

جَائِزَةُ الْحُسَيْنِ
بْنِ عَبْدِ اللَّهِ الثَّانِي
لِلْعَمَلِ التَّطَوُّعِيِّ

AL HUSSEIN BIN ABDULLAH II
AWARD FOR VOLUNTARY WORK



النادي الطبي
Medical Club



Radiology

Subject: Pediatric imaging

Group no: D11

Done by: Hala Yaseen



هَذَا خُلِقَ اللَّهُ فَأَرْوِيهِ مَاذَا خُلِقَ الذِّينَ مِنْ دُونِهِ بَلِ الظَّالِمُونَ فِي ضَلَالٍ مُبِينٍ



DDH
✓S★
X-ray
at 4 months ★
CT → avoided
may affect on
the pt.

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 ✓

قبل ولادة
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 CXRs have to be read by clinicians.

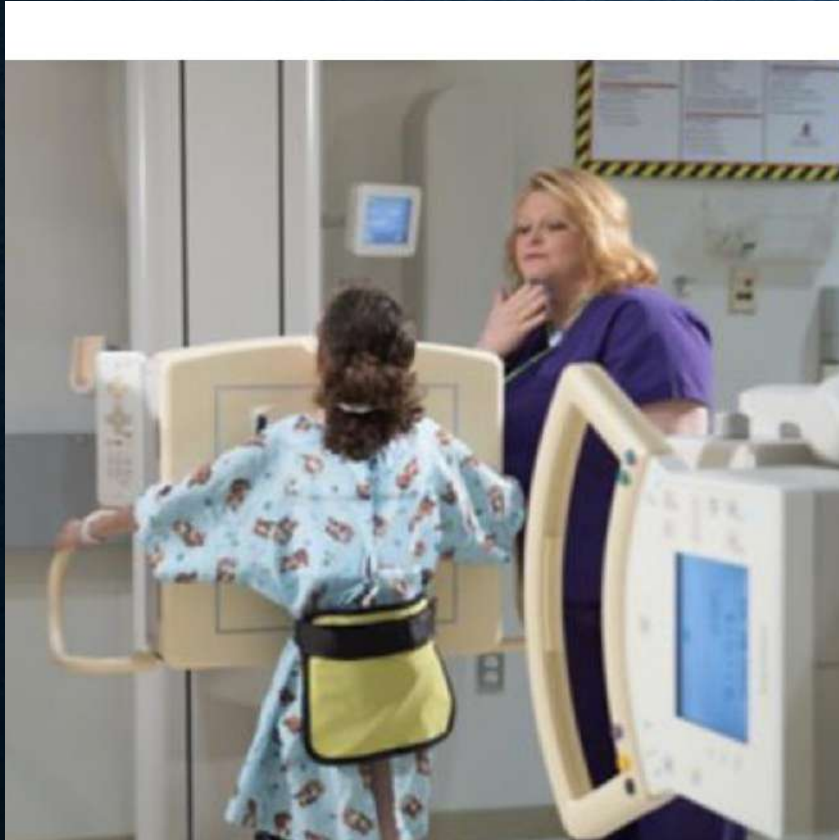
BASIC CXR VIEWS

- 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

AP → PA

PA
(ELDER CHILD/ADOLESCENT)



AP
(INFANTS/YOUNG CHILDREN)



LATERAL



LINES AND TUBES

endotracheal tube

Bifurcation of the trachea to (main) left and right bronchus

165°, above angle with 2.5 cm

- **ETT** above carina, below inlet, varies with neck position (between thoracic inlet and carina). Ideally the tip should lie between C7 and T4, 1.2 cm below the vocal cords, or 2 cm above the level of carina. to assess ventilation

