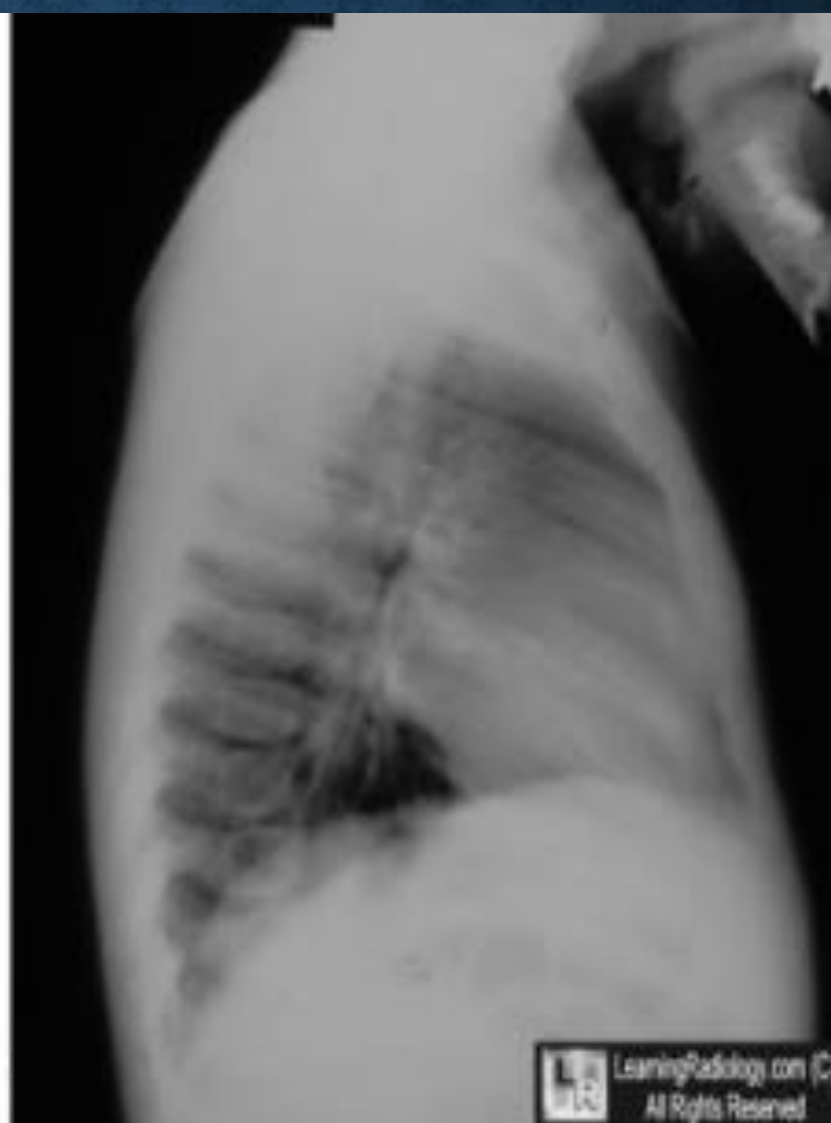


Inspiratory view



Expiratory view

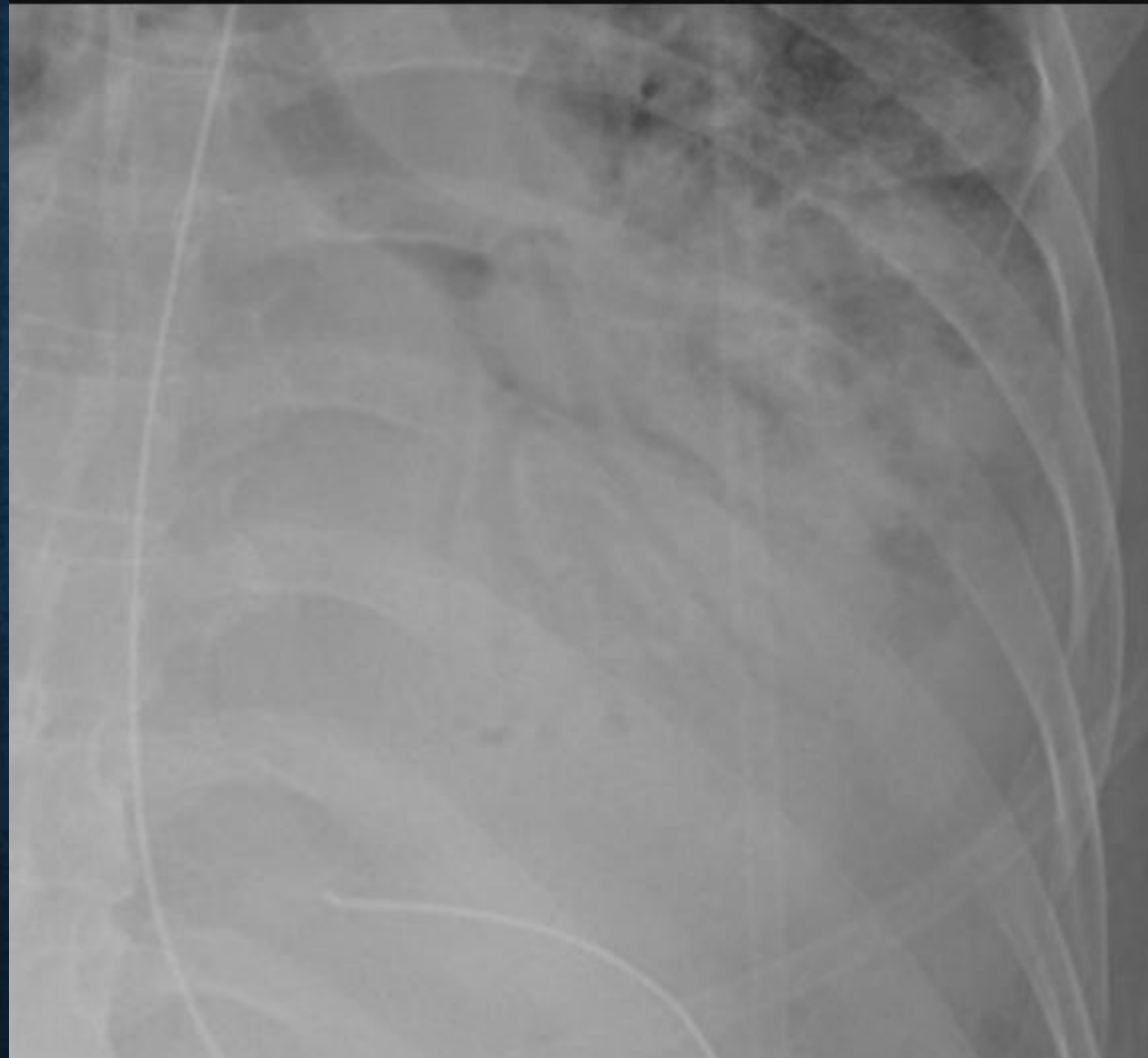
Figure 1. Right-sided air trapping (i.e., obstructive emphysema) due to partial obstruction (check valve) of the right main bronchus. The left side deflates during expiration but the right side cannot deflate. Mediastinum shifts toward the unobstructed side. When obstruction becomes complete, then complications such as pneumonia or atelectasis can ensue.



LUNG PATHOLOGY: ALVEOLAR LUNG DISEASE

- Also known air space disease .
- Features of Airspace disease:
 - Air bronchogram (hallmark).
 - Respects lobar anatomy.
 - Ill-defined borders except at fissures.
- Airspace disease could be:
 - Partial: Ground glass opacity.
 - Complete: Consolidation.

Air bronchogram



ALVEOLAR LUNG DISEASE(ALD)

- Causes of ALD:

- Pulmonary edema (fluid).

- **Pneumonias (pus).**

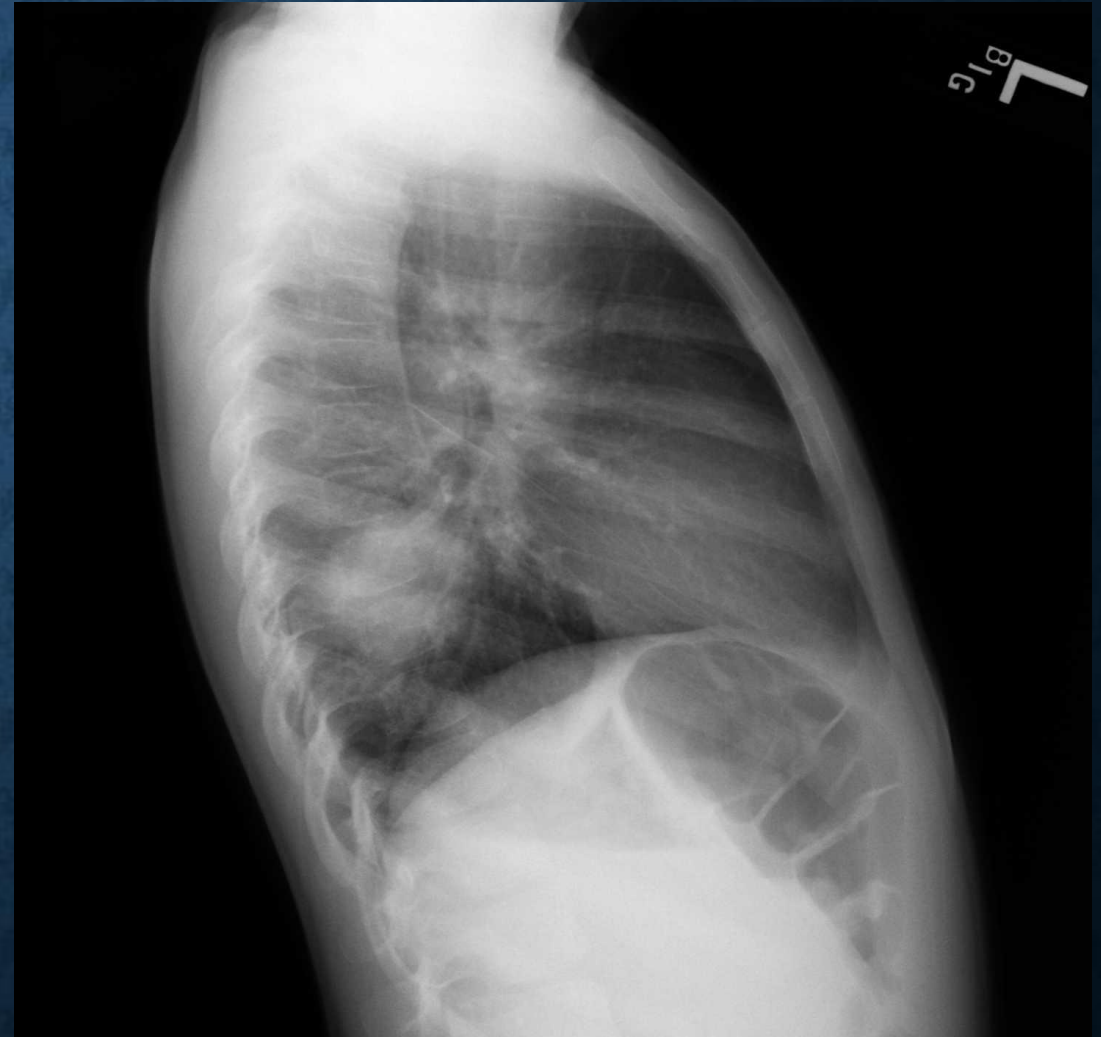
- Pulmonary hemorrhage (blood).

