



Round : Radiology

Group no : A4

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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

عشان ال DDH قبل
ال ٤٠ يوم بنصور
الطفل ultrasound و
بعدها X-ray

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

✚ عند الاطفال حطوا ببالكم انه حجم القلب عندهم يكون اكبر لانه الاطفال بنصورهم AP، و كمان اشي بميز الصورة
انها AP ال ribs بكونوا striaght اكثر و ال lung apexes بكونوا above the clavicle و كمان بنشوف ال scapula

PA
(ELDER CHILD/ADOLESCENT)



AP
(INFANTS/YOUNG CHILDREN)



LATERAL

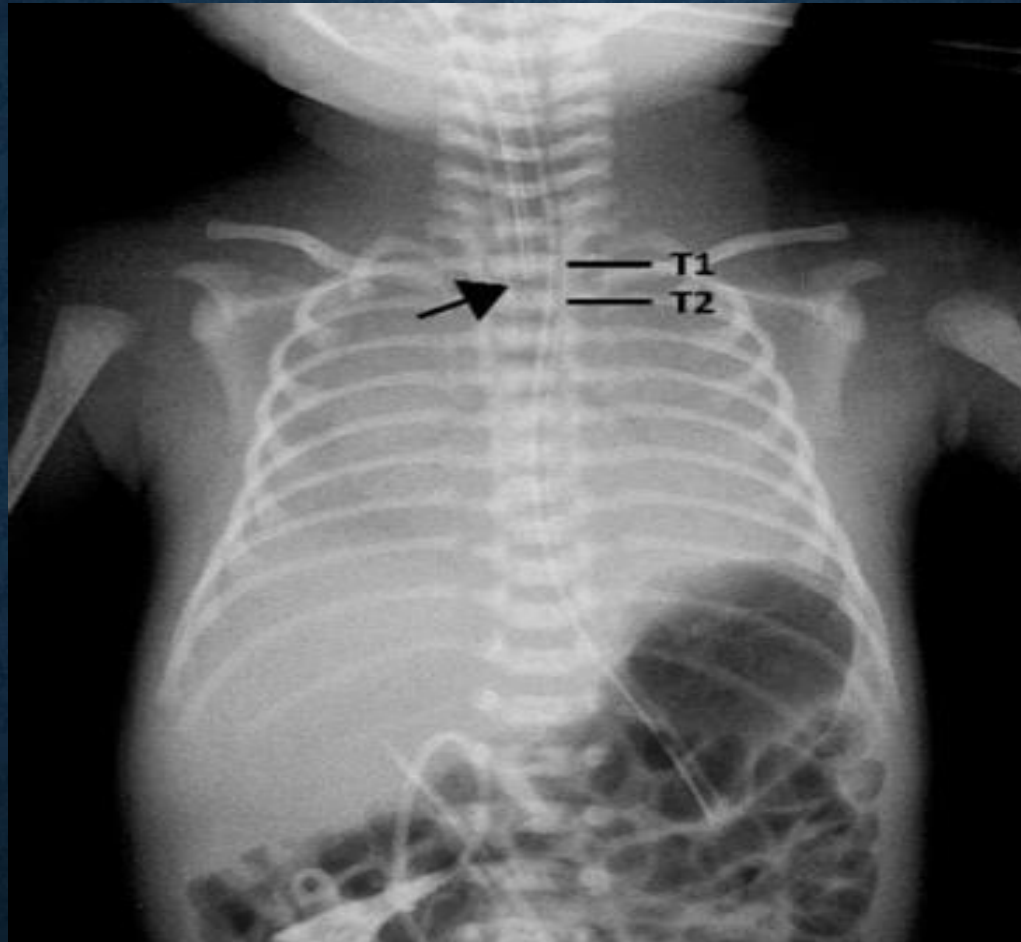




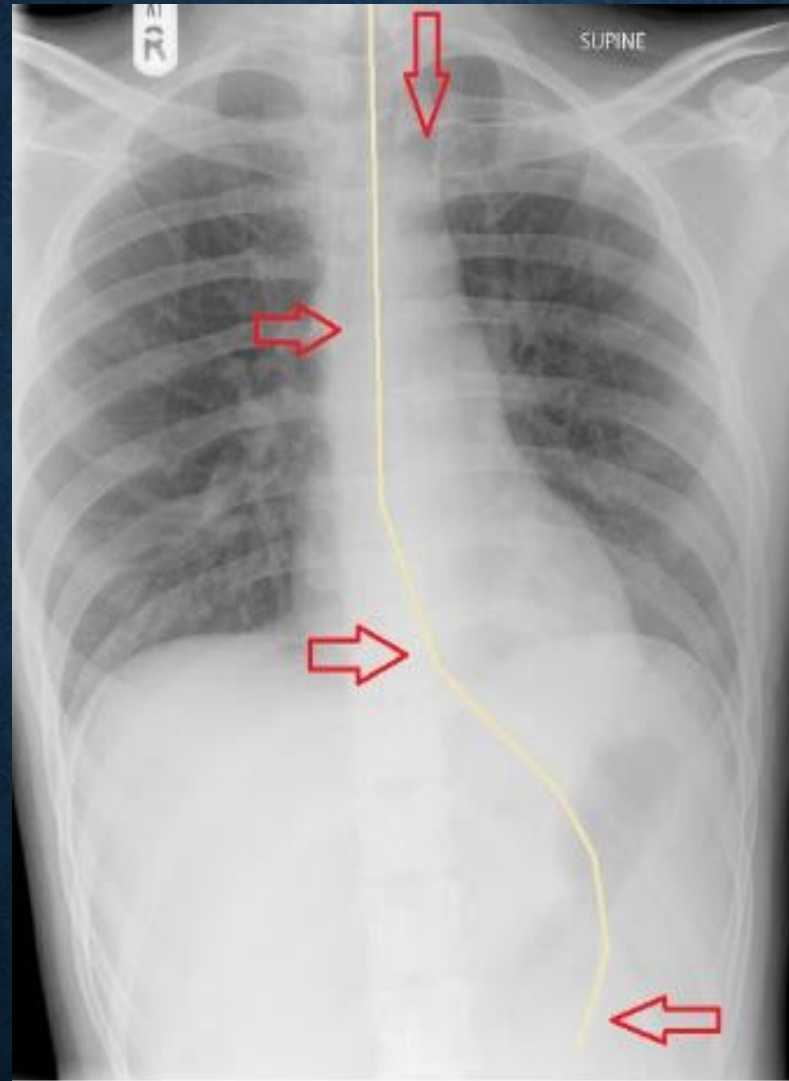
LINES AND TUBES

Bifurcation of the trachea to main left and right bronchus

- **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. **Purpose » taking blood samples**
- **UAC** - **high T7, low L3-L4**
- **UVC** - **IVC/RA, not in liver!**
Purpose » giving medications

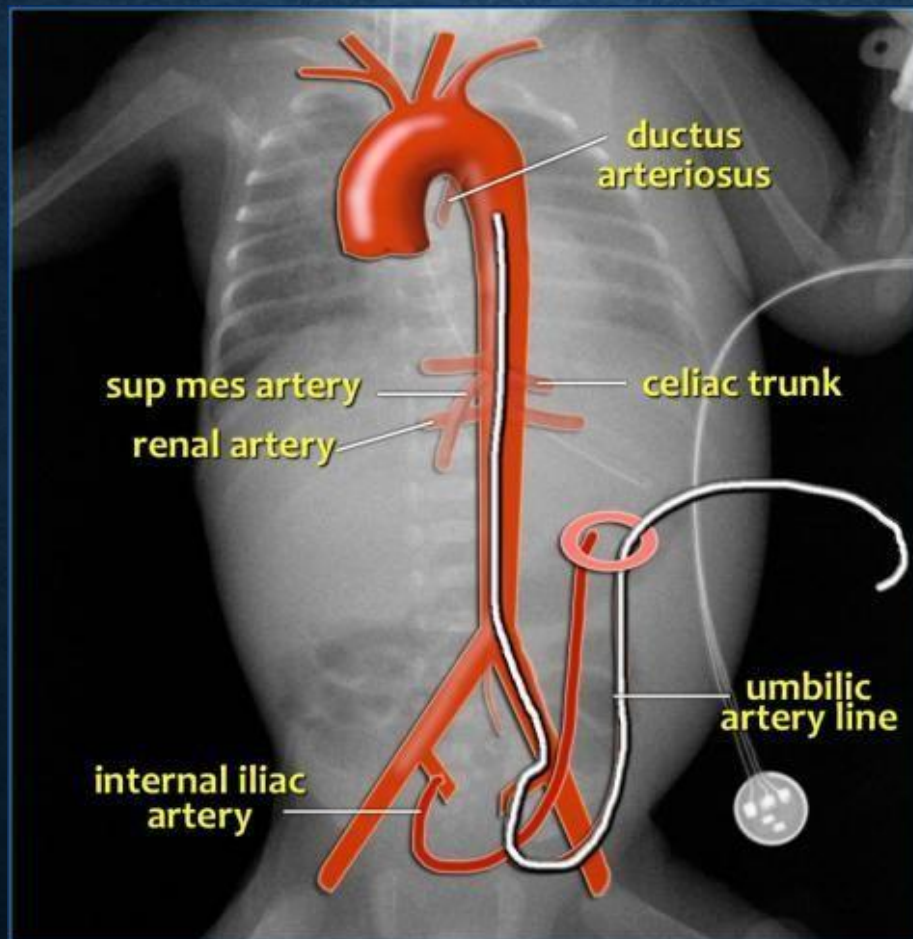


ETT



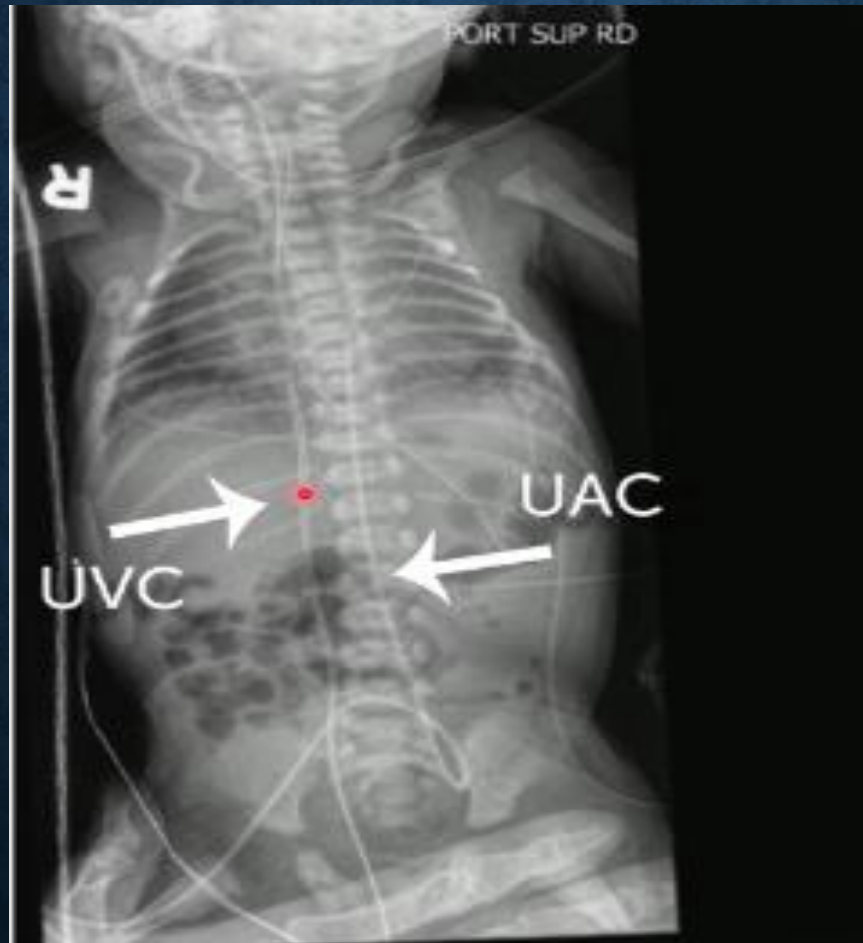
OGT

UAC



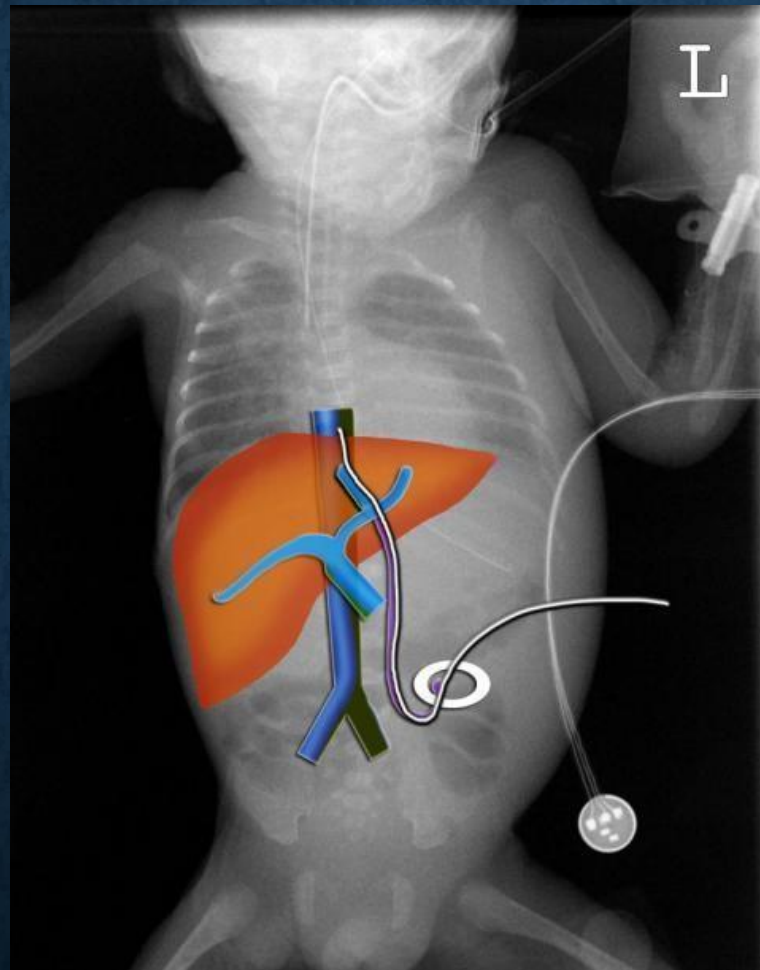
كيف بدى اميز ال line ال artery or vein حسب ال location