orogastric tube

- **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

umbilical arterial

- **UAC** - high T7, low L3-L4 at L1 ⇒ for measuring BP and samplings

umbilical drains

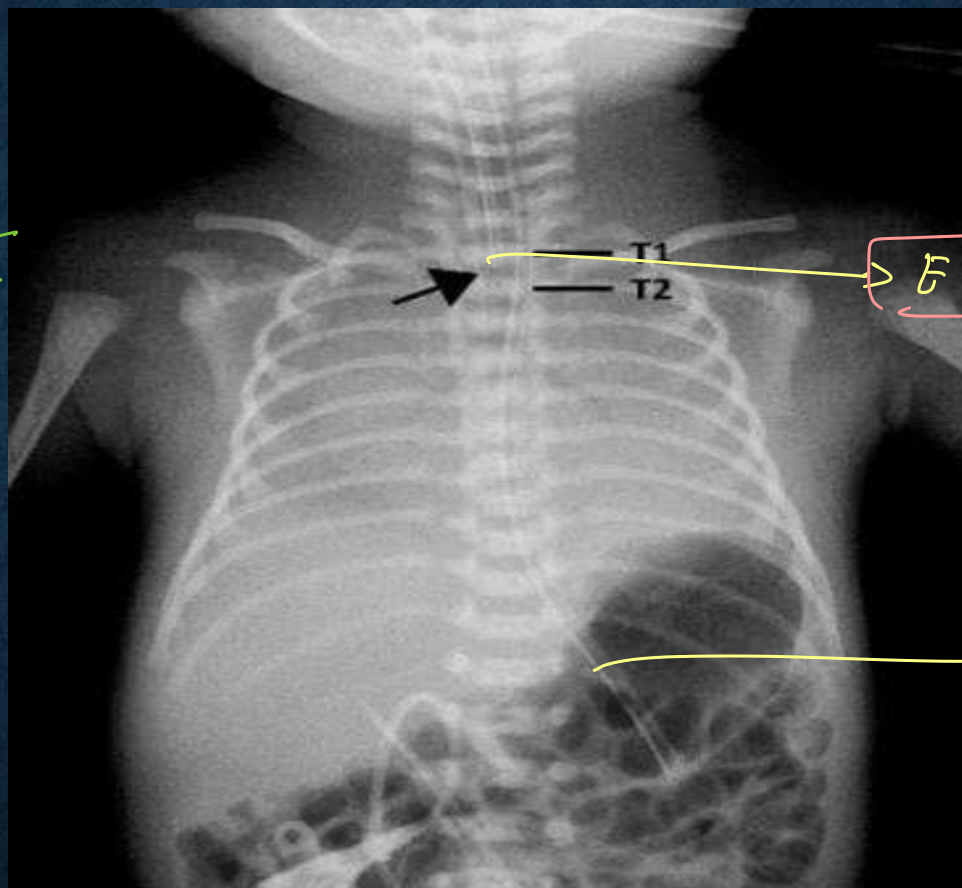
- **UVC** - IVC/RA, not in liver! at R1

→ Purpose » giving medications