- Etiology of LRI varies with age

Preschool **95%** viral

School age : Viral > **Mycoplasma (30%)** > streptococcal

LLL ROUND PNA

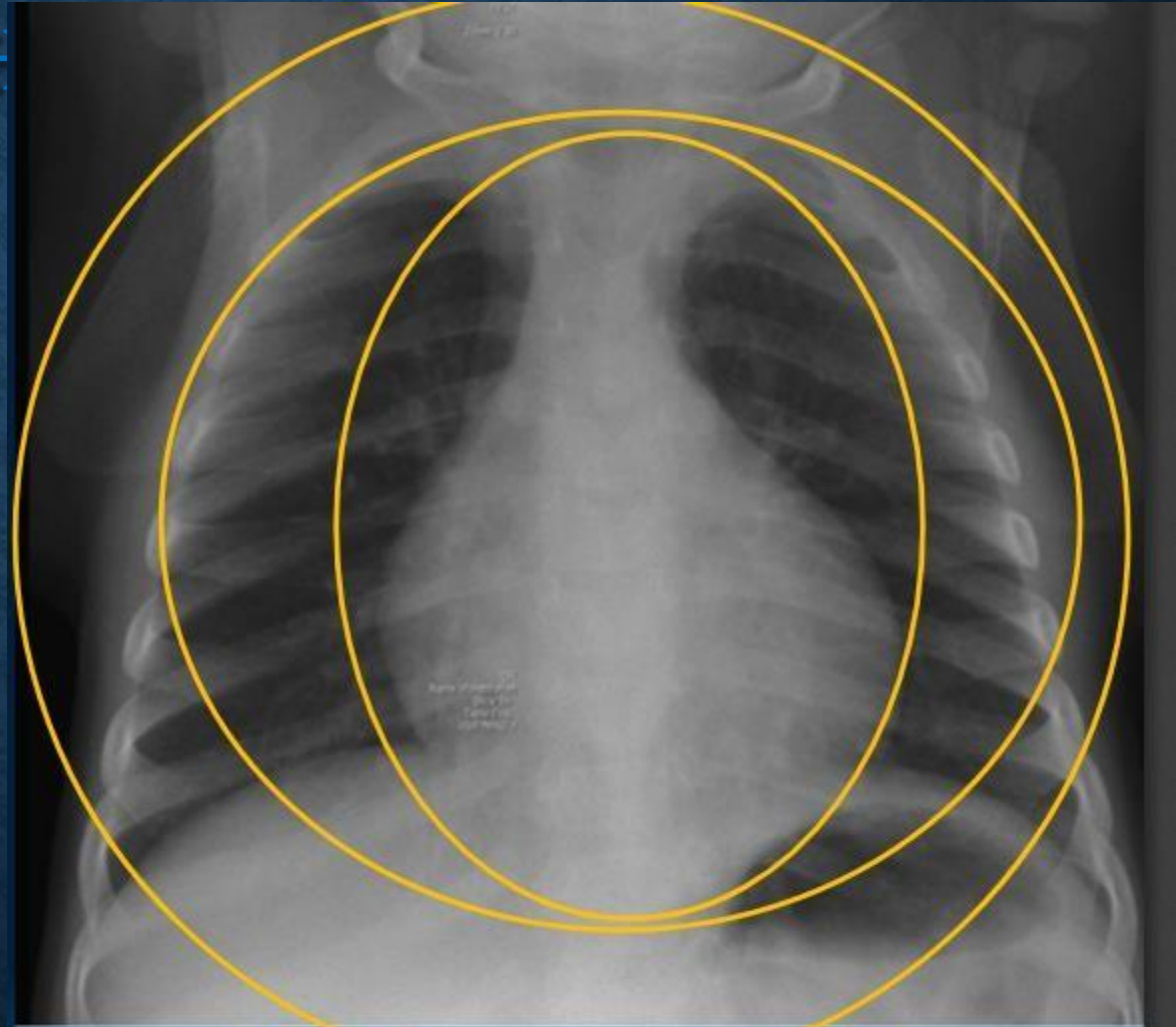


ROUND PNEUMONIA

- Definition : Nonsegmental consolidation seen up to 8 years of age secondary **to lung immaturity**. Collateral pathways not well developed.
- Most common cause is **Streptococcal pneumonia**

THE

- Airway
- Mediastinum
- Hili



AIRWAYS

- Position
- Caliber
- Displacement

epiglottitis

is a life-threatening condition caused by inflammation of the [epiglottis](#) and [aryepiglottic folds](#) , which can lead to acute airway obstruction.

Haemophilus influenzae type B.



Steeple sign in croup





Distinguish this disease from previous

Medastinal mass

Anterior

Middle

Posterior

Thymus

Lymphadenopathy

Neurogenic
Tumors

Teratoma germ
cell Tumors

Lymphoma/
leukemia

Neuroblastoma
Ganglioneuroma

Thyroid

Bronchogenic
cyst

Neurofibroma

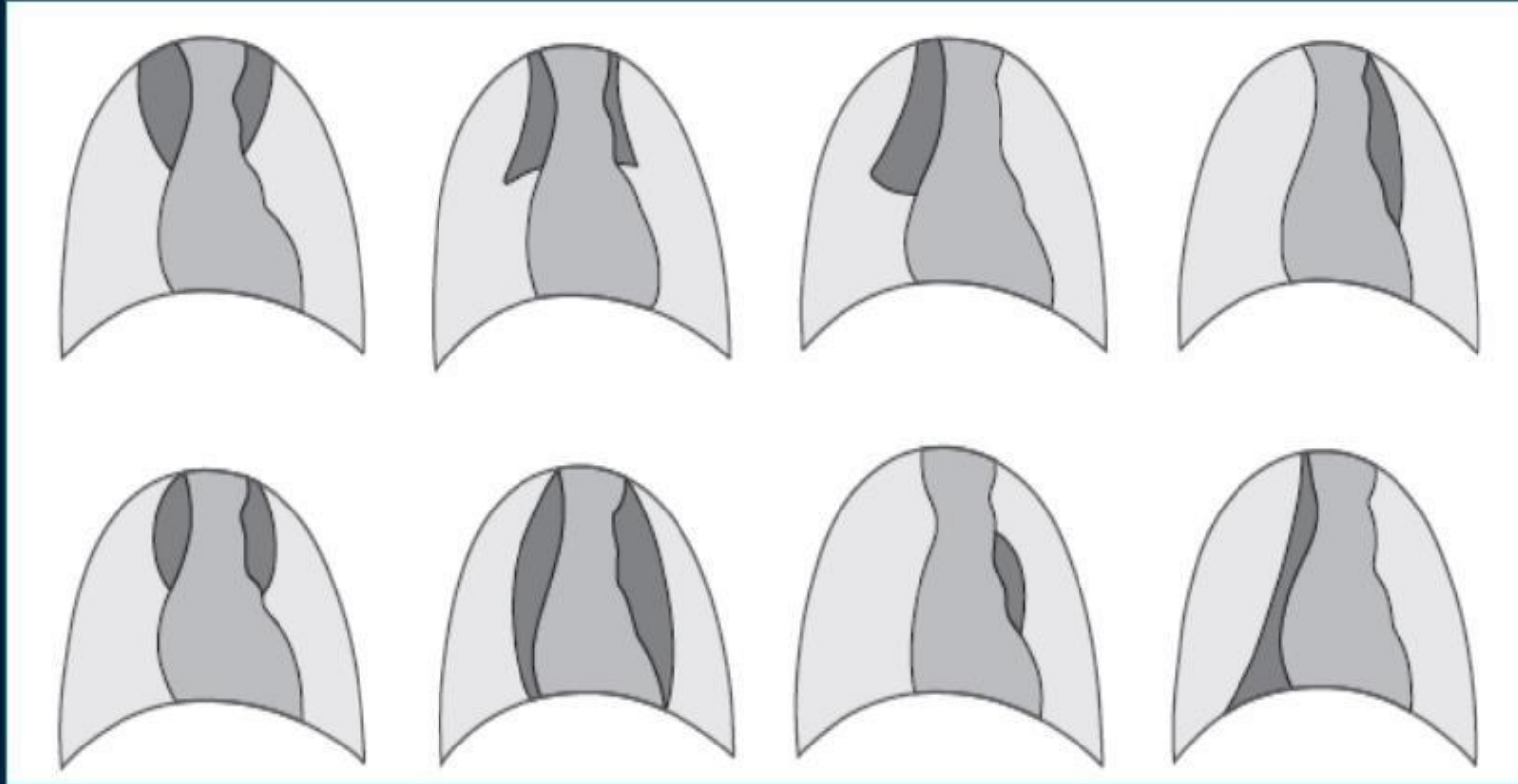
Lymphoma

Thoracic aorta

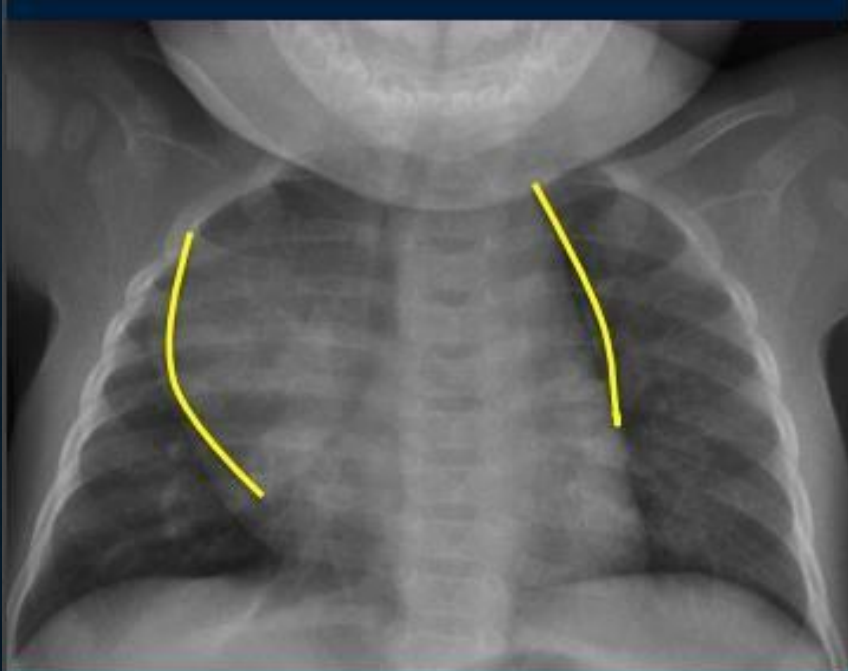
THYMUS

- Anterior mediastinum
- Costochondral indentations (wave sign)
- Notch sign
- Sail sign
- Never compressive
- Change with position/inspiration-expiration