- Aorta on the left
- Vein on the right



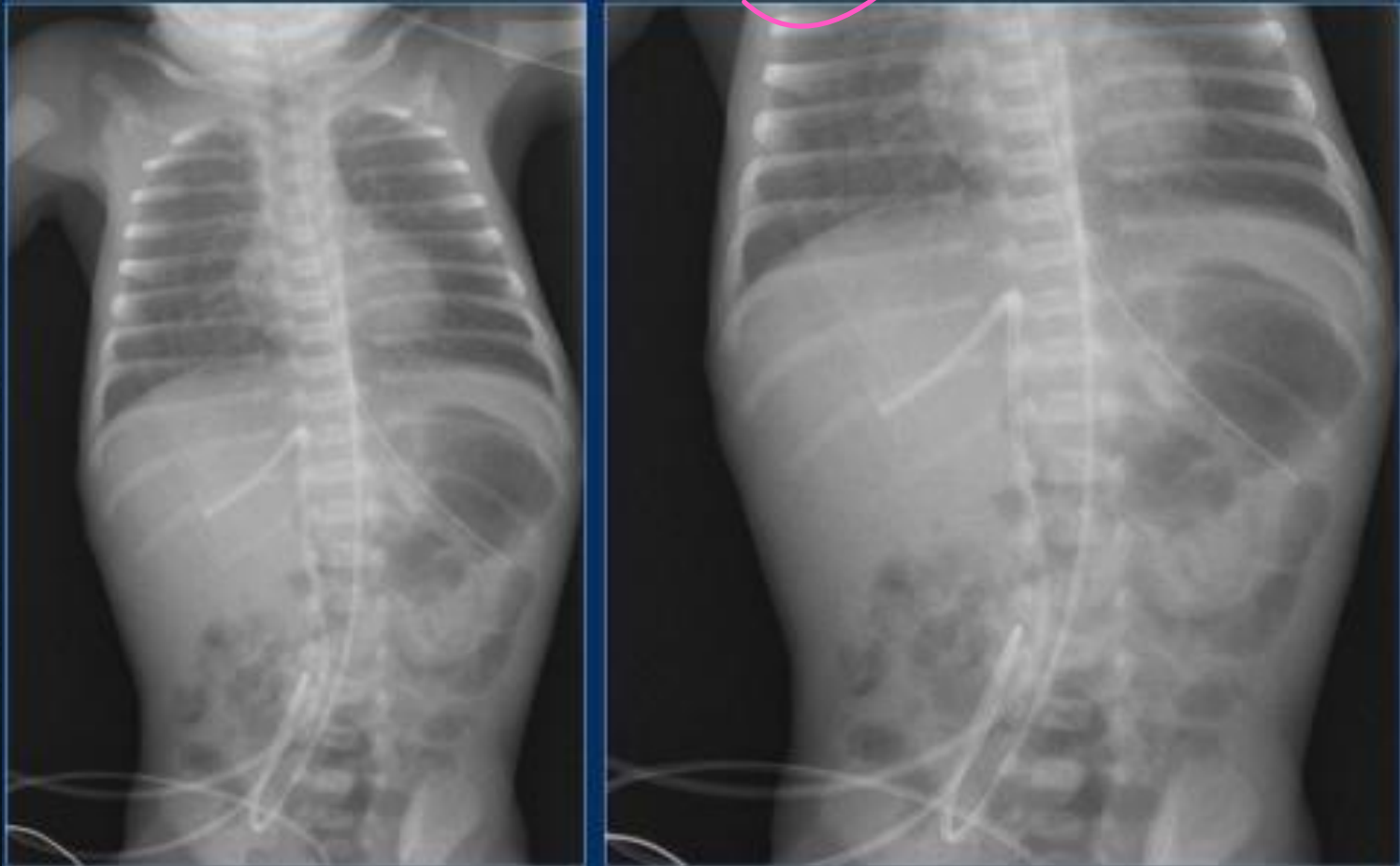
Right and left according to vertebral column

UVC



GOOD POSITION OF UAC BUT WHERE IS THE UVC!

Malposition in the liver



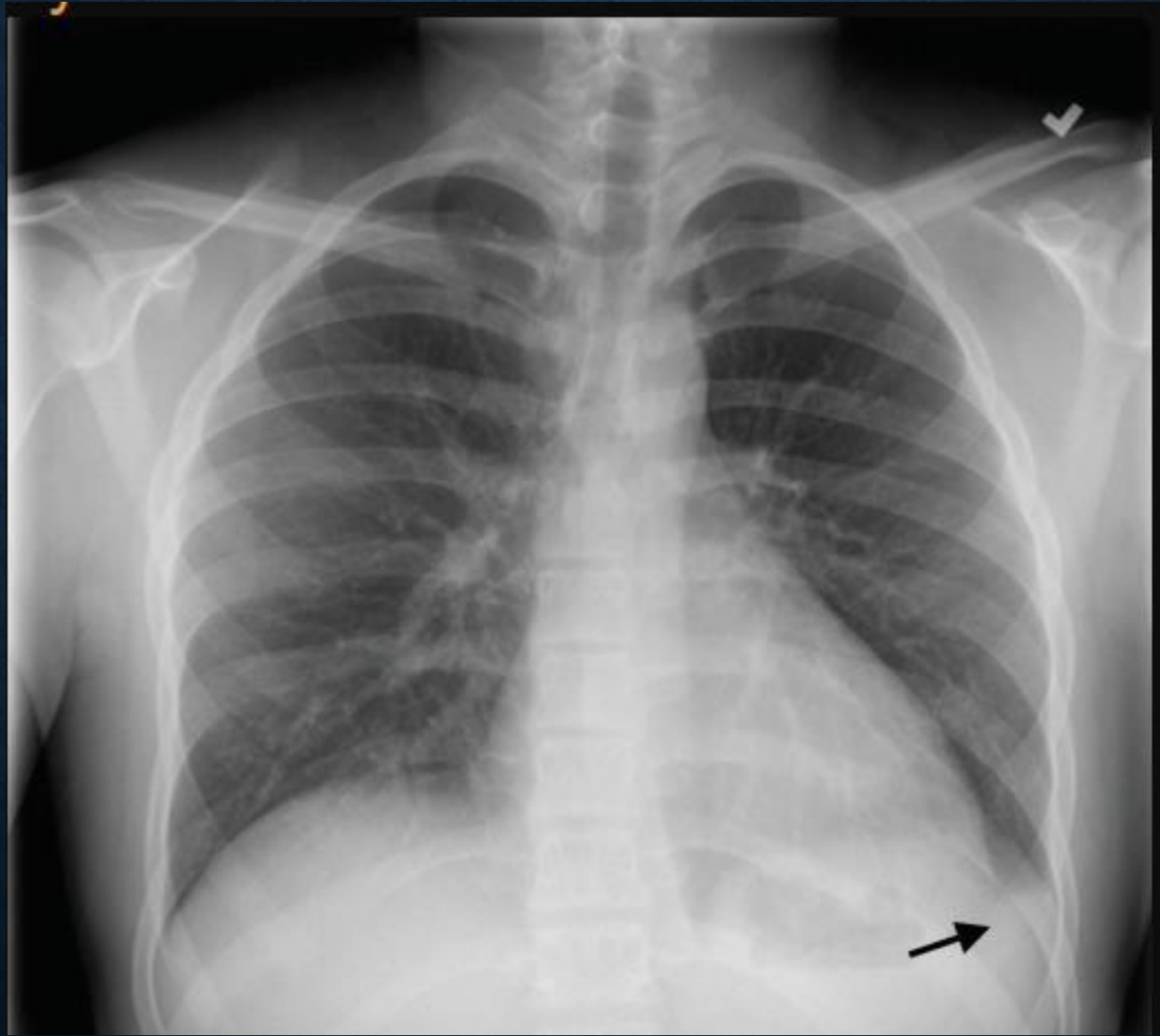
CXR-SYSTEMATIC APPROACH



FIRST CIRCLE

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





+ Normal costophrenic angle should be sharp

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



✚ Old fracture » calus » new bone formation ↗

↖ Sharp fractures

↖ Fracture not sharp

Multiple rib fractures and right clavicular fracture where we should suspect child abuse ↗
in the proper settings. ✚ Multiple fractures, multiple ages of fractures

SECOND CIRCLE

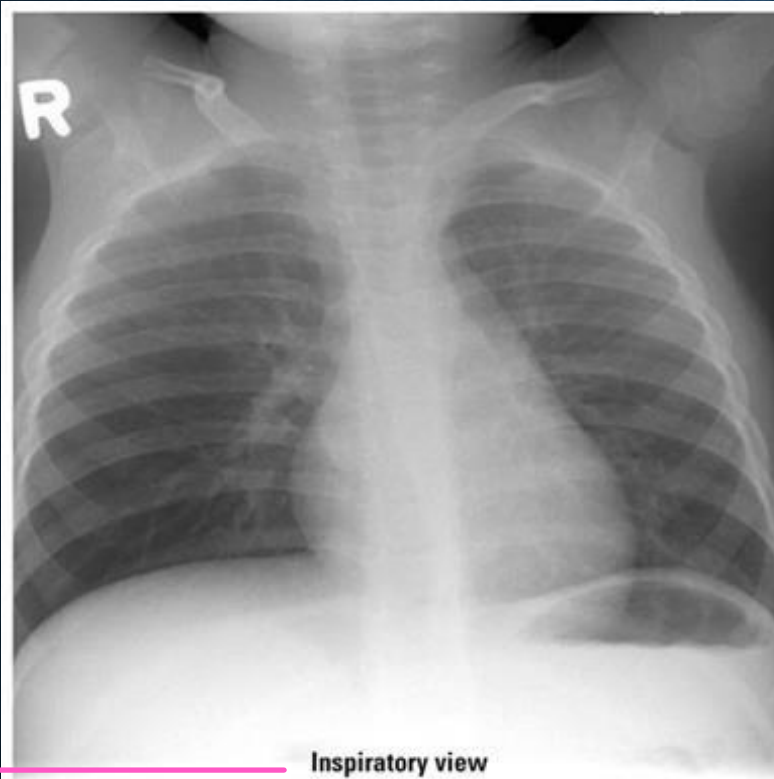
- Lung parenchyma and vascularity



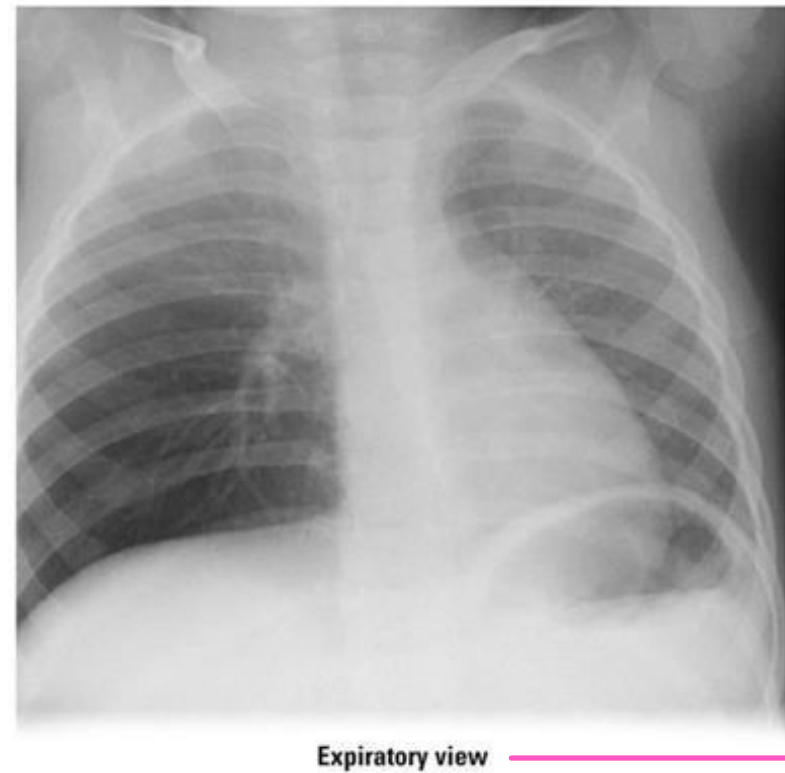
ممکنہ تشویش جالصورہ

ENDOBRONCHIAL FOREIGN BODY

Chocking and aspiration » inspiratory and expiratory X-rays



No abnormal finding



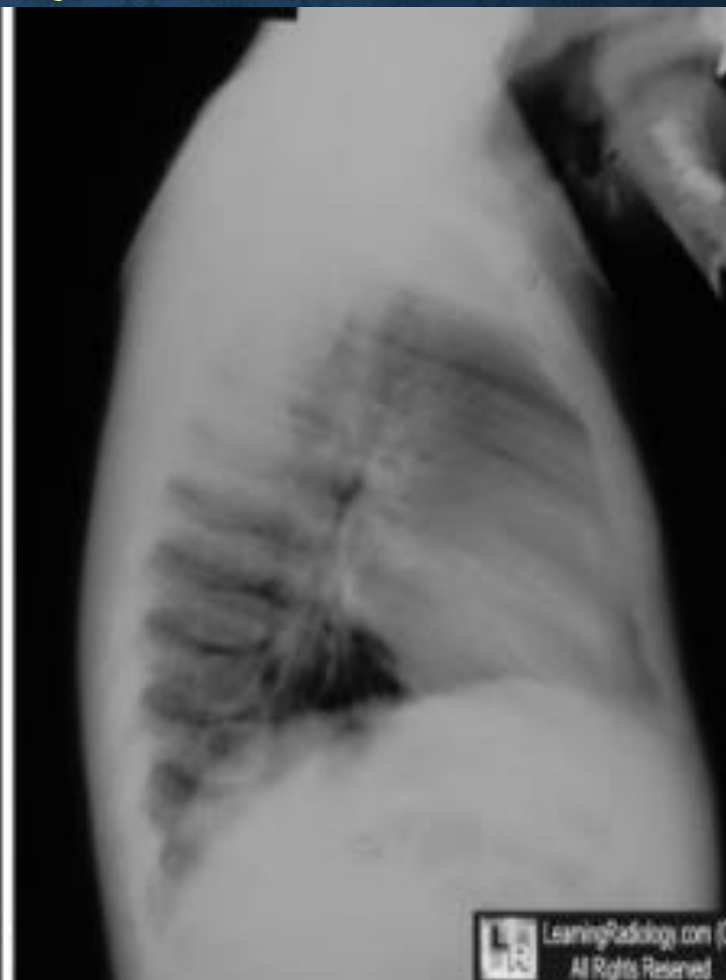
Slight shifting

Air trapping in right lung » more black

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.