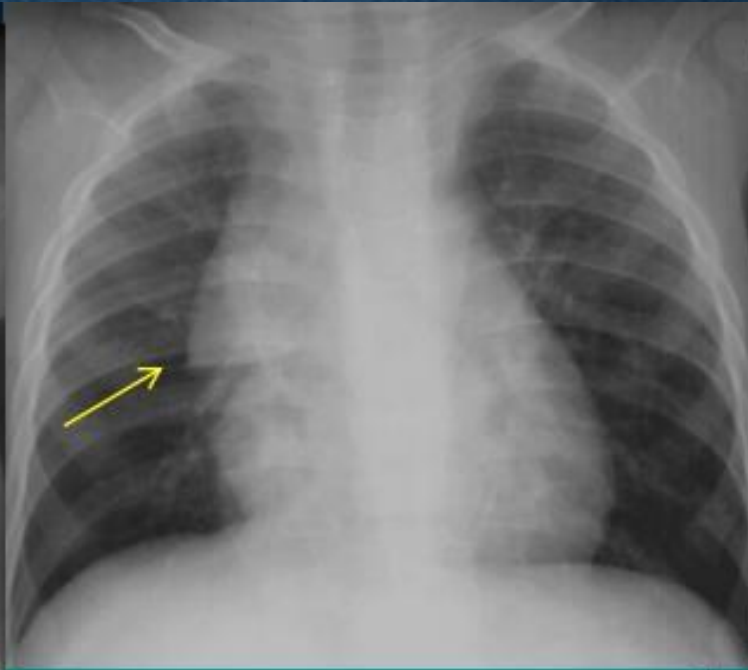
◇ Thymus: Various shapes and sizes



Chateil j-f. and coll EMC. 2005



2 month old



7 month old



16 year old



Asymmetric hypertrophy of the right lobe of the thymus

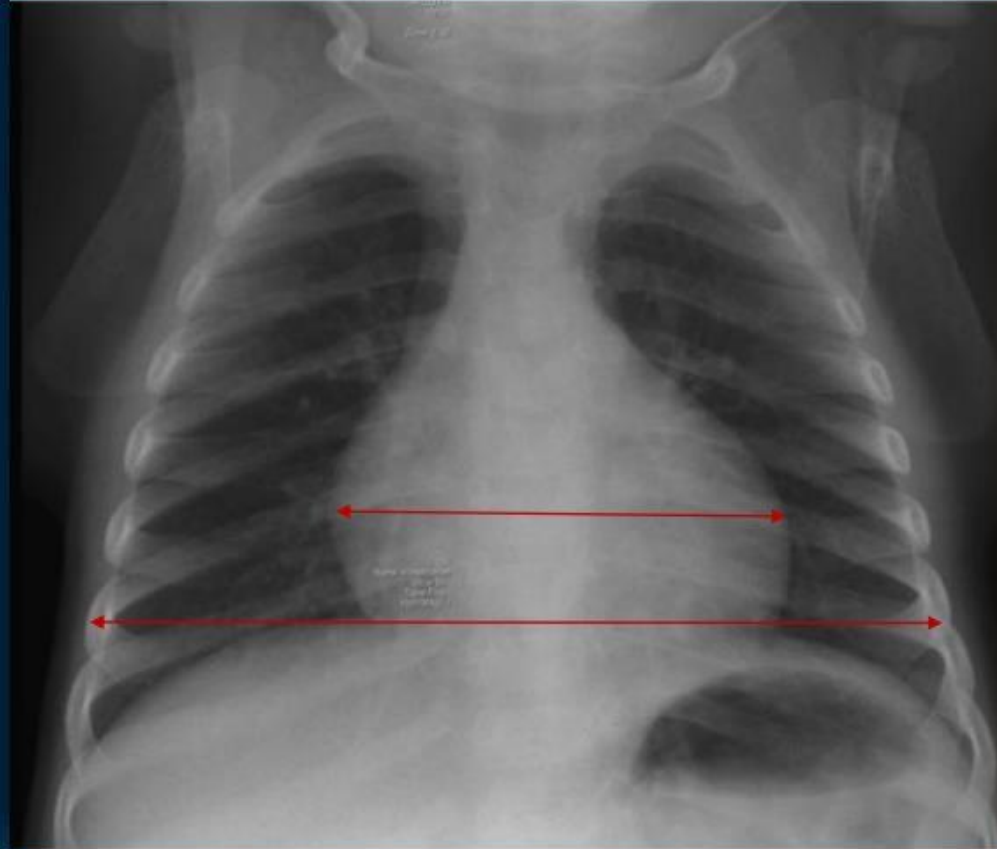


« **sail sign** » triangular appearance
Hypertrophy of the right lobe
Angular corner flattened
at the right minor fissure



THIRD CIRCLE- HEART

Cardiothoracic index



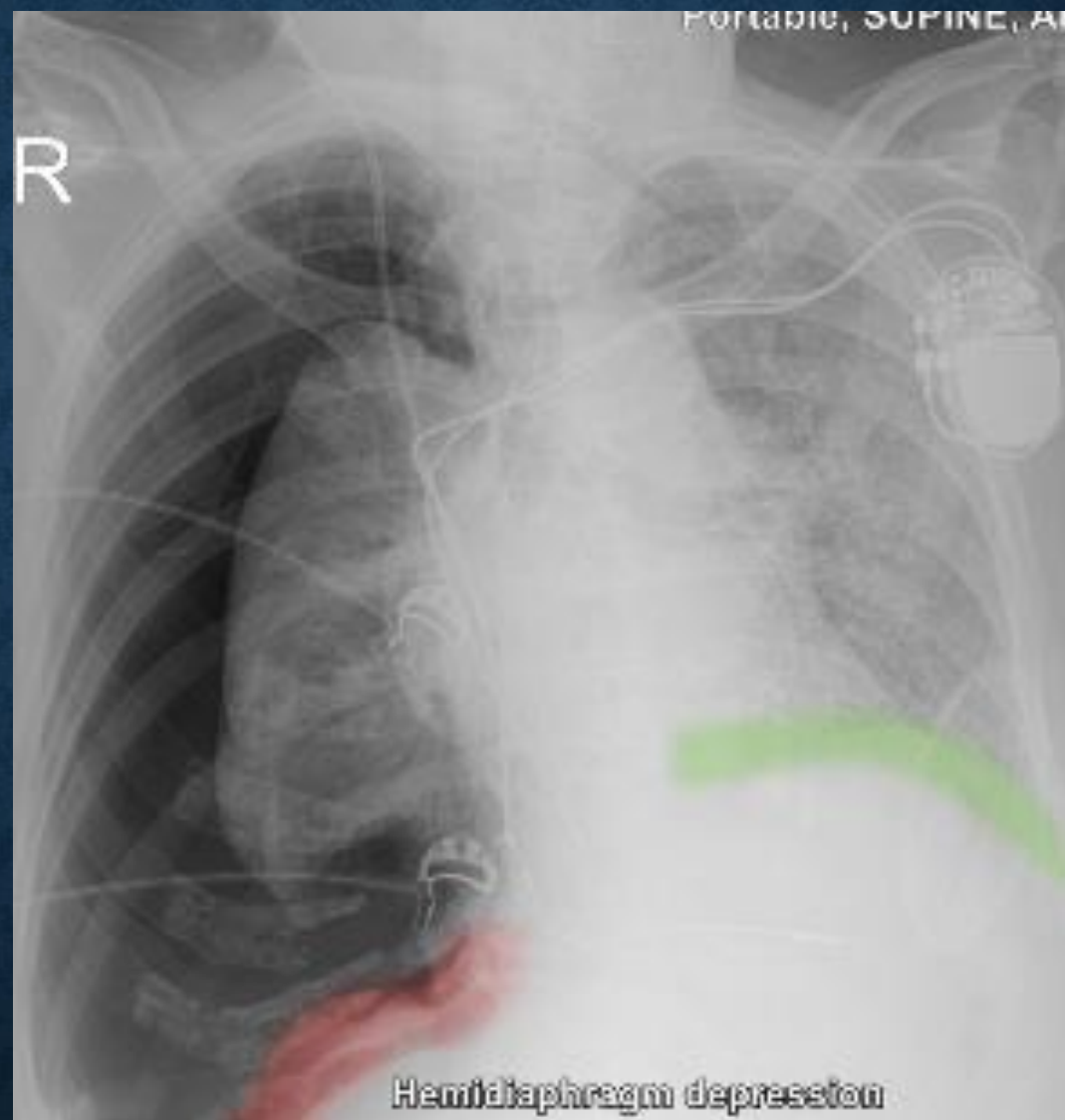
- Less reliable than in adults
- $\leq 55\%$ in infants and young children