✿ Not pneumothorax » vascular marking are visible

✿ Air tapping
on the right

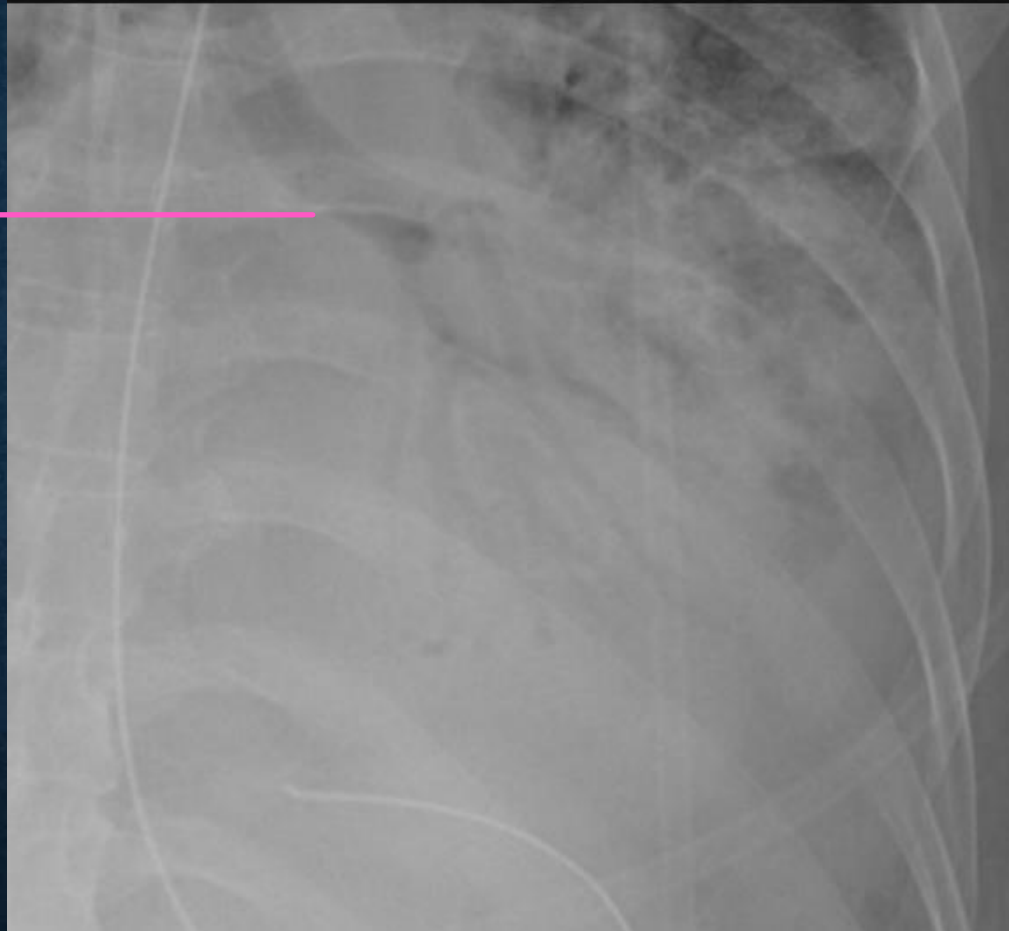


LUNG PATHOLOGY: ALVEOLAR LUNG DISEASE

- 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

Opacity of lung » air visible
in bronchus



اكيد normally ال bronchi فيهم air
لما ال lung حواليهم يصير فيها
opacity السواد تا ع ال air راح يكون
واضح اكثر و بتبين زي الشجرة
المرسومة .. ال lung بكون فيها
pneumonia or bronchopneumonia

ALVEOLAR LUNG DISEASE(ALD)

- Causes of ALD:

- Pulmonary edema (fluid).

- **Pneumonias (pus).**

- Pulmonary hemorrhage (blood).

- Etiology of LRI varies with age

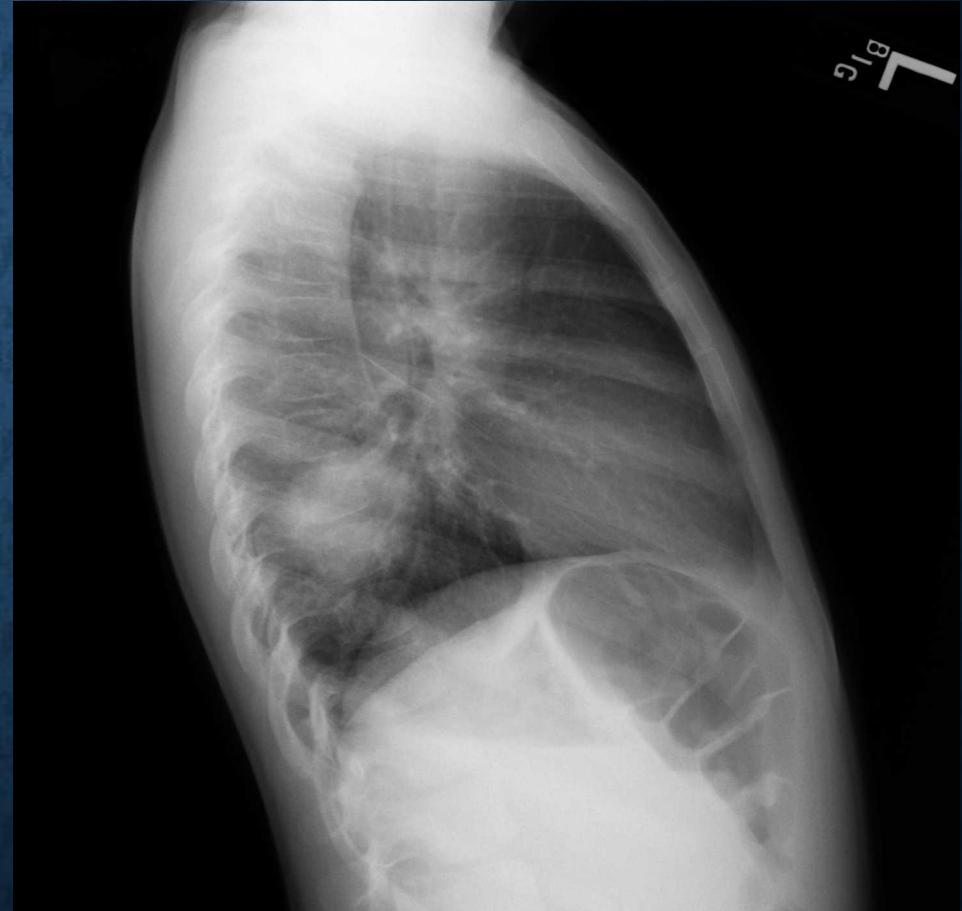
Preschool **95%** viral

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

LLL ROUND PNA

ال pneumonia بتيجي بالاطفال rounded mass

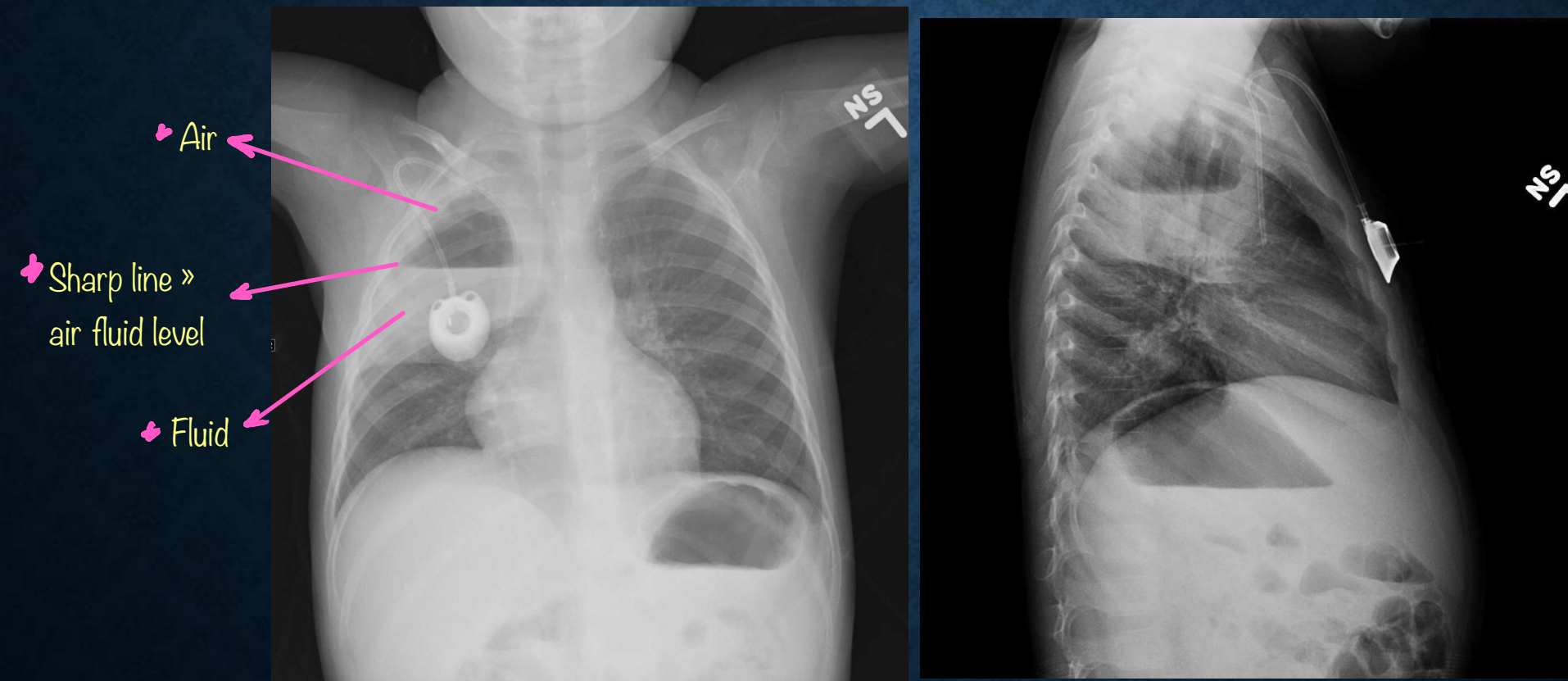
✚ Rounded pneumonia in left lower lobe



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**

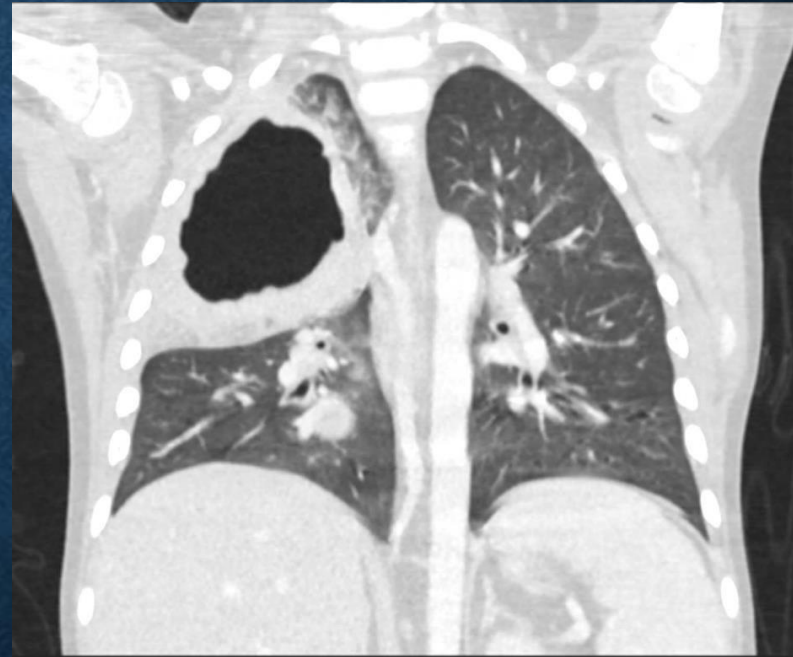
RUL CAVITARY/NECROTIZING PNA



CAVITARY NECROSIS :A SELF-LIMITED COMPLICATION OF BACTERIAL PNEUMONIAS THAT RESOLVES WITH TX OF CAUSE



Axial



Coronal

✿ Lung window

THE

- Airway
- Mediastinum
- Hili



AIRWAYS

- Position
- Caliber
- Displacement

epiglottitis

+ Don't ever use tongue depressor

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.

+ Thumb sign



Steeple sign in croup

↪ Narrowed trachea

✚ Not life threatening





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

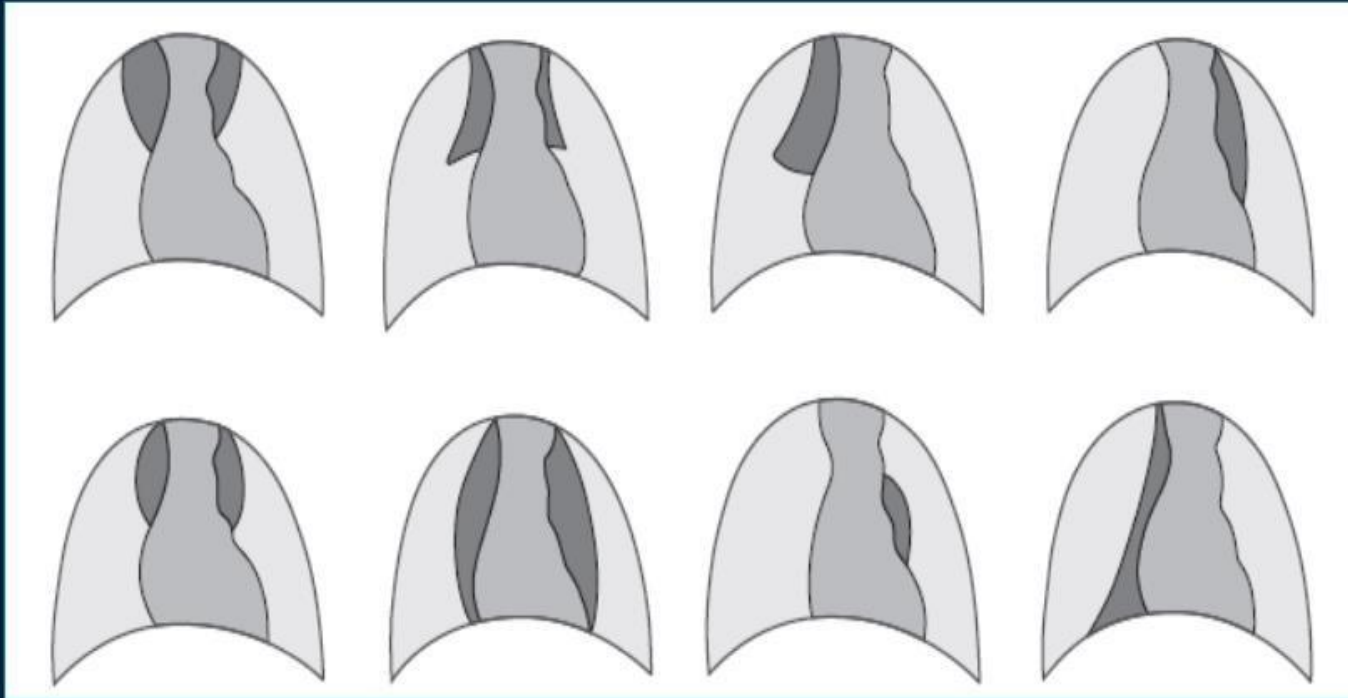
Thoracic aorta

THYMUS

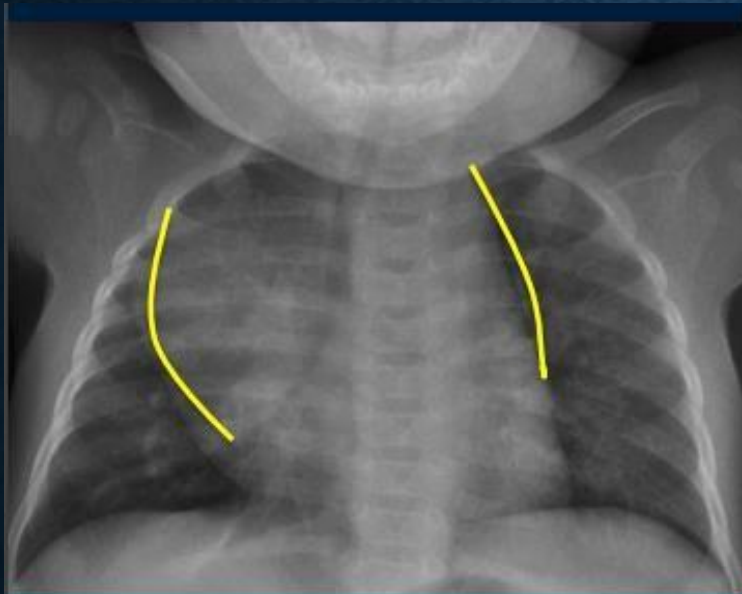
- Anterior mediastinum
- Costochondral indentations (wave sign)
- Notch sign
- Sail sign
- Never compressive
- Change with position/inspiration-expiration