Tension pneumothorax



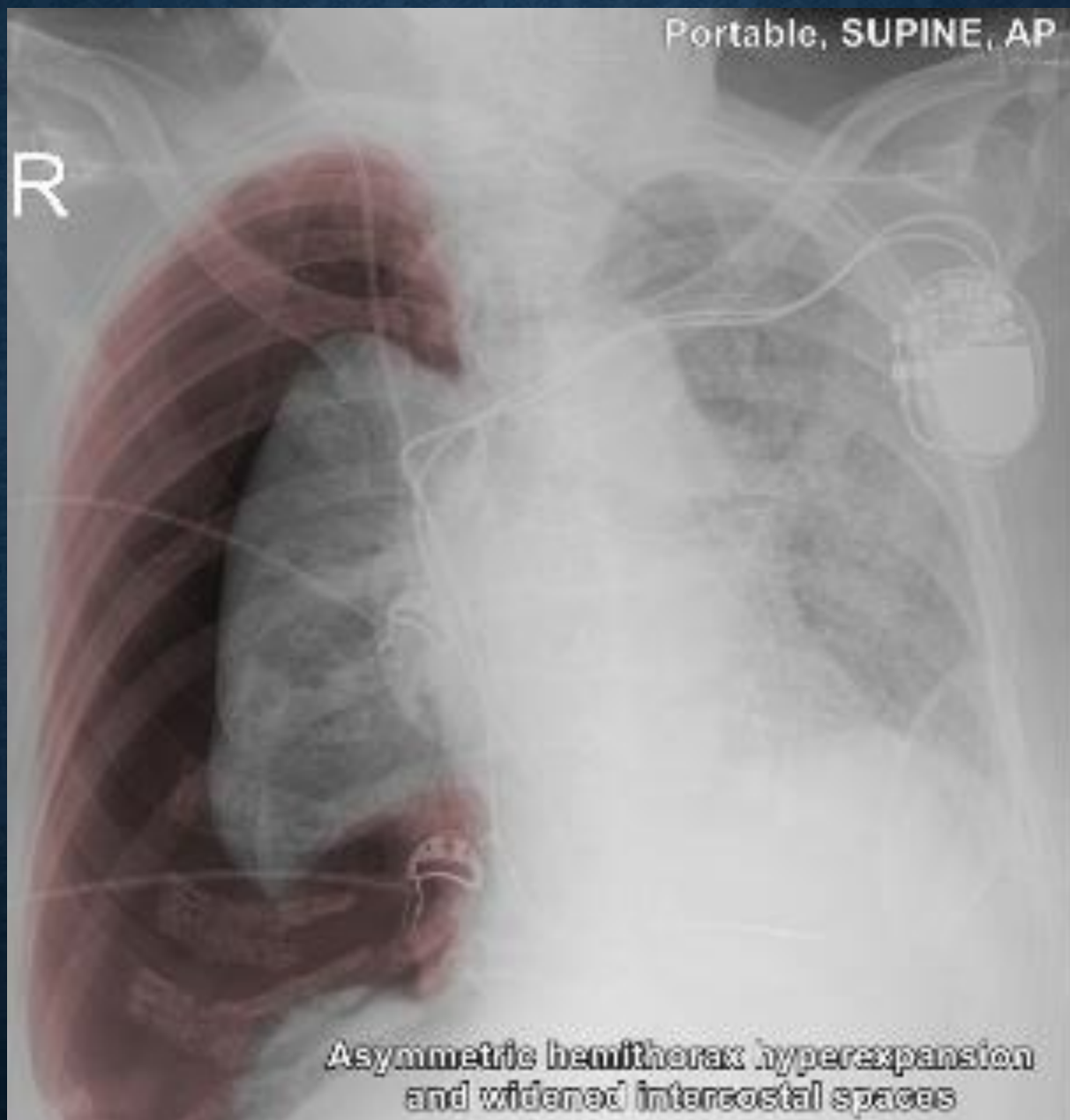


Contralateral mediastinal shift



Portable, SUPINE, AP

R

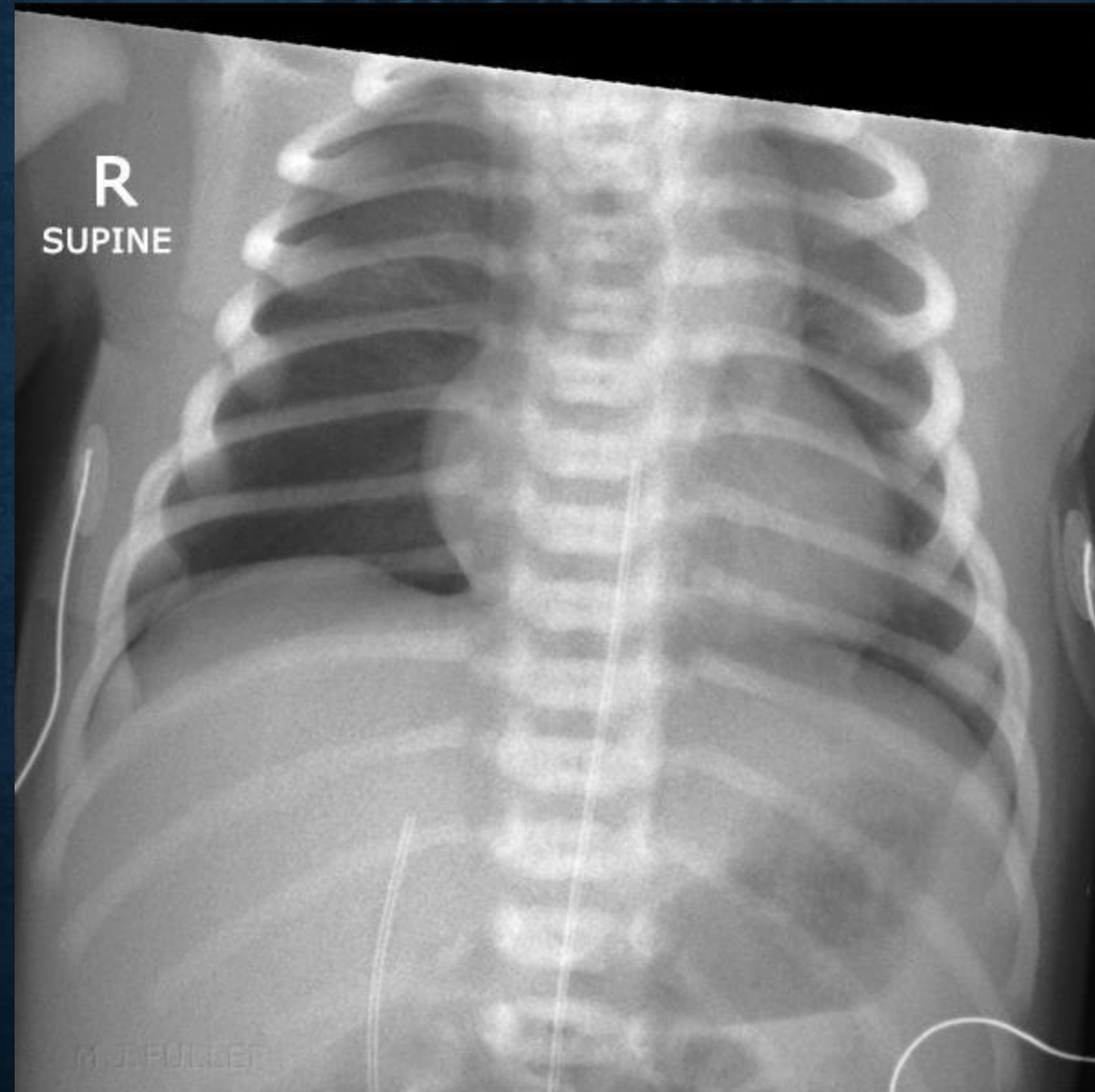


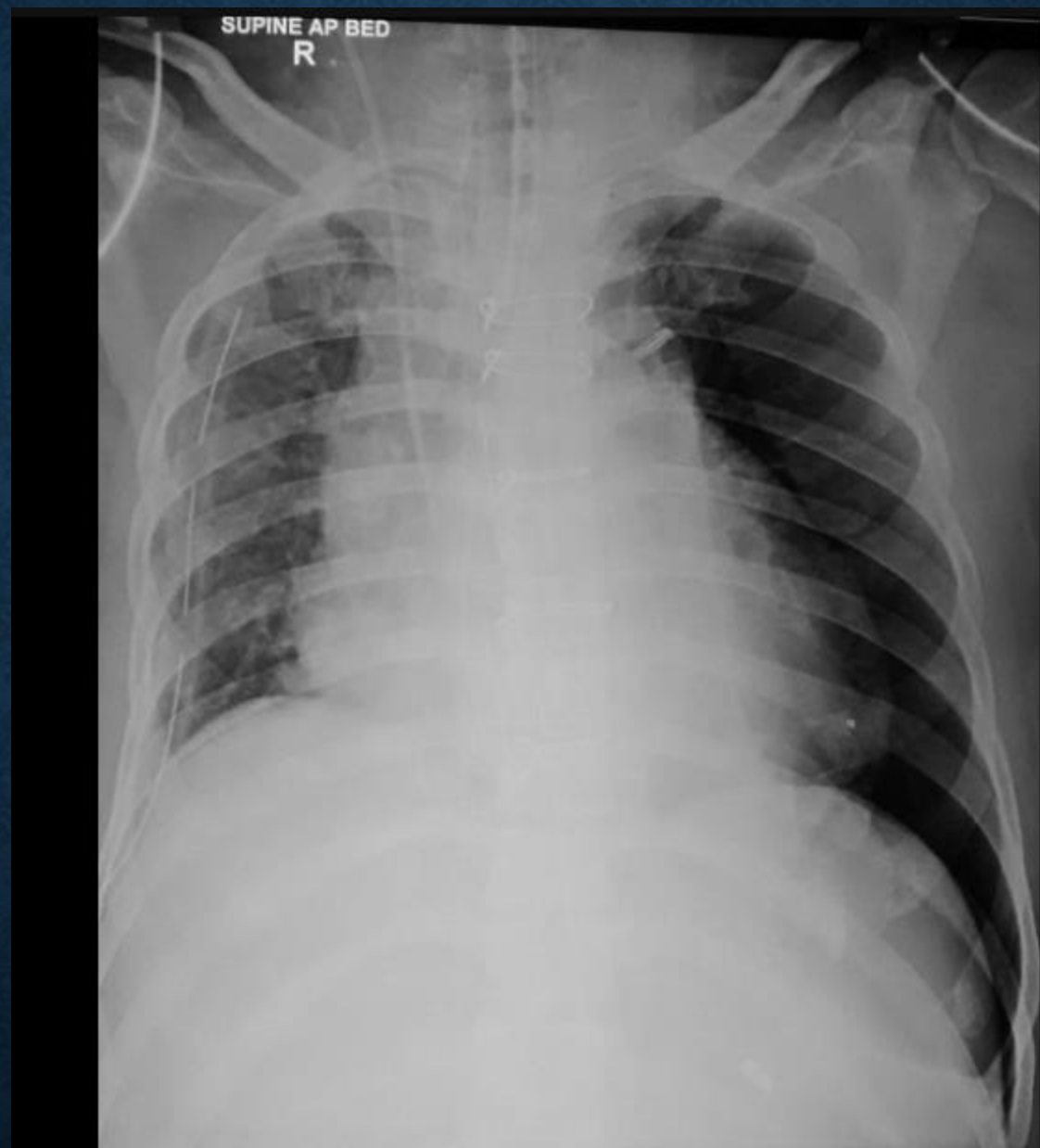
Asymmetric hemithorax hyperexpansion
and widened intercostal spaces

RIGHT DEEP SULCUS

RIGHT DEEP SULCUS

BORDER SIGNS

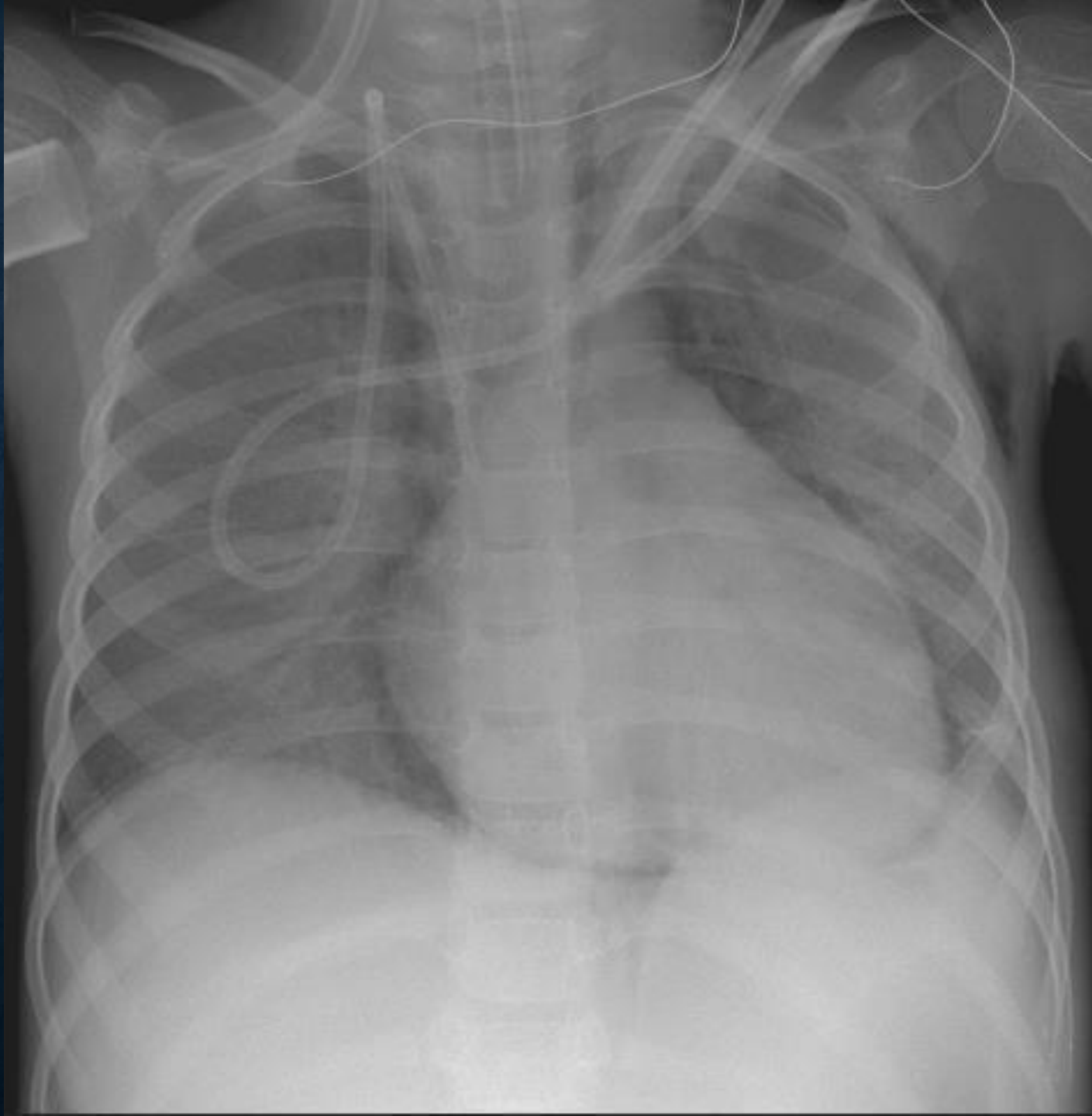




Left pneumothorax with deep sulcus sign seen on supine projection.

PNEUMOPERICARDIUM

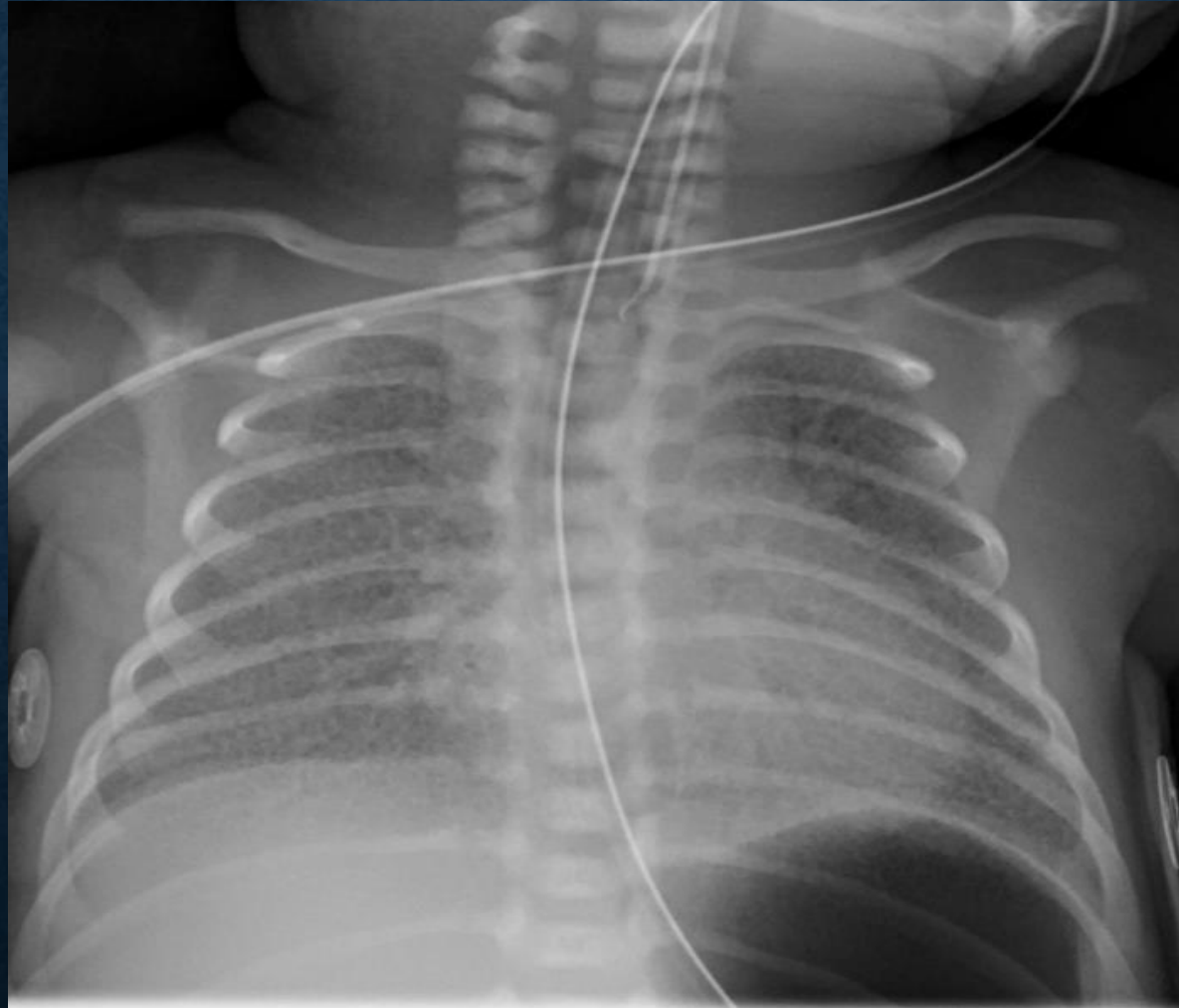




Continuous
diaphragm sign

NEWBORN X-RAY PATHOLOGY

CASE 1
2 DAYS OLD PREMATURE INFANT WITH
TACHYPNEA



FINDINGS

- Decrease lung volume
- Diffuse granular appearance
- Air-bronchiogram

Diagnosis: RDS, hyaline membrane disease

- **Respiratory distress syndrome (RDS)** is a relatively common condition that occurs in preterm neonates resulting from insufficient production of surfactant.
- Respiratory distress presents in the first few hours of life in a premature baby. Signs include tachypnea, expiratory grunting, and nasal flaring. The infant may or may not be cyanosed. Substernal and intercostal retractions may be evident.

ABDOMINAL RADIOGRAPHY

CASE 1:

**CASE 1: A NEONATE WITH
PERSISTENT VOMITING**

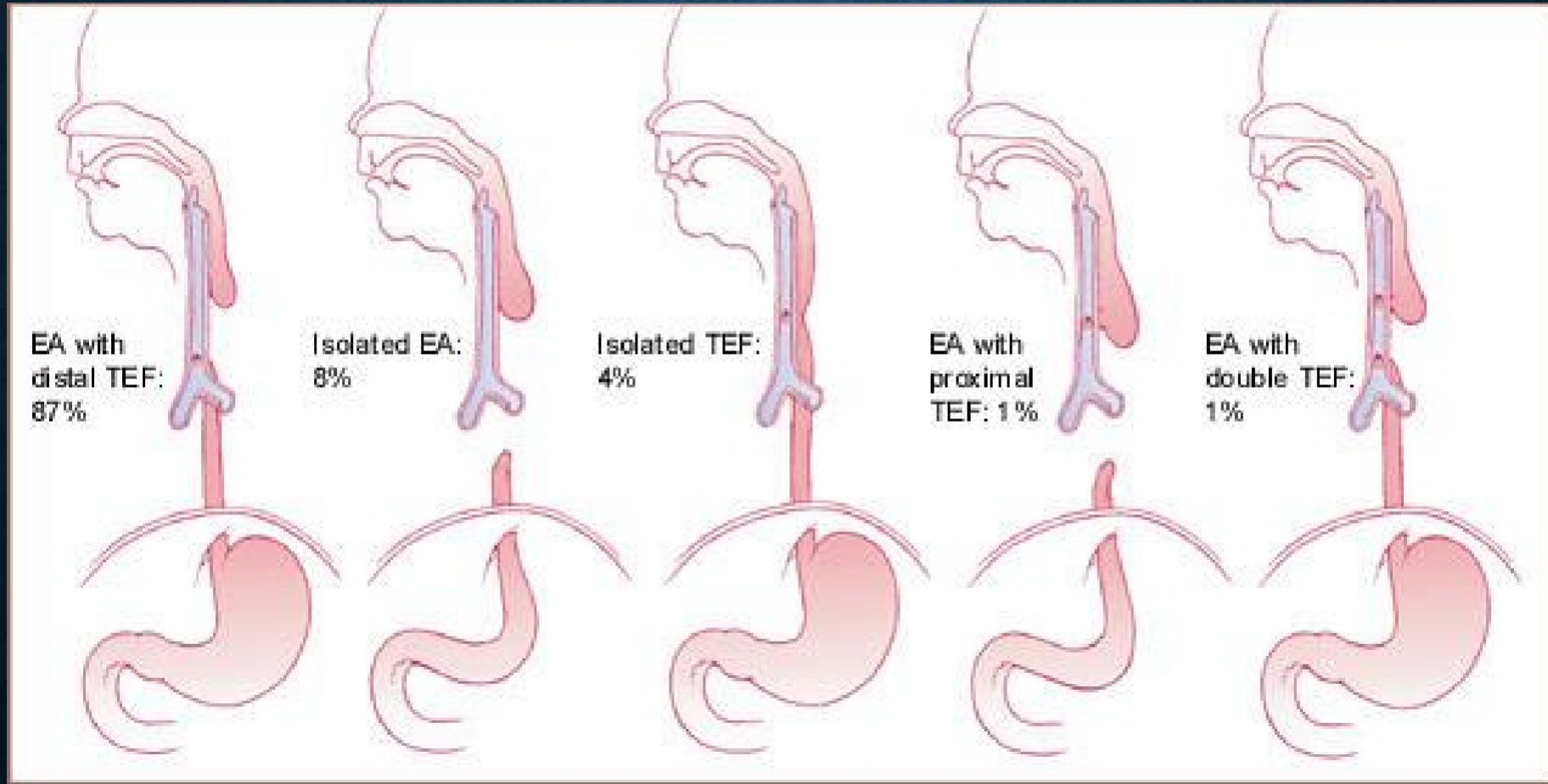


FINDINGS:

**THERE IS A DISTENDED AND GAS-FILLED
PROXIMAL ESOPHAGUS WITH A
NASOGASTRIC TUBE LOOPED WITHIN IT.
GAS IS SEEN WITHIN THE STOMACH.**