◈ Thymus: Various shapes and sizes

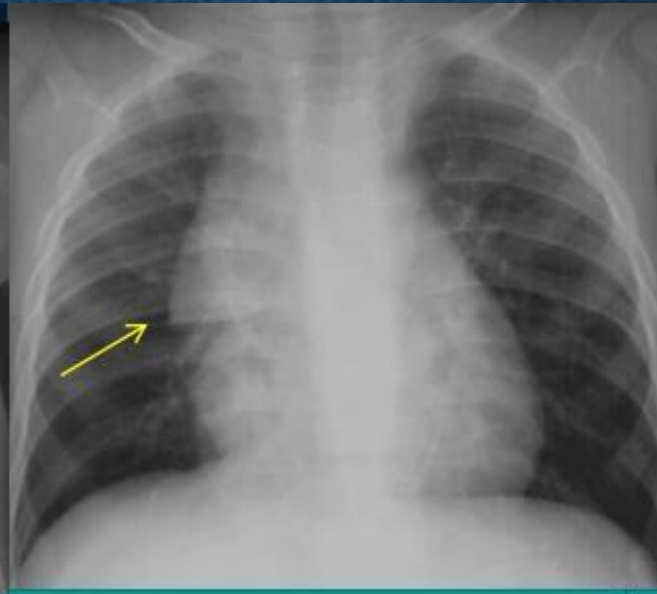
✦ Normal until the age of 16 ←



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

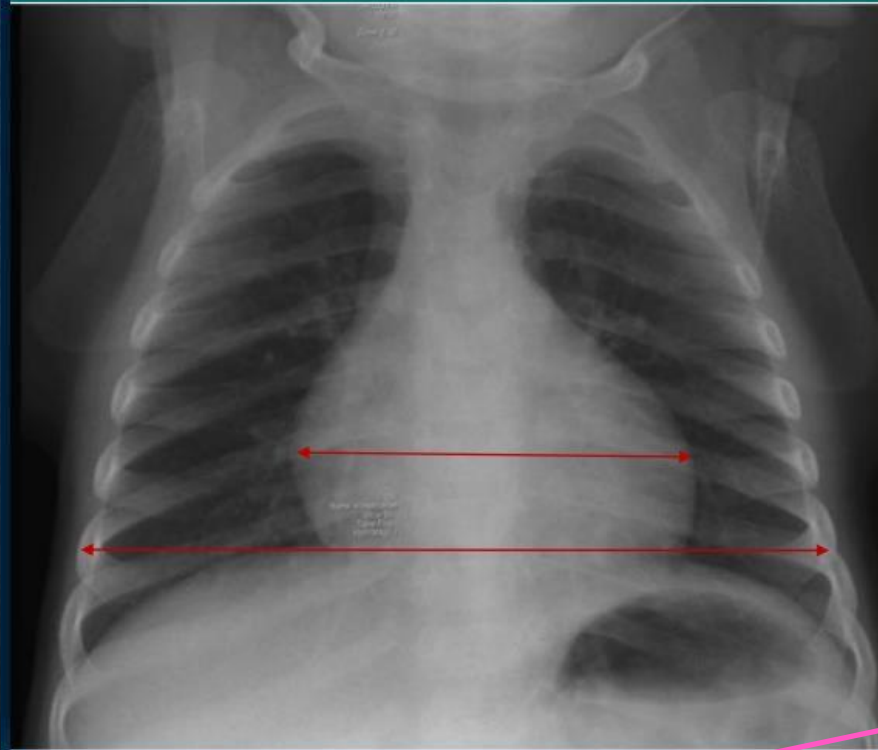


« **sail sign** » triangular appearance
Hypertrophy of the right lobe
Angular corner flattened
at the right minor fissure



THIRD CIRCLE- HEART

Cardiothoracic index



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

✚ لانه اولاً بنصورهم AP و ثانياً في

كثير congenital anomalies

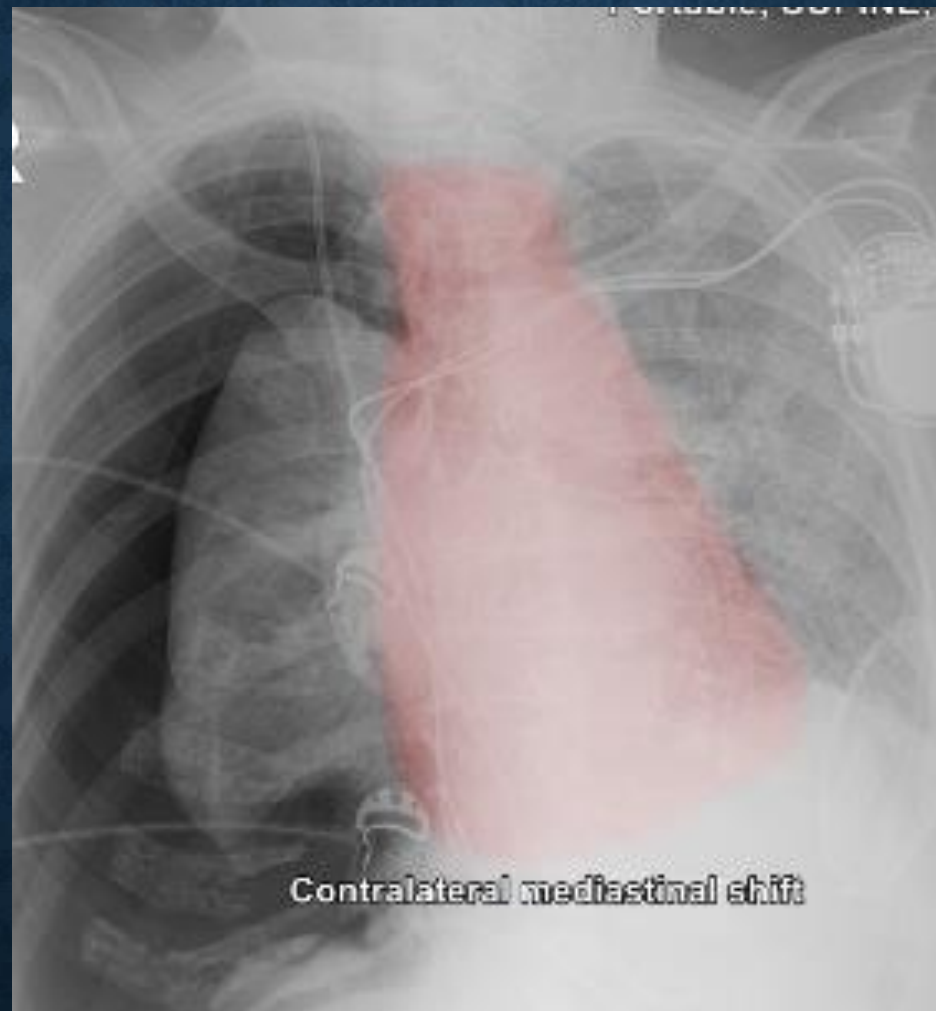
بالاطفال كل وحدة الها شكل معين

✚ بناخذ ال widest diameter in heart and widest diameter in chest و بنقسمهم على بعض

Tension pneumothorax ↗ ↘ Life threatening condition » compromises heart and lungs



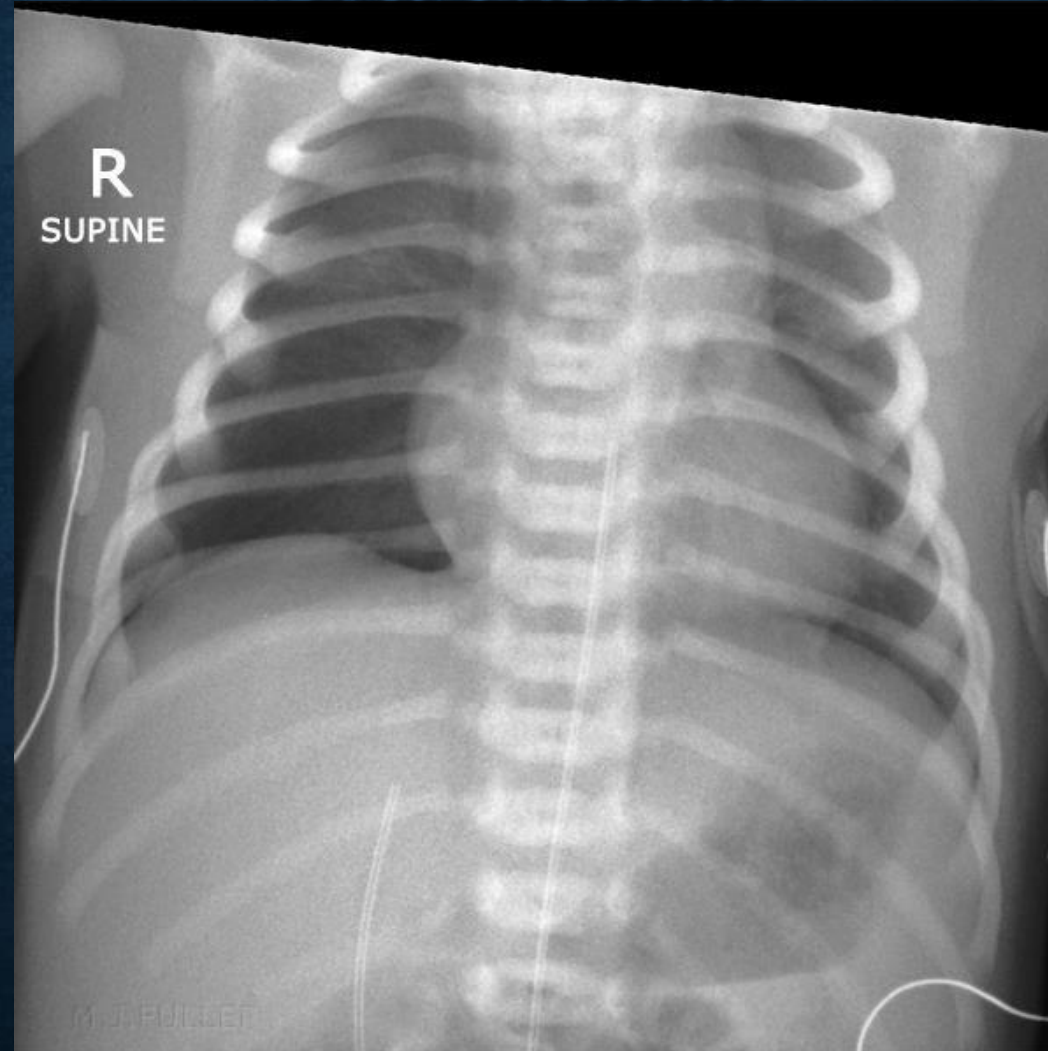
- ✦ No vascular markings
- ✦ Contralateral mediastinal shift
- ✦ Ribs are more straight
- ✦ Diaphragm » differences in height on both sides



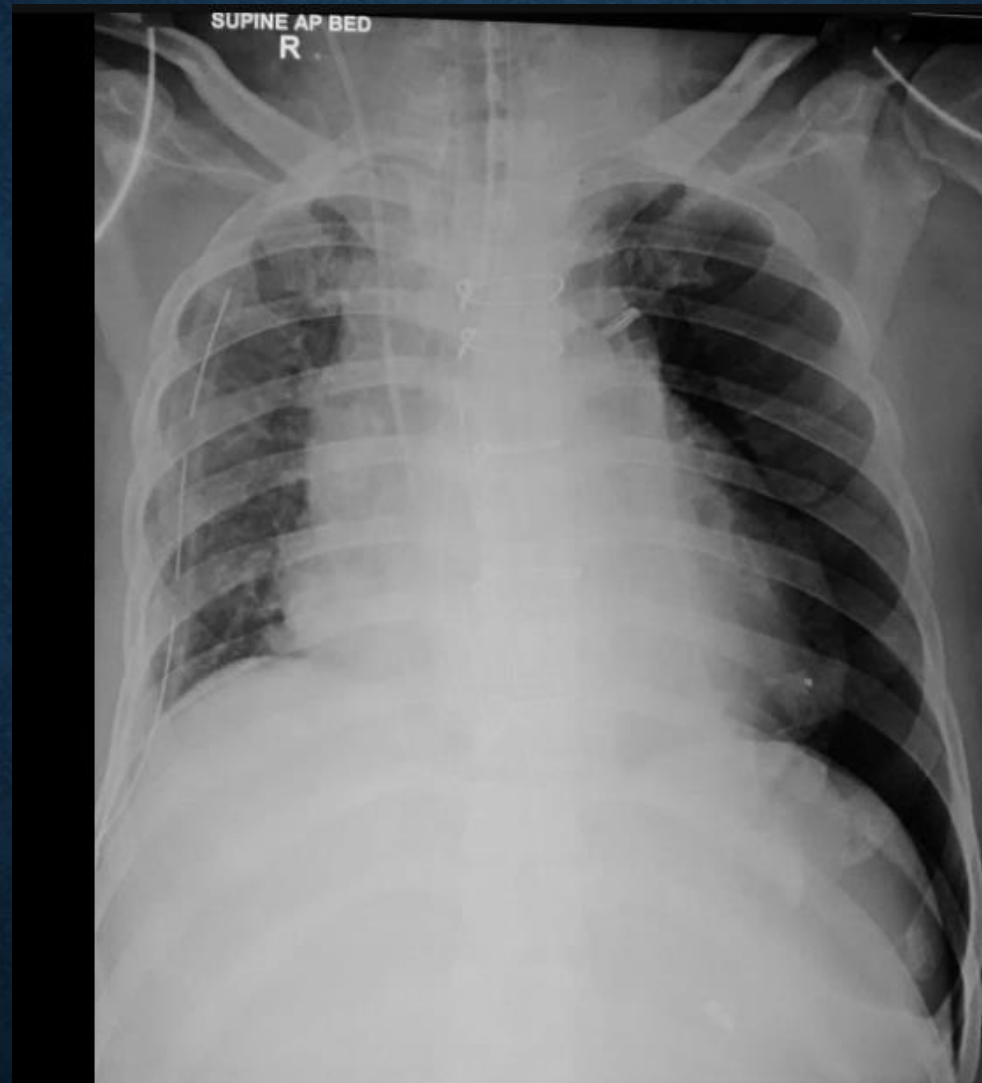




RIGHT DEEP SULCUS



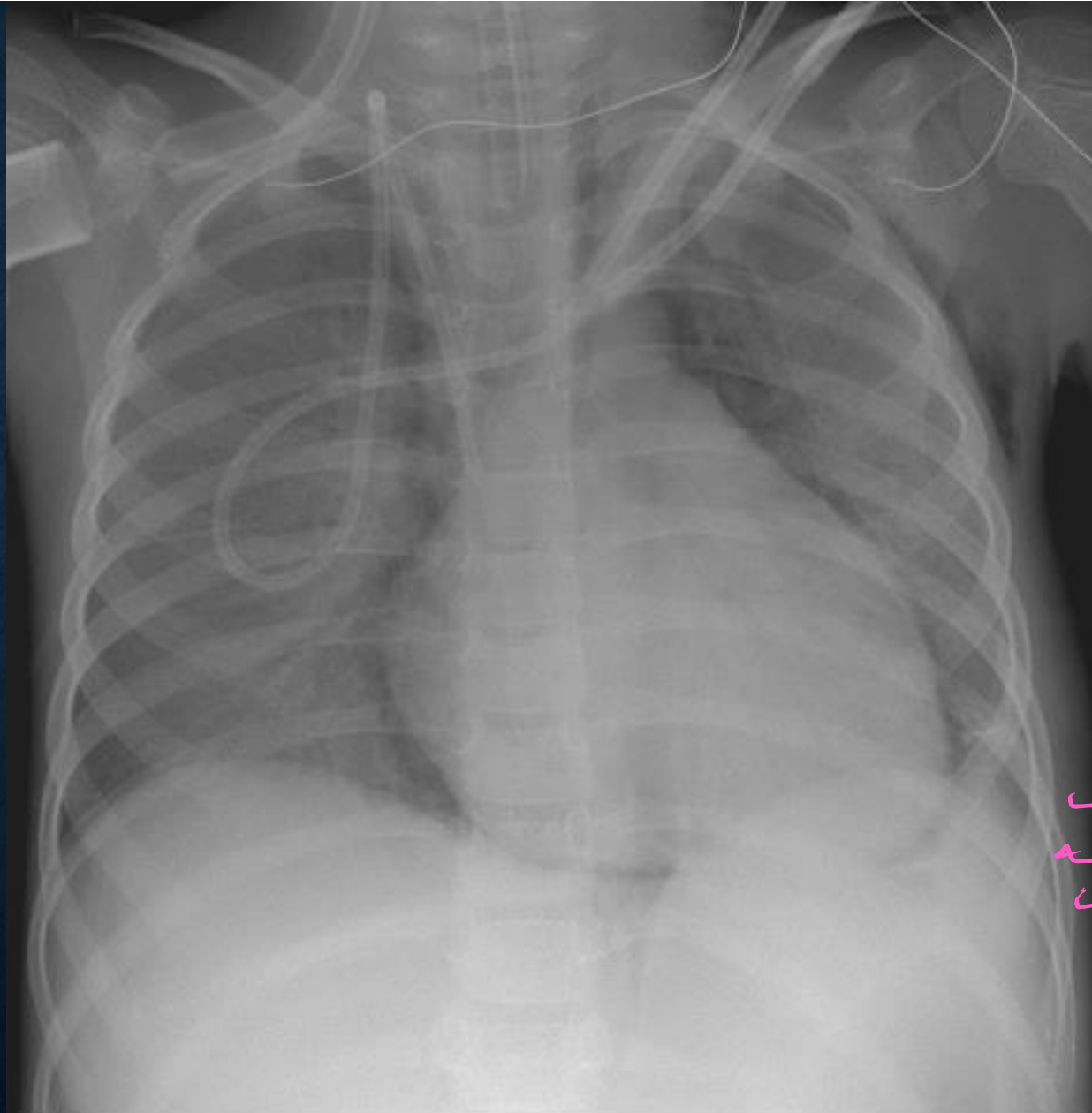
دائما بال pneumothorax ال
air لانه اخف بطلع لفوق و
بكبر لتحت لو زادت كميته،
الطفل اذا ما كان قادر يوقف
ناخذ erect position بنصوره
supine or lateral و وقتها
اكثر مكان بروحله الهواء هو ال
costophrenic angle و بتصير
sharp كتير و لونها اسود اكثر
من ال angle الطبيعية



Left pneumothorax with deep sulcus sign seen on supine projection.

PNEUMOPERICARDIUM ✦ Air around the heart



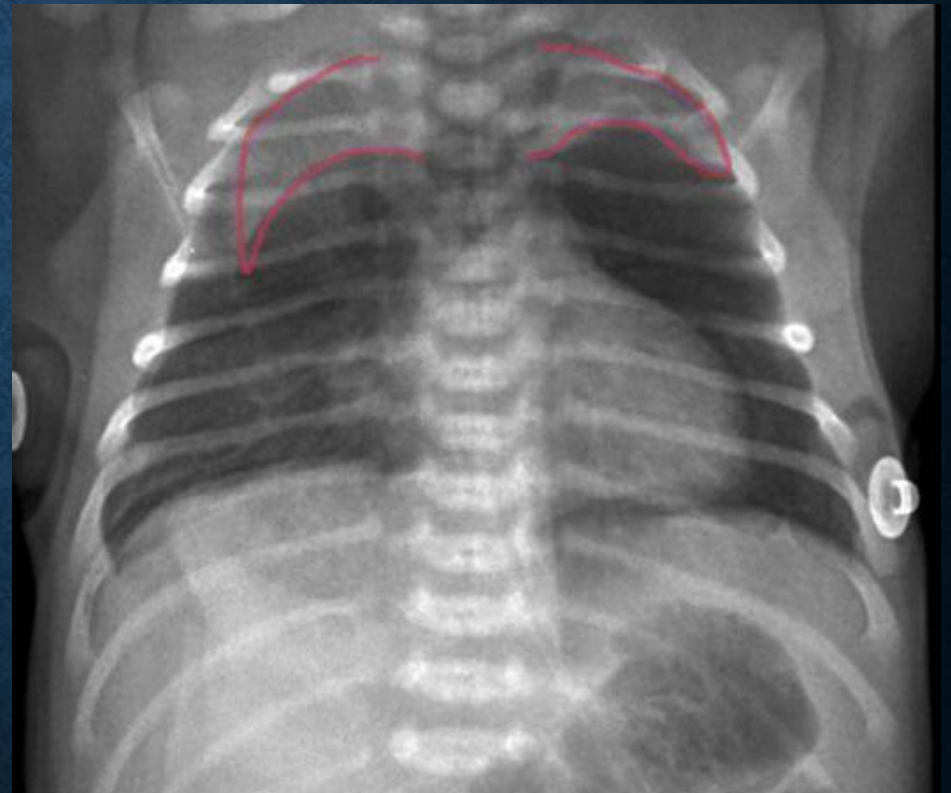


Continuous
diaphragm sign

دائما بال heart في اشفي
اسمه slihuotte يعني اشفي
بخبي على اشفي يعني مثلا
pneumonia تخبي ال
border of the heart
fluid يخبوا ال diaphragm ..
و دائما ال heart and
diaphragm لازم ما ينفصلوا
عن بعض اذا بين بينهم فراغ
يعني هوا هاد دليل
pneumopericardium او هاد
الجواب اشفي اكبر الي هو
pneumomediastinum الي تحمله
بالامتحان

+

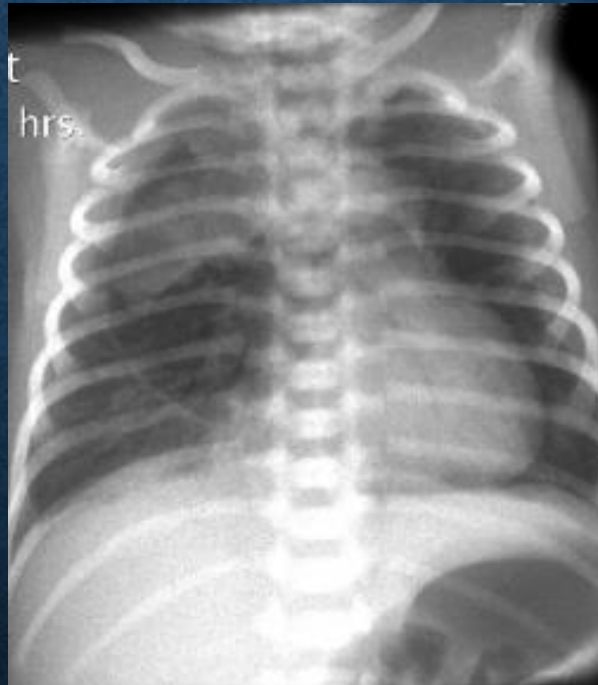
Angel wing sign



x

Angle wing sign

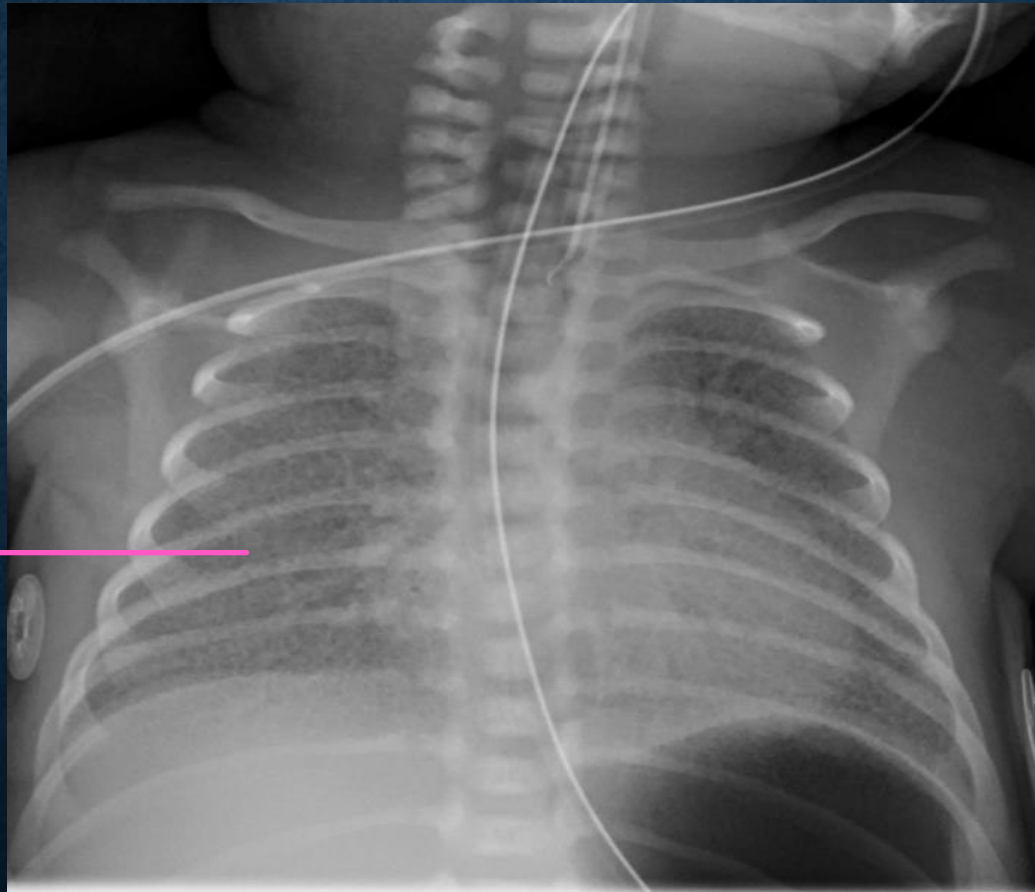
is a sign of [pneumomediastinum](#) seen on neonatal chest radiographs. It refers to the [thymus](#) being outlined by air with each lobe displaced laterally and appearing like spinnaker sails.