**DIAGNOSIS:
ESOPHAGEAL ATRESIA WITH TEF**

ESOPHAGEAL ATRESIA / TE FISTULA



CASE 2:
NEWBORN WITH RESPIRATORY DISTRESS



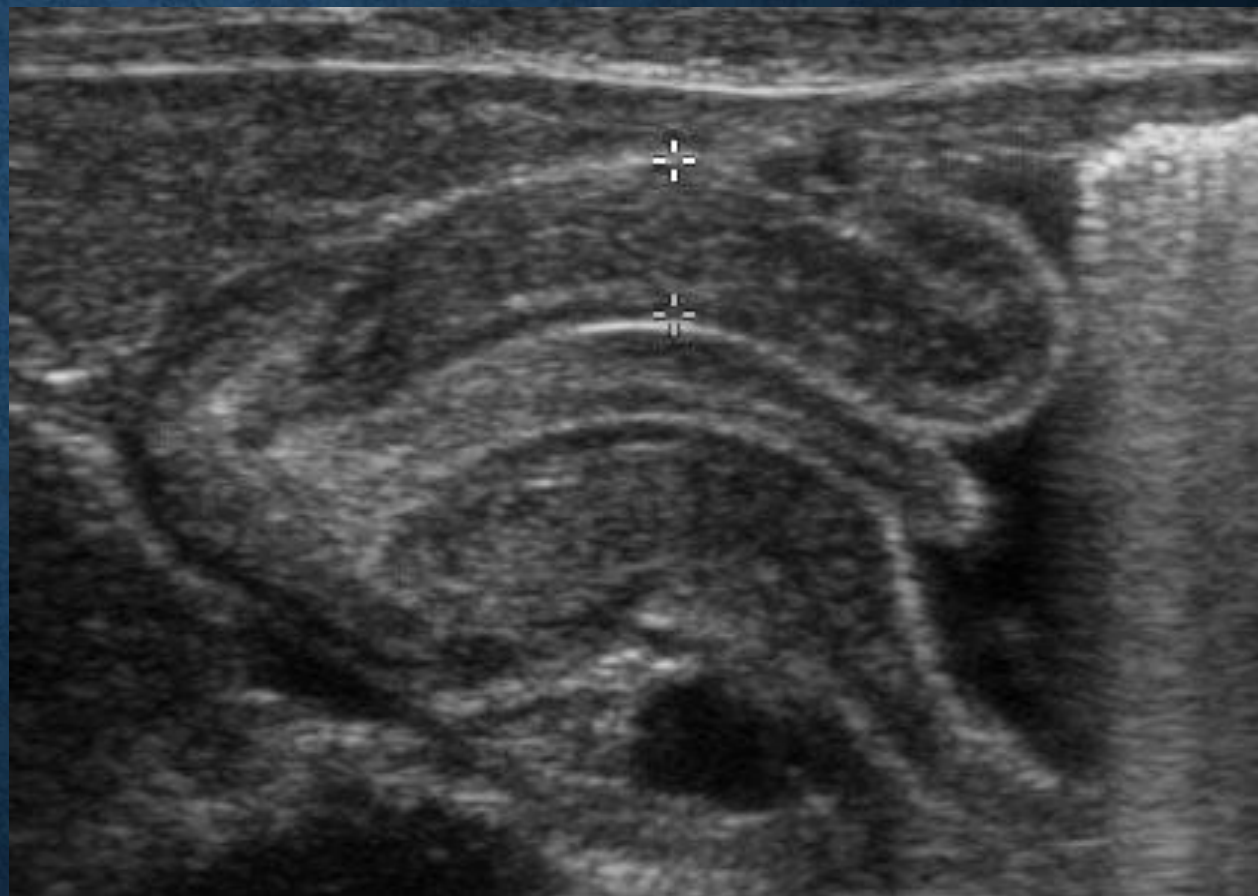
FINDINGS:

MULTIPLE BOWEL LOOPS SEEN IN THE RIGHT HEMITHORAX

DIAGNOSIS

CONGENITAL DIAPHRAGMATIC HERNIA

**CASE 3: 6WK OLD BOY PRESENTED WITH
PROJECTILE NONBILIOUS VOMITING**



FINDINGS:

**MULTIPLE U/S IMAGES DEMONSTRATING ABNORMAL
ELONGATION OF THE PYLORIC CHANNEL WITH
THICKENING OF THE HYPOECHOIC MUSCLE LAYER
LENGTH > 16MM
MUSCLE THICKNESS > 3MM**

**DIAGNOSIS:
HYPERTROPHIC PYLORIC
STENOSIS**

CASE 4



IMAGING FINDINGS

- Frontal x-ray of the chest and abdomen demonstrating “Double bubble sign” ; gas in the gastric fundus and in the duodenal bulb with absent gas in the rest of the abdomen. Ddx duodenal atresia / web and mid gut volvulus.

DIAGNOSIS: DUODENAL ATRESIA

CASE 7
NEWBORN WHO FAILED
TO PASS MECONIUM



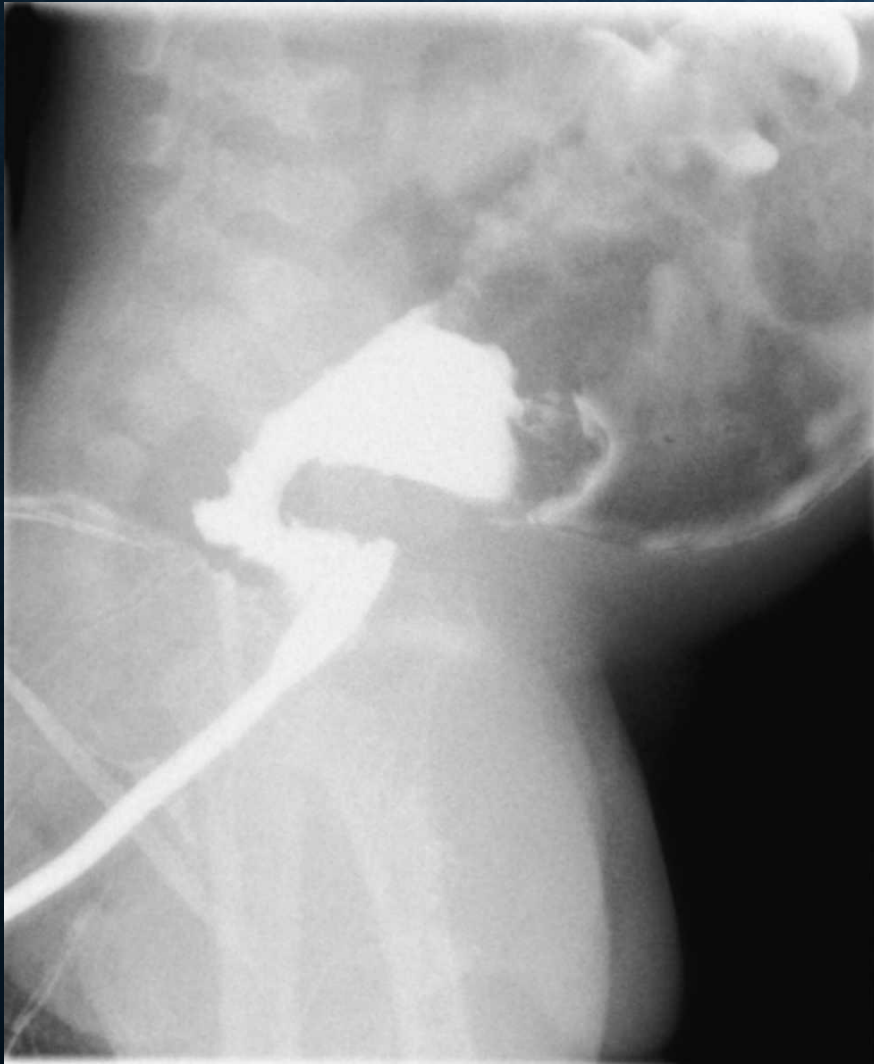
IMAGING FINDINGS

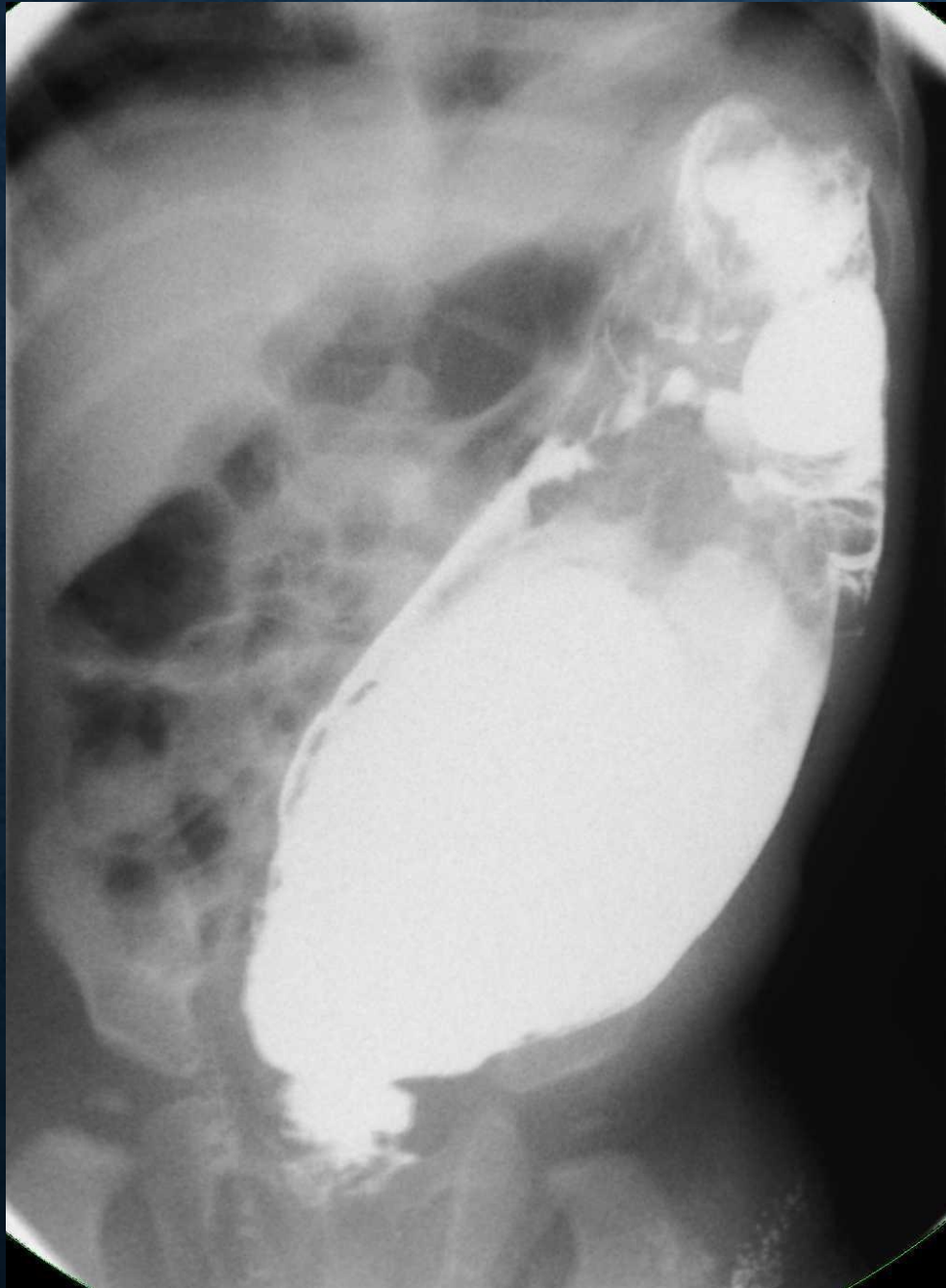
- Barium enema showing small caliber of the entire colon “microcolon” with reflux of contrast into the proximal ileum which contains multiple filling defects “ inspissated meconium” (soap bubble appearance). Note the background of multiple distended bowel loops throughout the abdomen.