NEWBORN X-RAY PATHOLOGY

CASE 1 → = surfactant insufficiency = respiratory distress
**2 DAYS OLD PREMATURE INFANT WITH
TACHYPNEA**

✦ Grainy lung or ground
glass appearance →



FINDINGS

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

Diagnosis: RDS, hyaline membrane disease

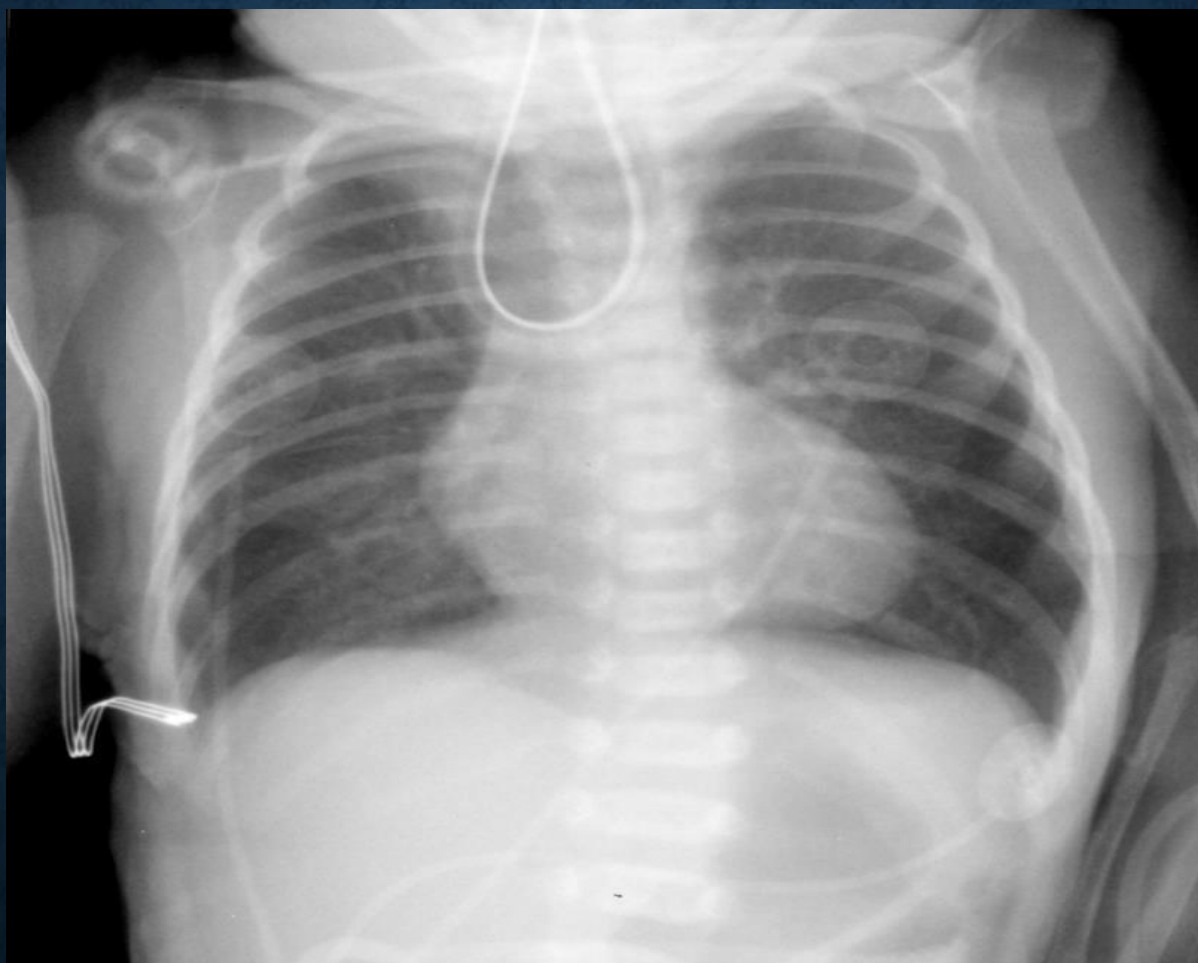
- **Respiratory distress syndrome (RDS)** is a relatively common condition that occurs in preterm neonates resulting from insufficient production of surfactant.
- Respiratory distress presents in the first few hours of life in a premature baby. Signs include tachypnea, expiratory grunting, and nasal 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

✚ ما يكون راضي يرضع بصير dehydrated بنيجي نحطه NGT او OGT
عشان نعطيه fluids لما اجينا ندخله صار الي بالصورة الي تحت



FINDINGS:

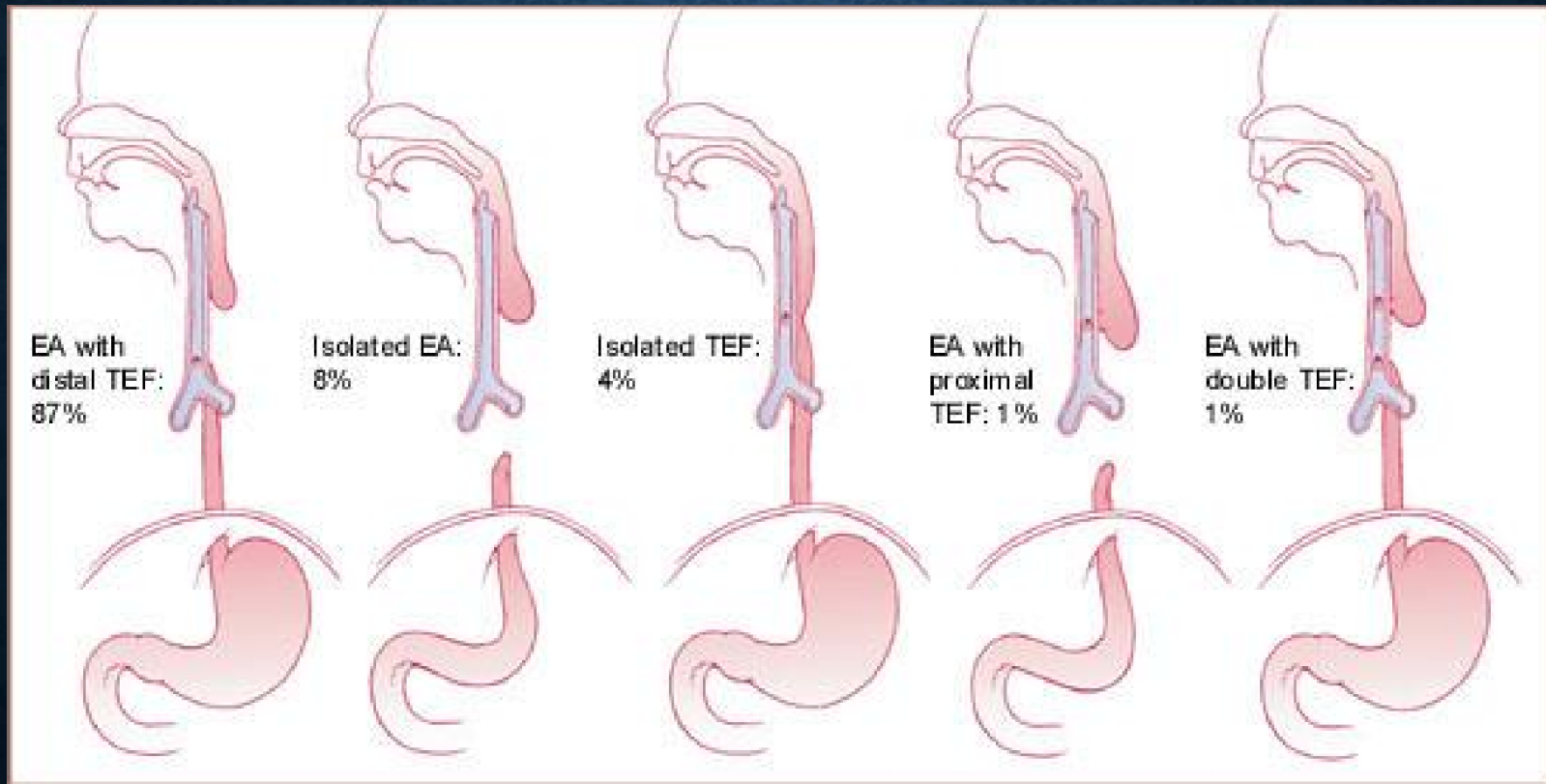
**THERE IS A DISTENDED AND GAS-FILLED
PROXIMAL ESOPHAGUS WITH A
NASOGASTRIC TUBE LOOPED WITHIN IT.
GAS IS SEEN WITHIN THE STOMACH.**

DIAGNOSIS: ESOPHAGEAL ATRESIA WITH TEF

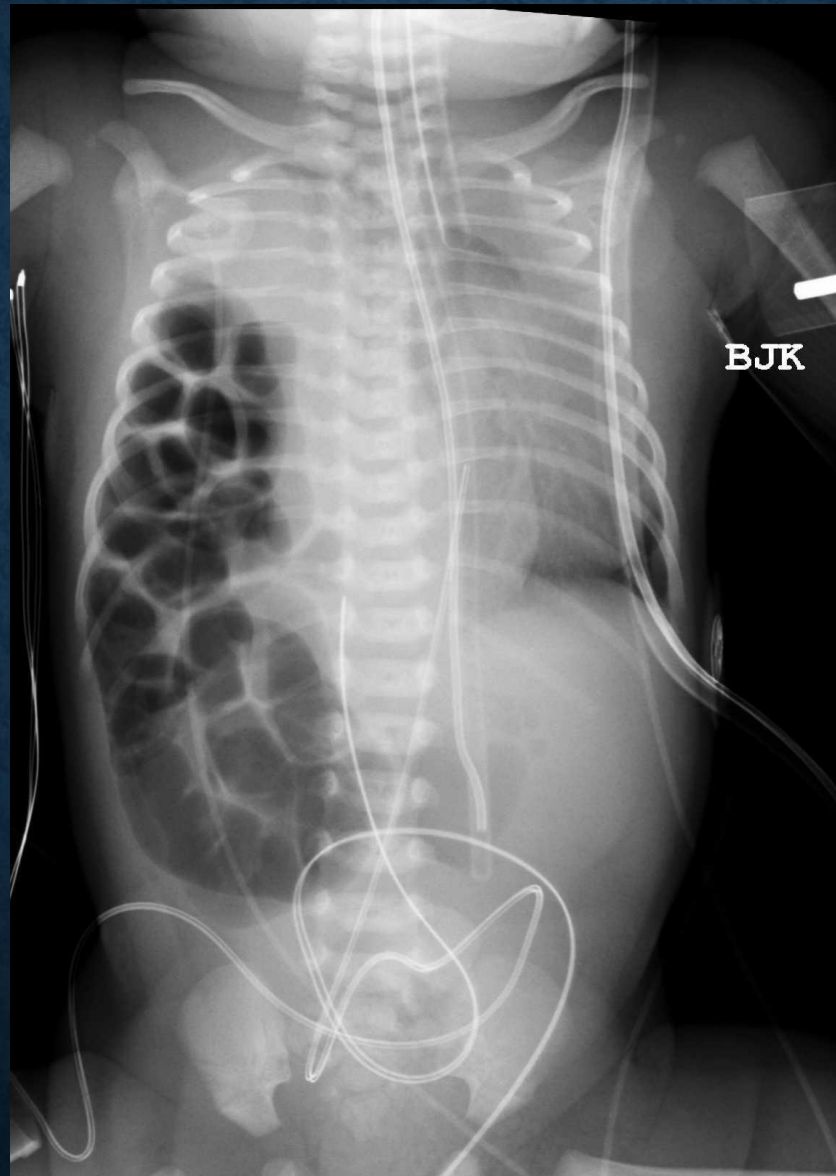
tracheo-esophageal fistula



ESOPHAGEAL ATRESIA / TE FISTULA



CASE 2:
NEWBORN WITH RESPIRATORY DISTRESS

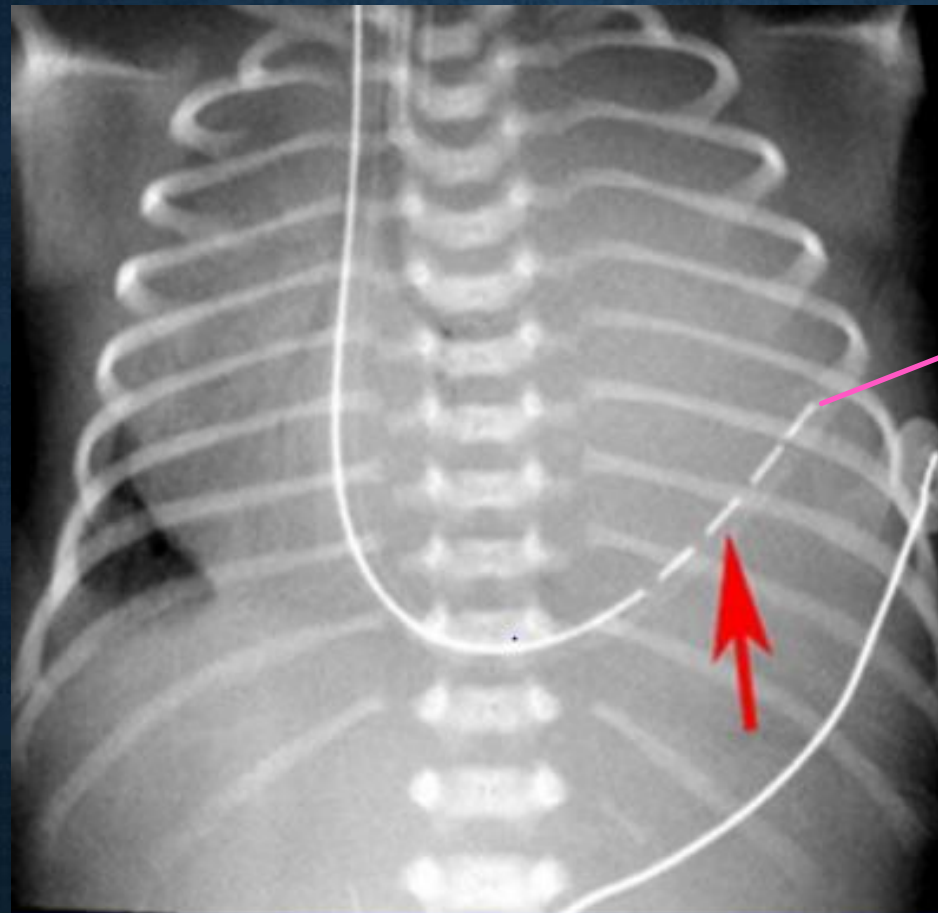


FINDINGS:

MULTIPLE BOWEL LOOPS SEEN IN THE RIGHT HEMITHORAX

DIAGNOSIS

CONGENITAL DIAPHRAGMATIC HERNIA



NGT

✦ Stomach above the diaphragm

CXR demonstrates a mass in the left chest with shift of the mediastinum. Although no bowel gas is identified, the position of the nasogastric tube (red arrow) indicates the stomach is located in the thoracic cavity.

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

يعني المشكلة قبل ال 2nd part of the duodenum 

+ Landmark of the pylorus » gallbladder

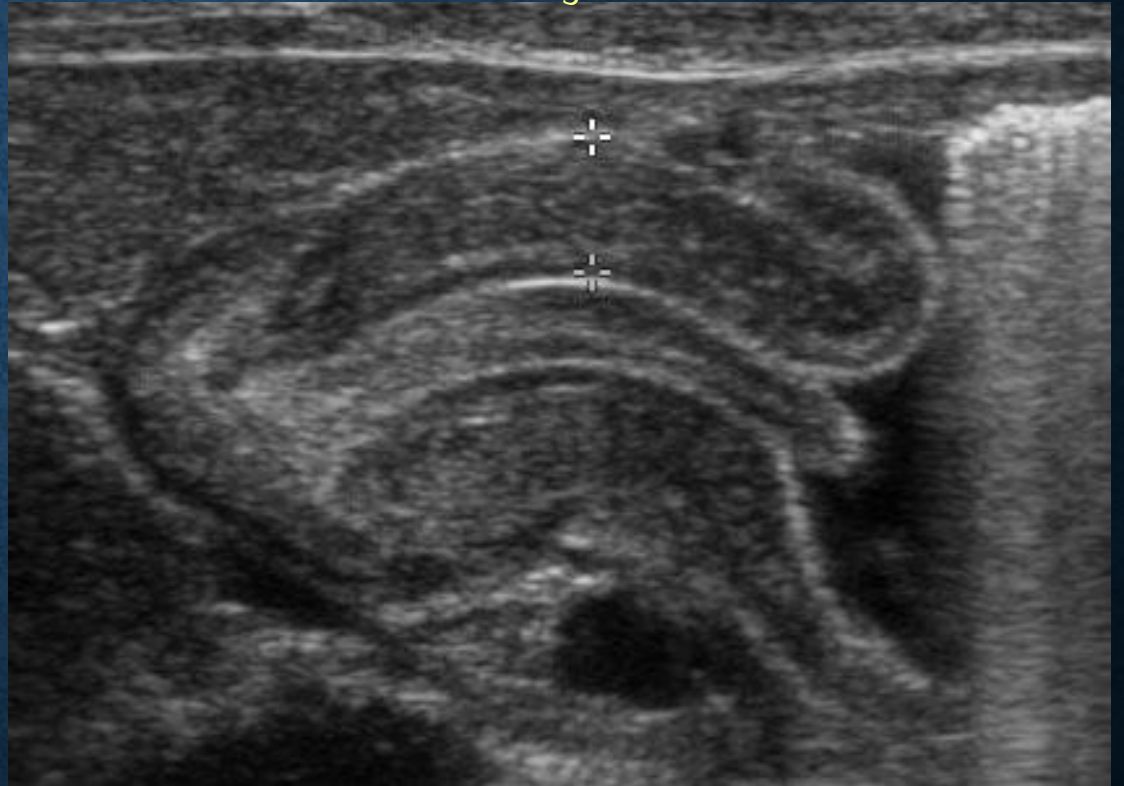
Axial



Muscles of pylorus

+ علامت بكون و ام بعض

Sagittal



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

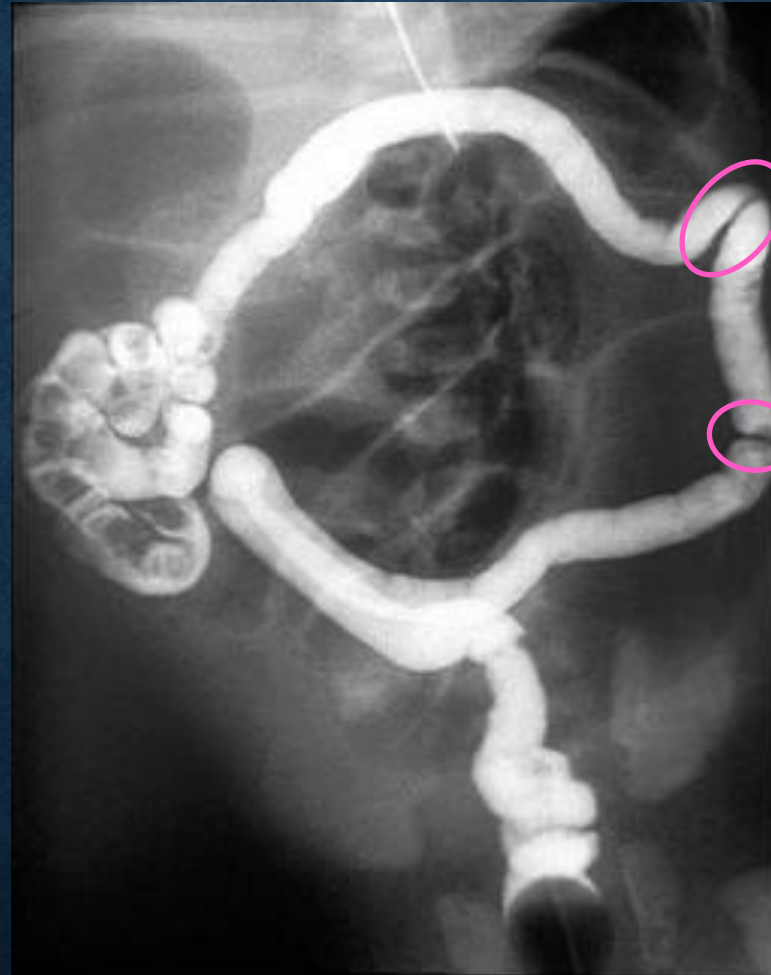


IMAGING FINDINGS

- 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



✦ Filling defect

✦ Large bowel » small caliper

✦ Small bowel » large caliper

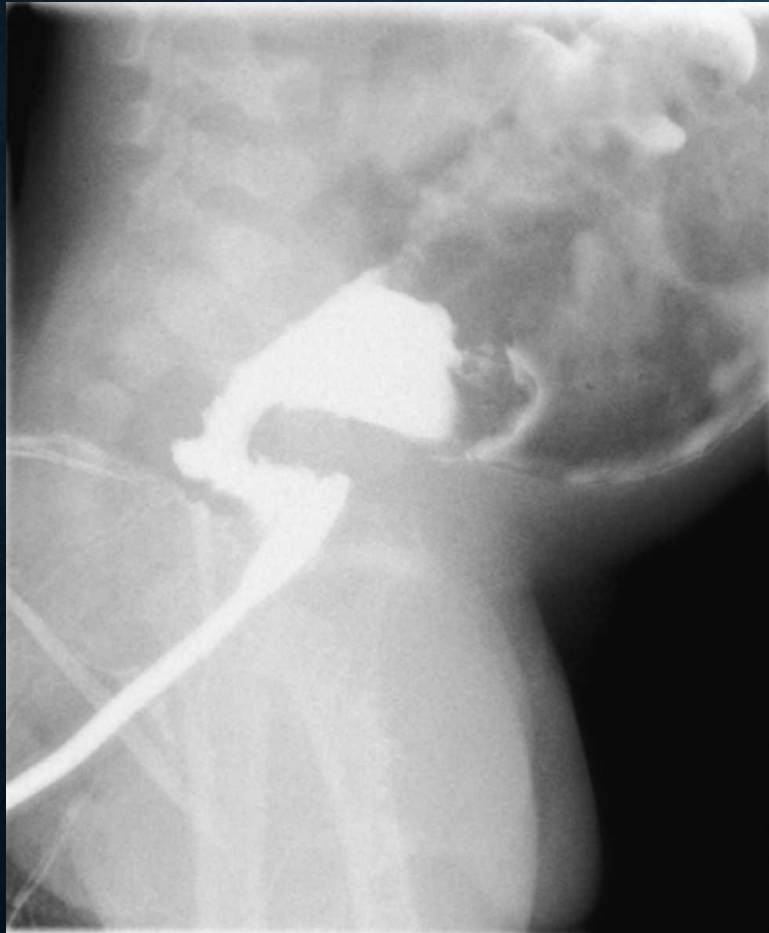
IMAGING FINDINGS

- 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)**

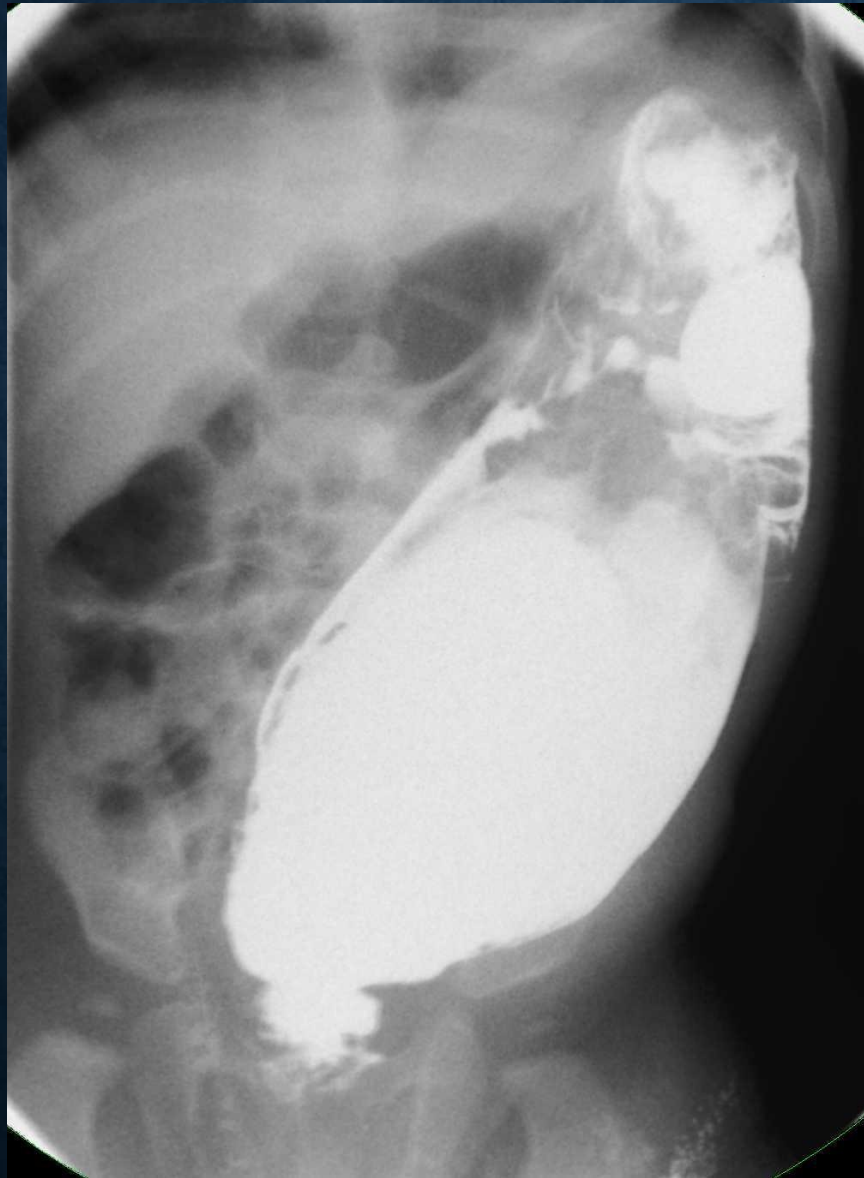
CASE 8

Barium enema lateral projection early filling phase



✚ Sacral bone » landmarke





Same pateint in the supine position

IMAGING FINDINGS

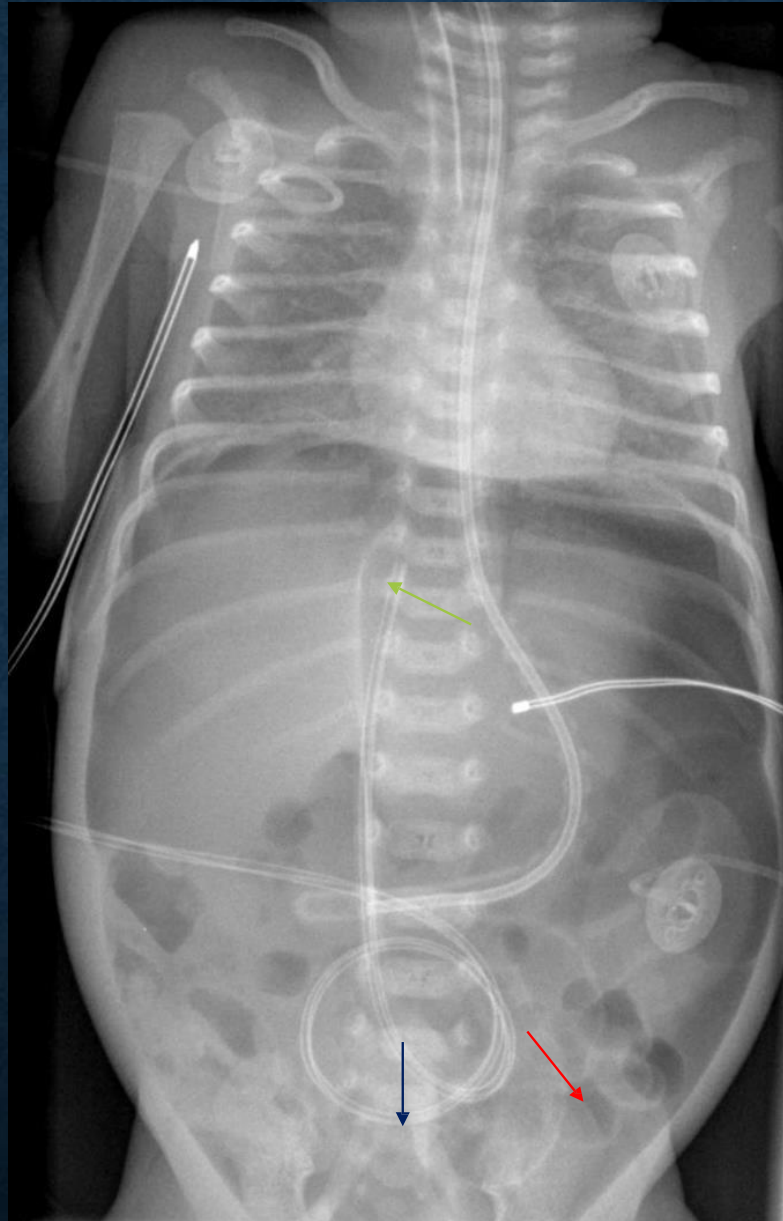
- Contrast enema studies demonstrating abnormal recto-sigmoid ratio of less than 1 with transition zone seen at the rectum.