**DIAGNOSIS: MECONIUM ILEUS VS. ILEAL
ATRESIA (BOTH ARE SURGICAL)**

CASE 8

Barium enema lateral projection early filling phase





Same pateint in the supine
position

IMAGING FINDINGS

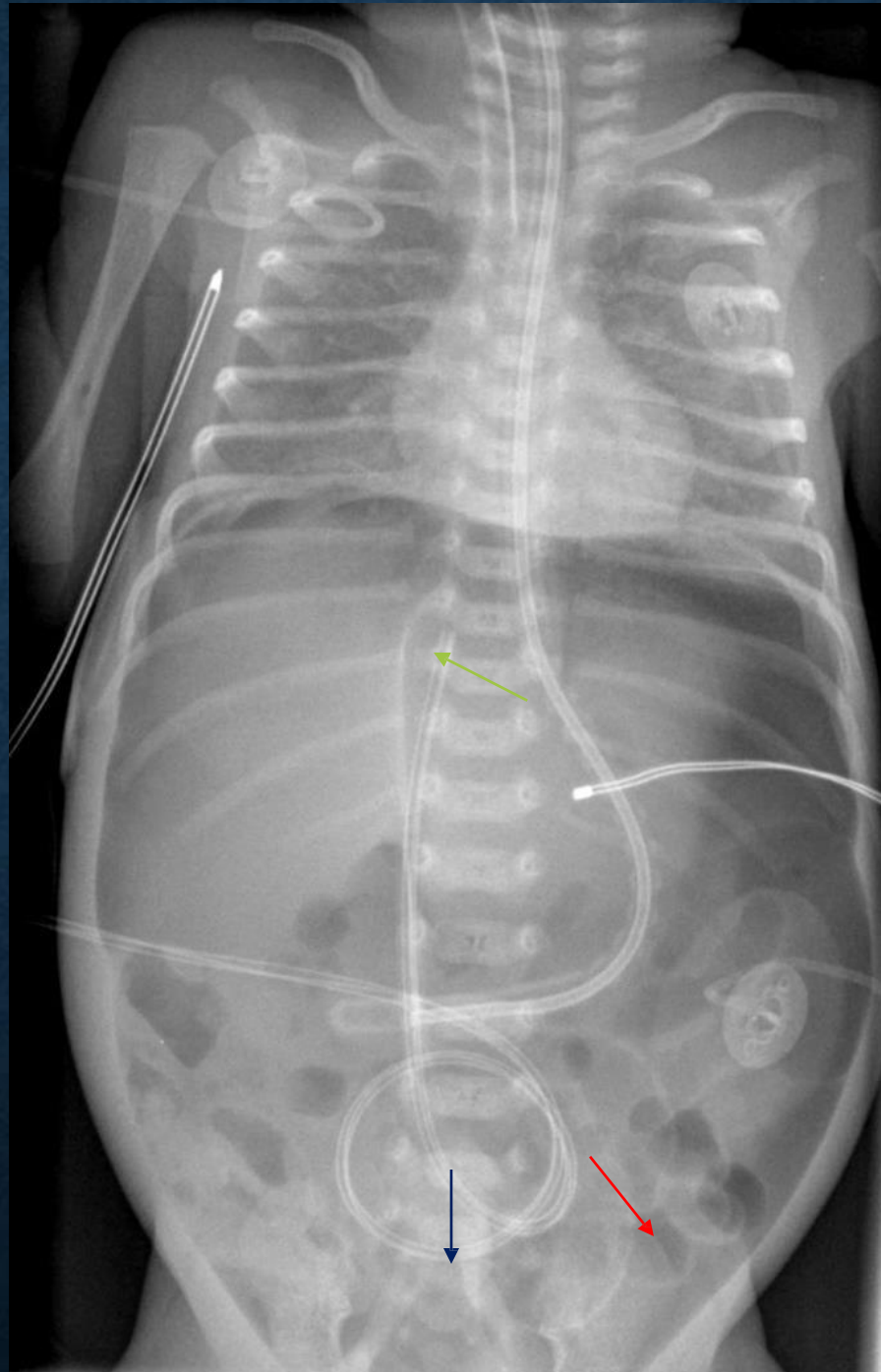
- Contrast enema studies demonstrating abnormal recto-sigmoid ratio of less than 1 with transition zone seen at the rectum.

**normally the rectum should be larger than the sigmoid or as large as the sigmoid R:S ratio 2:1 or 1:1) **

**DIAGNOSIS:
HIRSHPRUNG'S DISEASE**

short segment of colonic aganglionosis affecting term neonates, especially boys.

CASE 12

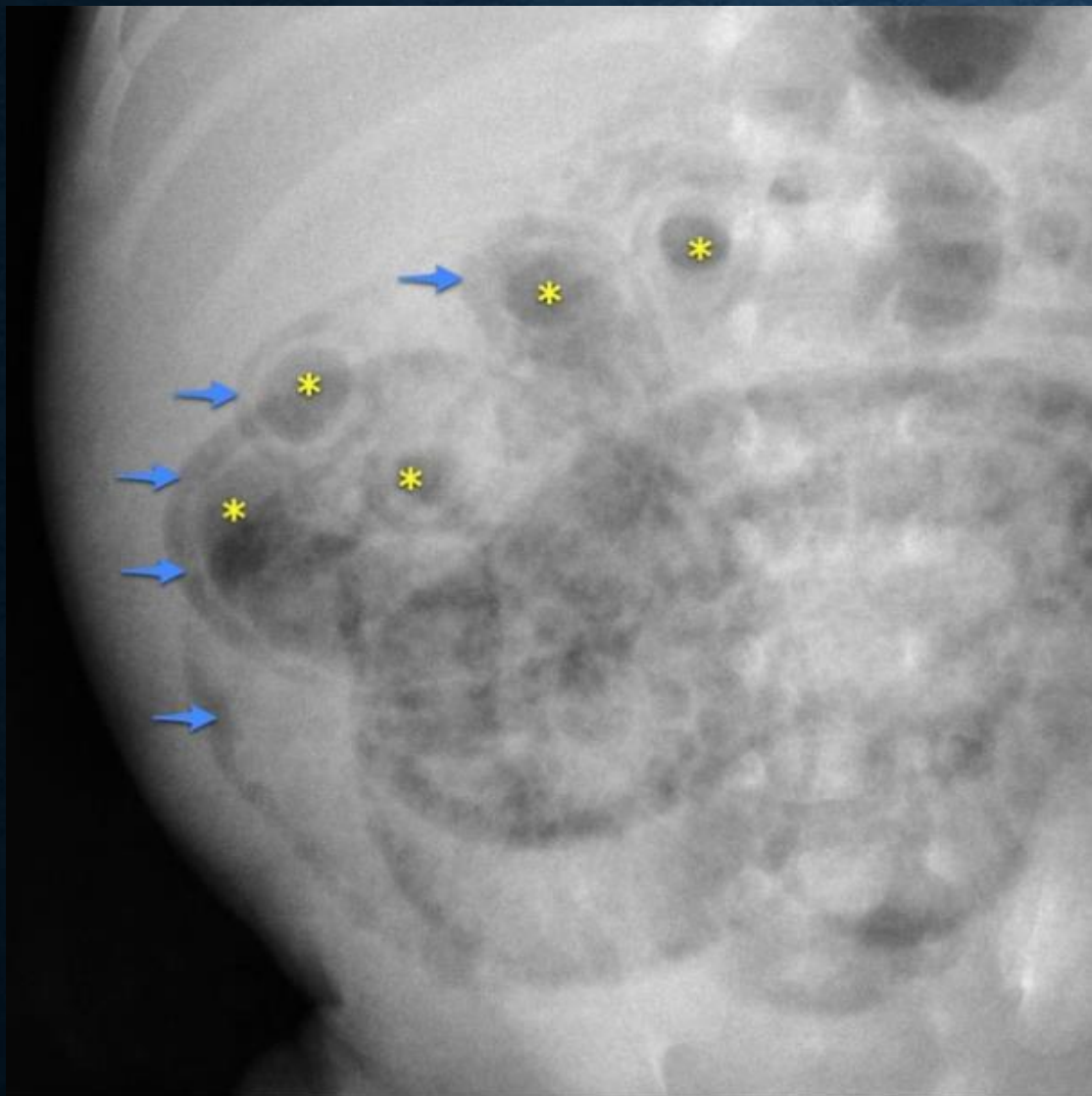


IMAGING FINDINGS

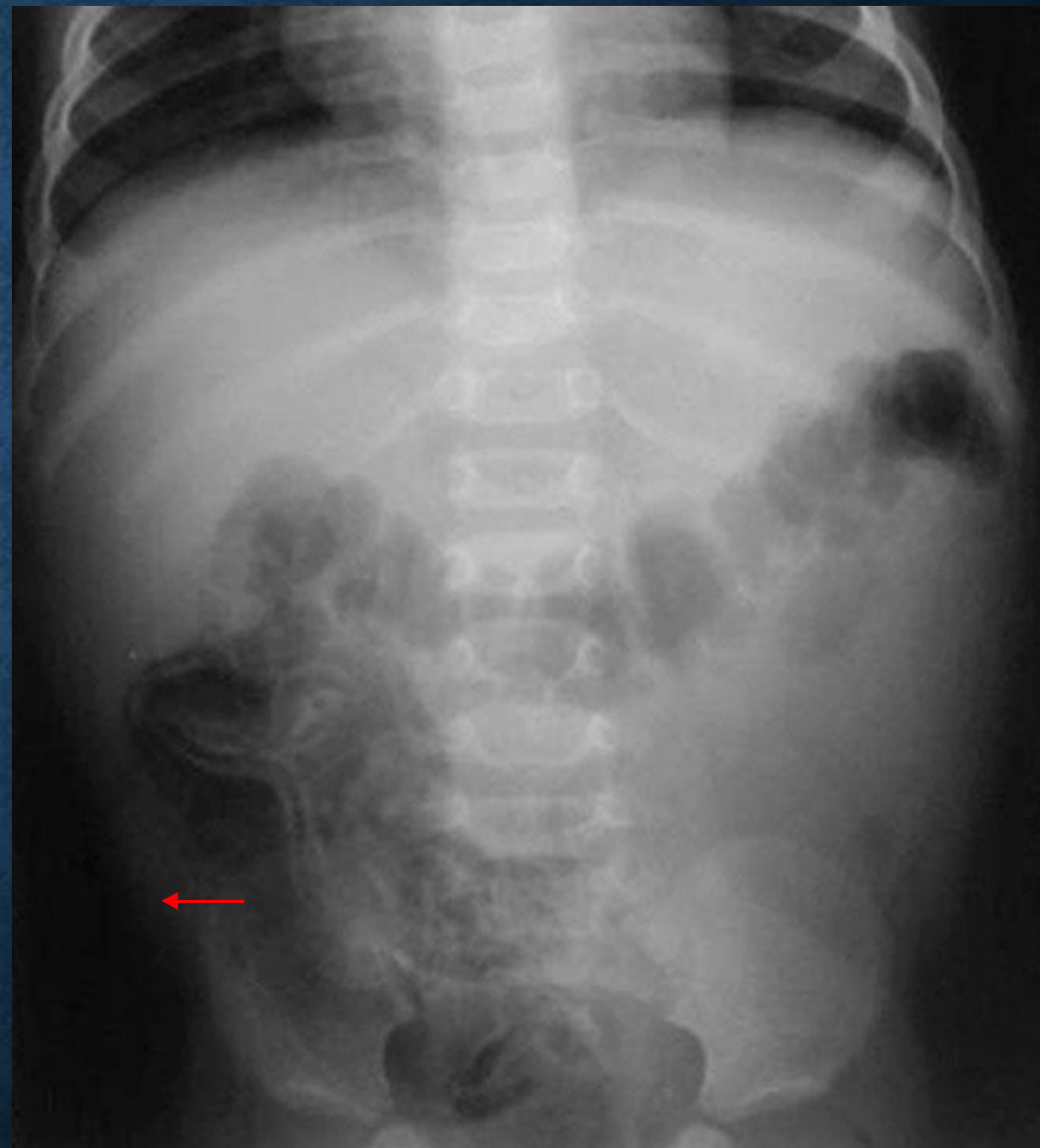
- Large amount of free intraperitoneal air (pneumoperitoneum) outlining the falciform ligament (light blue arrow) , note also the football sign and Rigler's sign(air outlining both sides of the bowel red arrow) , and the inverted V sign (air outlining the common iliac veins dark blue arrow)

DIAGNOSIS: PNEUMOPERITONEUM

CASE 13



Close up demonstrates intraluminal gas (yellow *) with prominent intramural gas (blue arrows).