**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



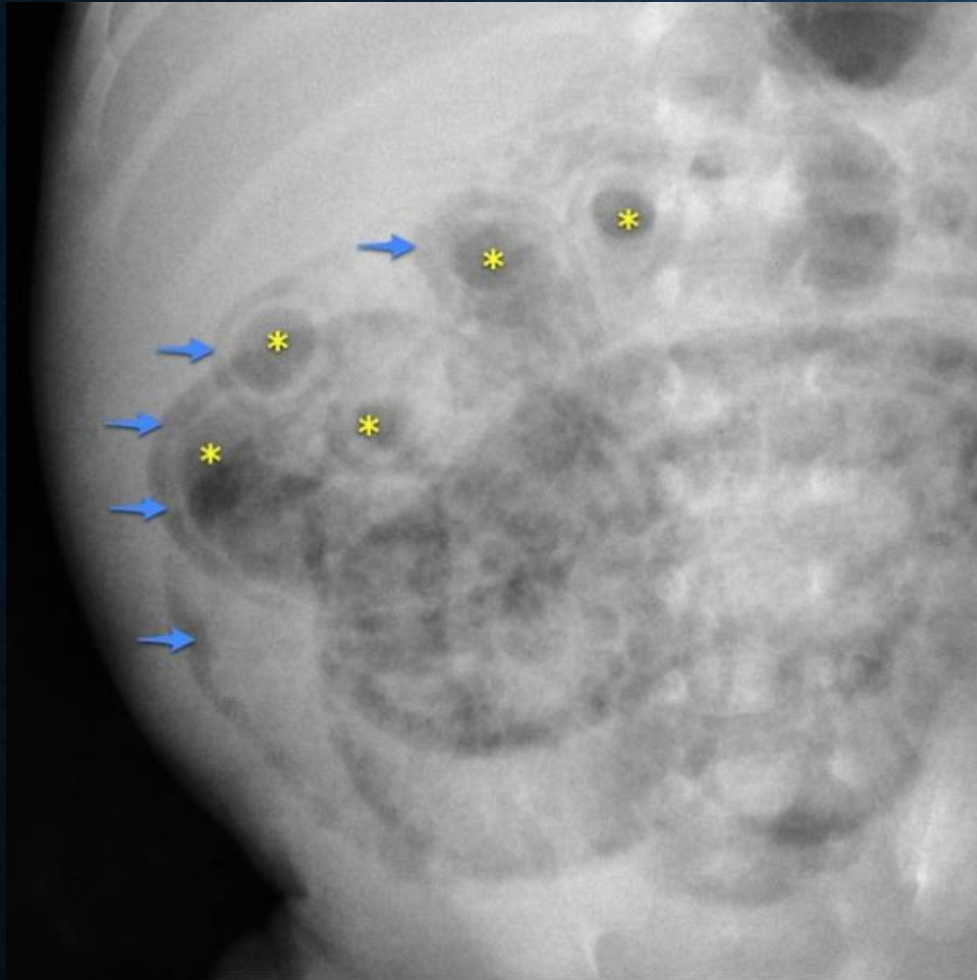
IMAGING FINDINGS

- 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)

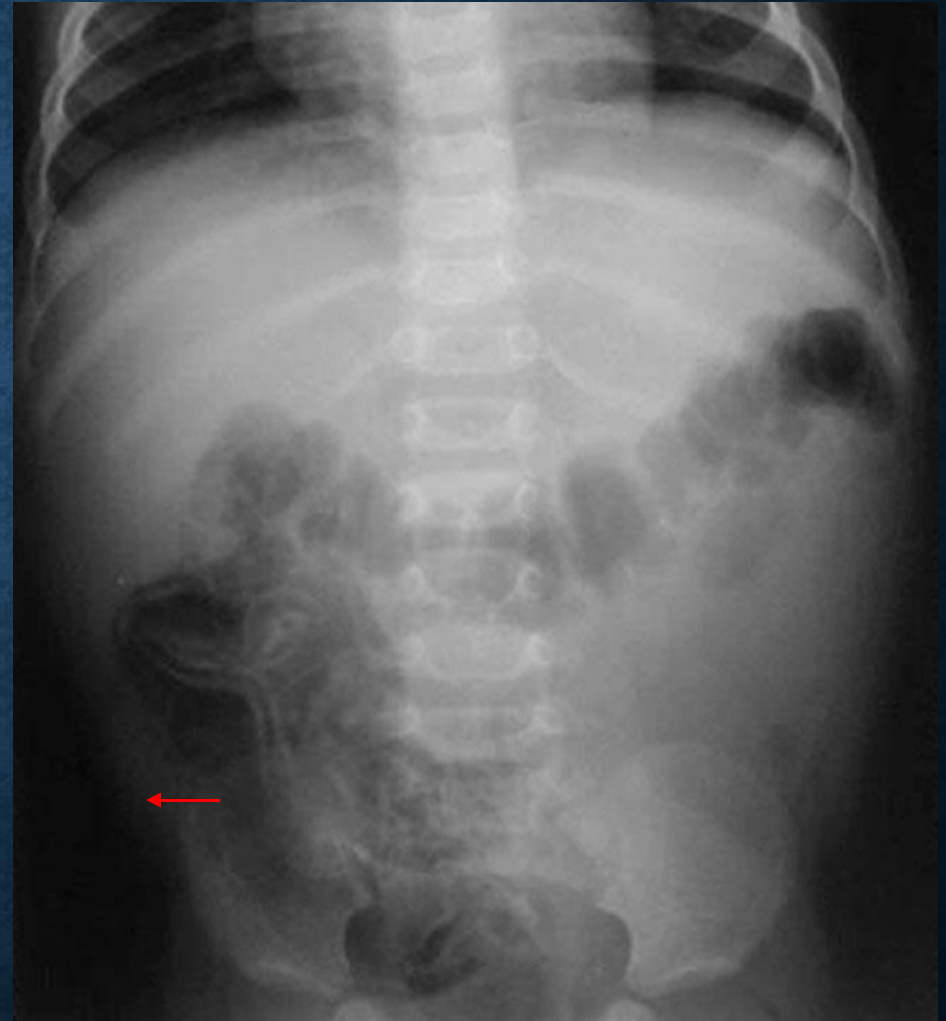
DIAGNOSIS: PNEUMOPERITONEUM

CASE 13

✚ Riggler sign



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**

↗ DJJ on the right

Malrotation

↓ Barium follow through

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



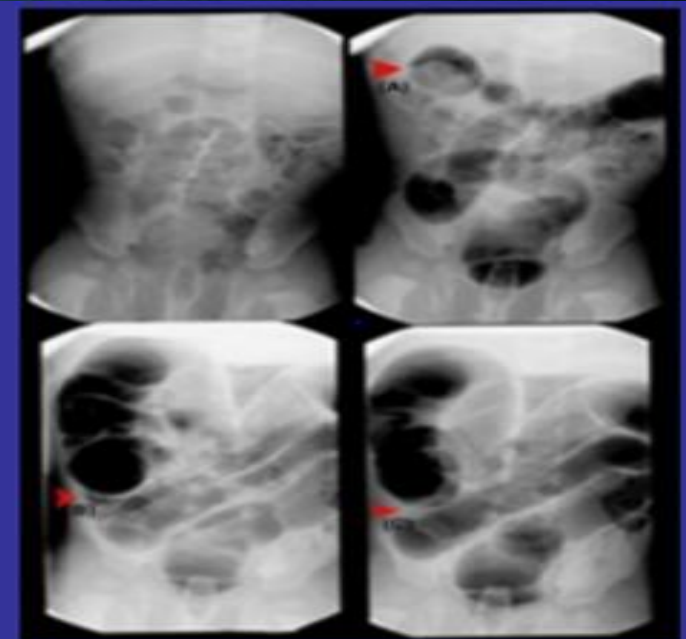
The duodenal-jejunal junction is to the right of the spine, and most of the small bowel is on the right side of the abdomen

Intussusception

Telescoping of one portion of the bowel into other .

Present at 3mo to 24 month.

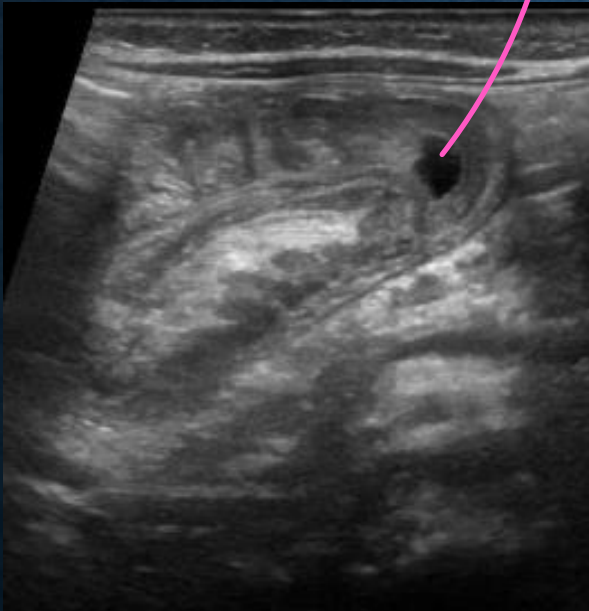
Treatment is fluoroscopically guided reduction with air or fluid enema or surgically if unreducible.



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)

+ Fluid in bowel

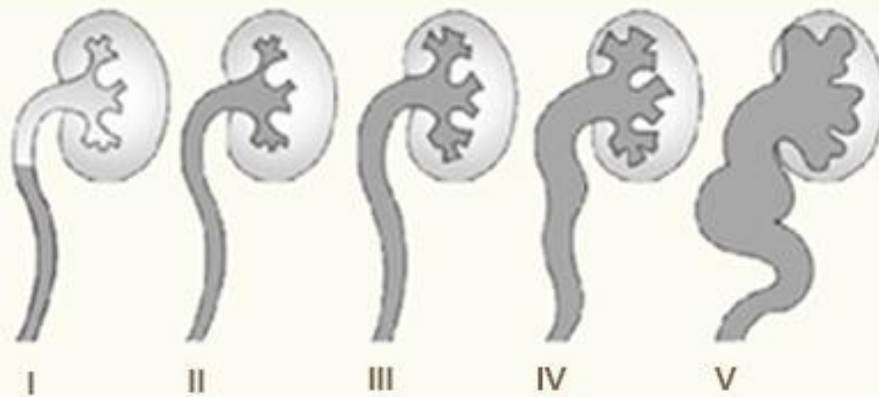
Pseudo kidney sign : alternating hypo/ hyper echogenic ring indicated telescopic bowel



MICTURATING CYSTOURETHROGRAM (MCUG)

↘ Non-ionized

- 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

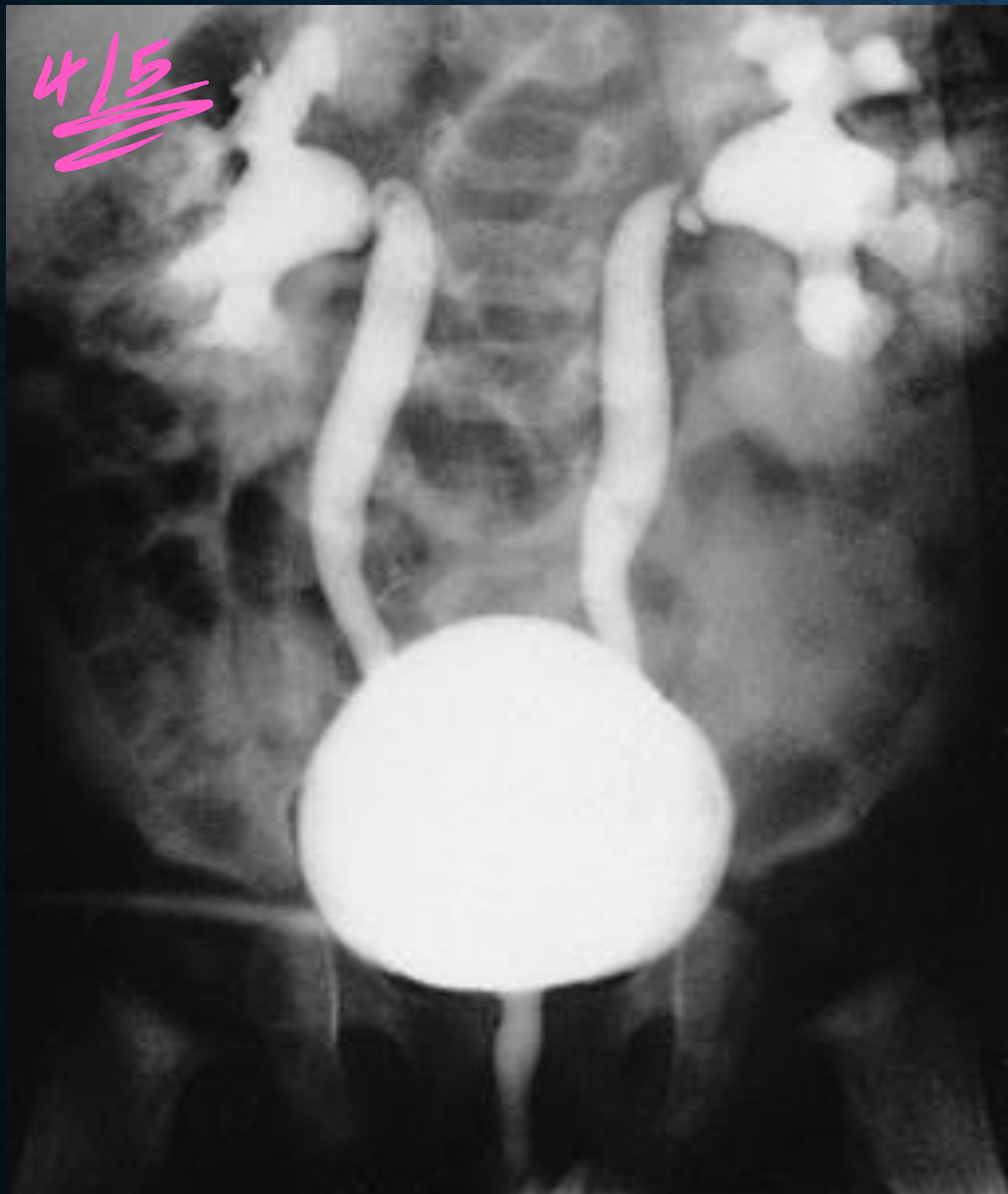
- I Into a nondilated ureter
- II Into the pelvis and calyces without dilation
- III Mild to moderate dilation of the ureter, renal pelvis, and calyces with minimal blunting of the fornices
- IV Moderate ureteral tortuosity and dilation of the pelvis and calyces
- V Gross dilation of the ureter, pelvis,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



Vesicoureteric Reflux

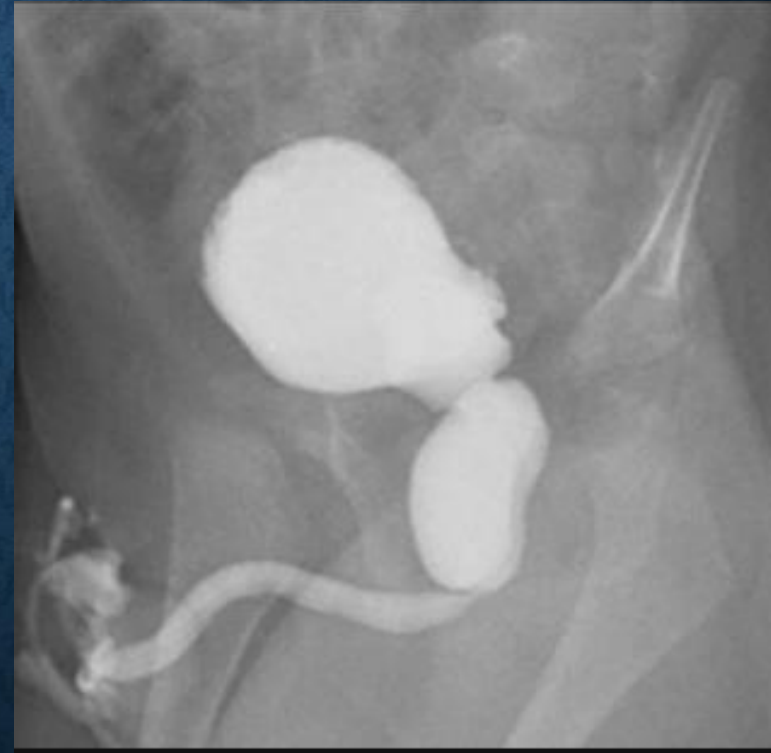


Grade I, left ureter



Posterior urethral valve

is a **congenital obstructing of posterior urethral membranes** and a common cause of obstructive uropathy in infancy.



THANK YOU