IMAGING FINDINGS

- Multiple abdominal x-rays demonstrating multiple dilated bowel loops with extensive pneumatosis intestinalis (red arrow). Note also the extensive portal venous gas (blue arrow).

**DIAGNOSIS:
NECROTIZING ENTEROCOLITIS
WITH PNEUMATOSIS
INTESTINALIS AND PORTAL
VENOUS GAS**

Malrotation

DJJ not reach its expected location at left side of spine at level of duodenal bulb



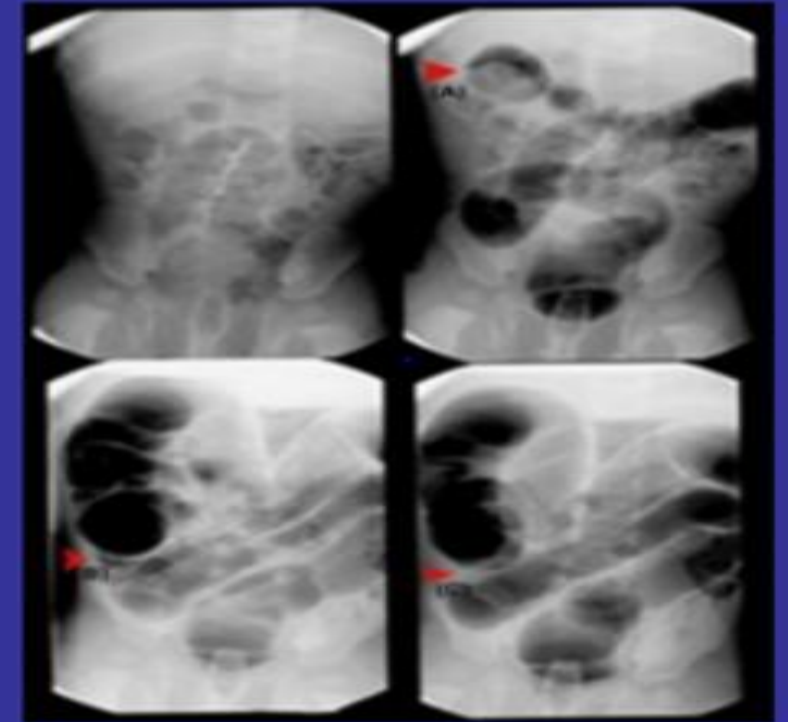
The duodenal-jejunal junction is to the right of the spine, and most of the small bowel is on the right side of the abdomen

Intussusception

Telescoping of one portion of the bowel into other .

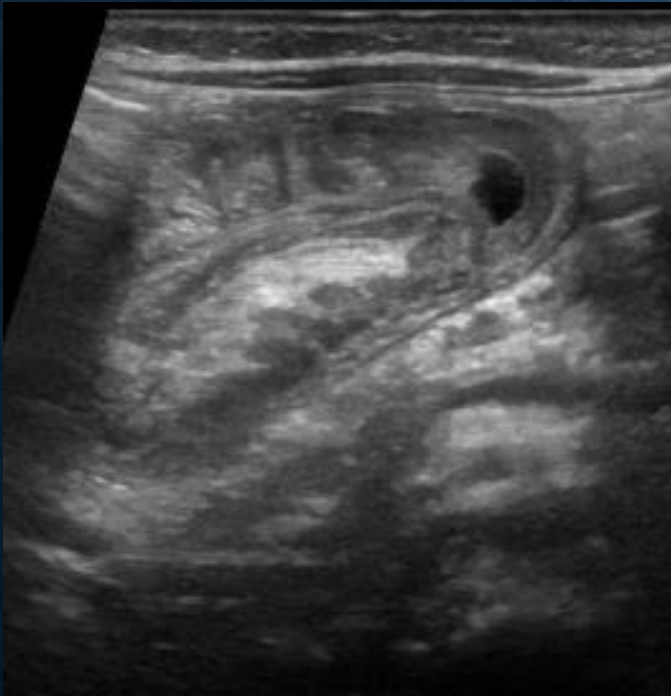
Present at 3mo to 24 month.

Treatment is fluoroscopically guided reduction with air or fluid enema or surgically if unreducible.



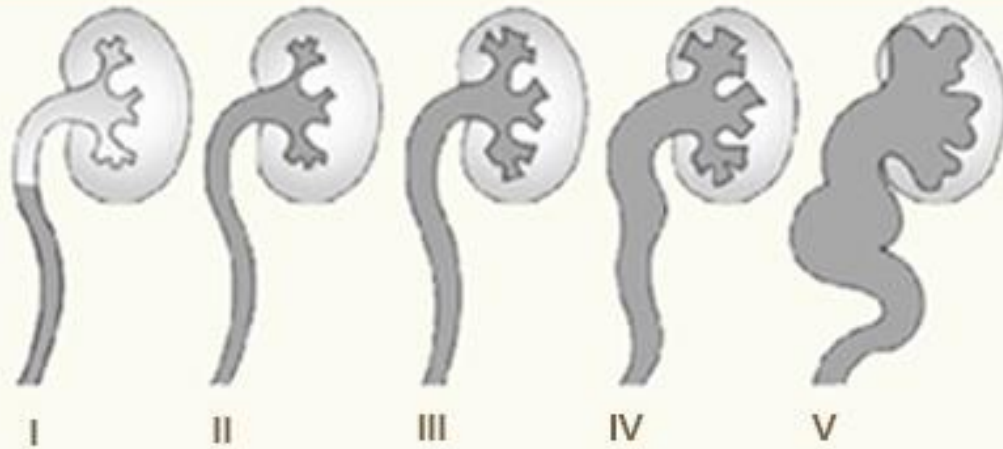
Air enema (clockwise from upper left):
Pre-reduction scout film
Demonstration of intussusception in
hepatic flexure (A)
Reduced to ileocecal valve (B)
Completely reduced with air refluxed
into small bowel (C)

Pseudo kidney sign :alternating hypo / hyper echogenic ring indicated telescopic bowel



MICTURATING CYSTOURETHROGRAM (MCUG)

- A catheter is inserted in the bladder which is filled to capacity with contrast.
- After catheter removal, films are taken of the UT under fluoroscopic guidance, as the patient is micturating looking for **vesicoureteral reflux**.
- Examination of the **urethra** in oblique position is necessary, particularly in suspected **posterior urethral valves** in infants and small children, as they are usually **only demonstrated** during micturition.



Grade

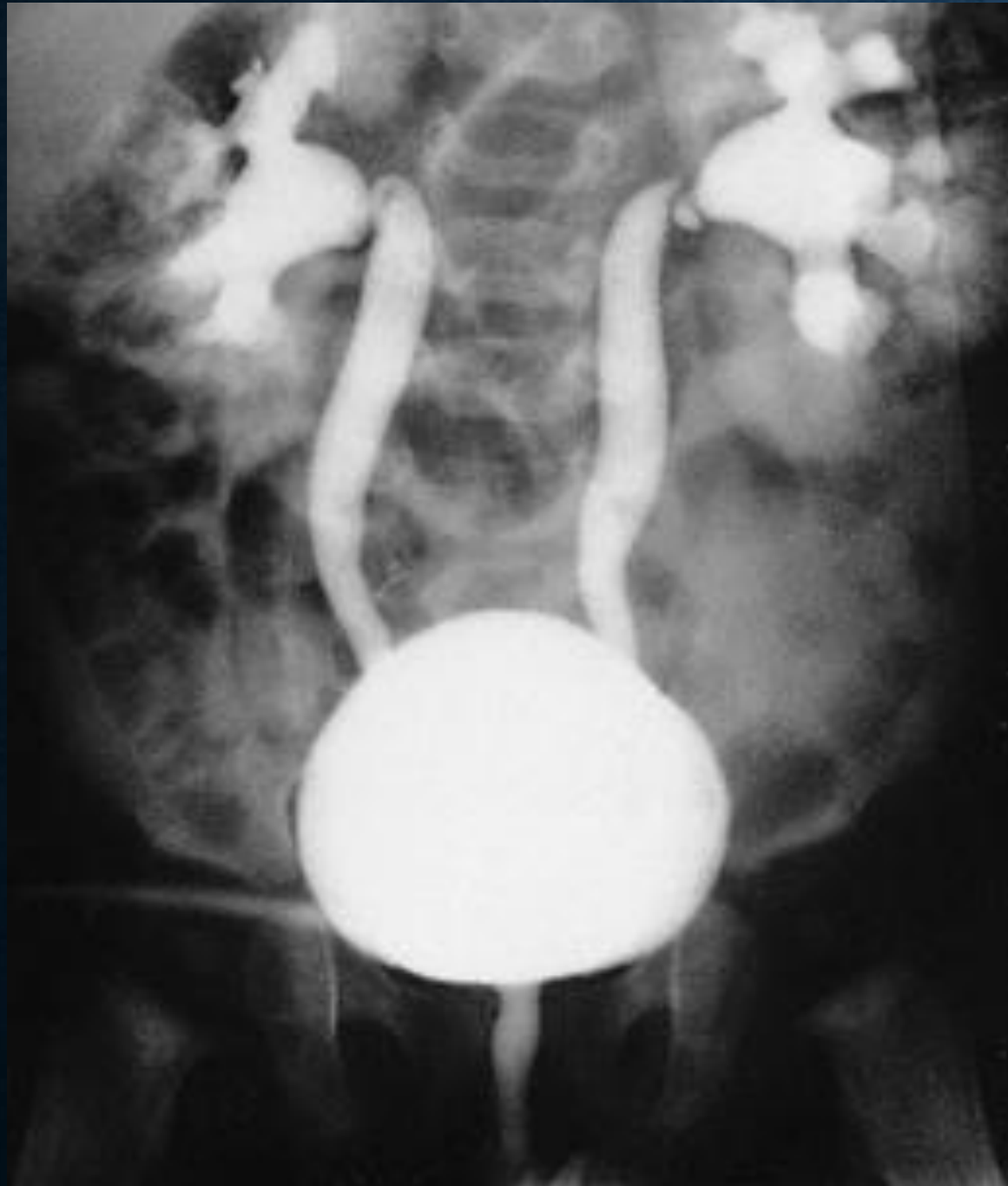
Description

- I Into a nondilated ureter
- II Into the pelvis and calyces without dilation
- III Mild to moderate dilation of the ureter, renal pelvis, and calyces with minimal blunting of the fornices
- IV Moderate ureteral tortuosity and dilation of the pelvis and calyces
- V Gross dilation of the ureter, pelvis, and calyces; loss of papillary impressions; and ureteral tortuosity



Vesicoureteric Reflux





Posterior urethral valve

is a **congenital obstructing of posterior urethral membranes** and a common cause of [obstructive uropathy](#) in infancy.



THANK YOU