any tube has fenestrations

not in ported → malpositioned UVC

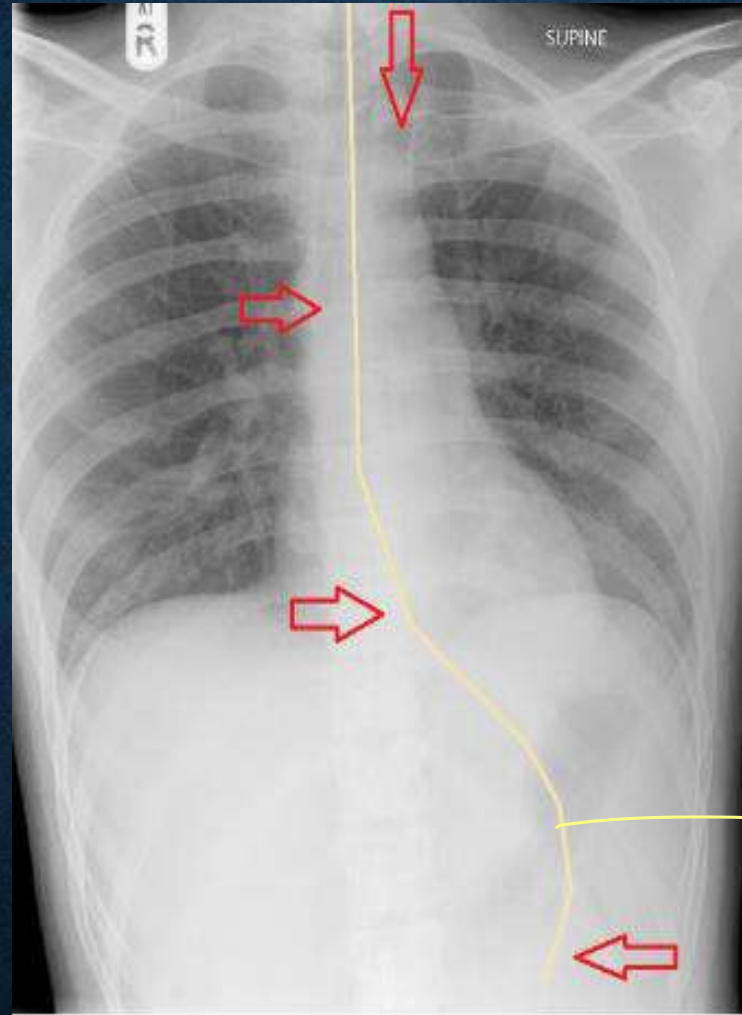
epiphysis? ←



ETT

ETT (→ btwn C7 and T4
ideally)

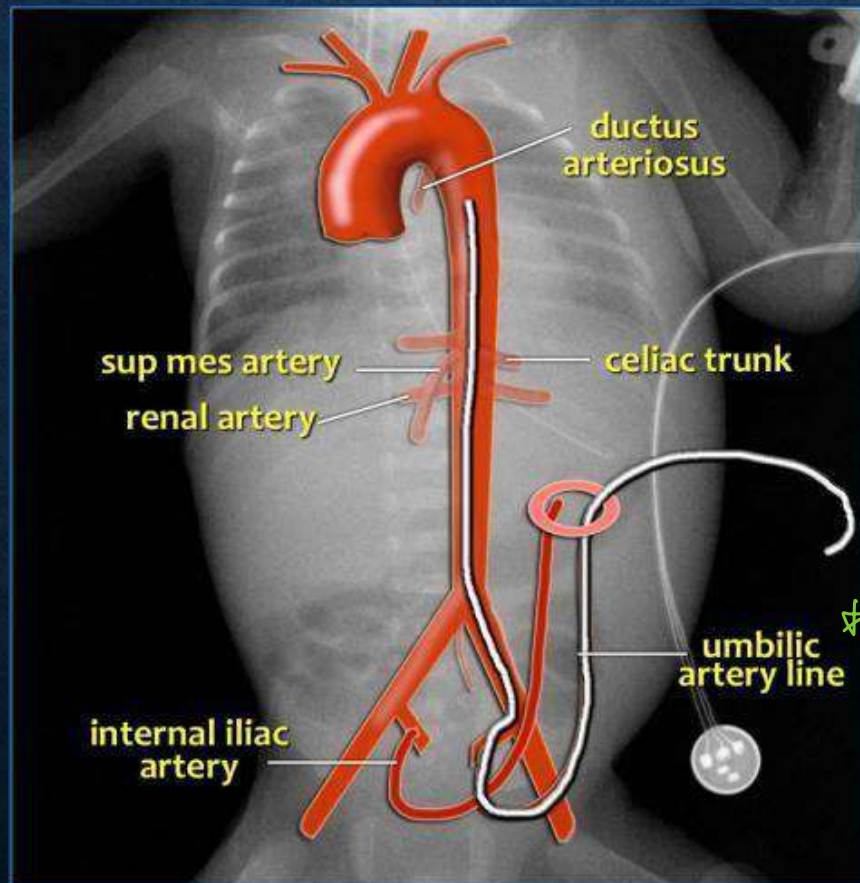
→ OGT
at stomach



OGT

OGT

UAC



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

• Aorta on the left

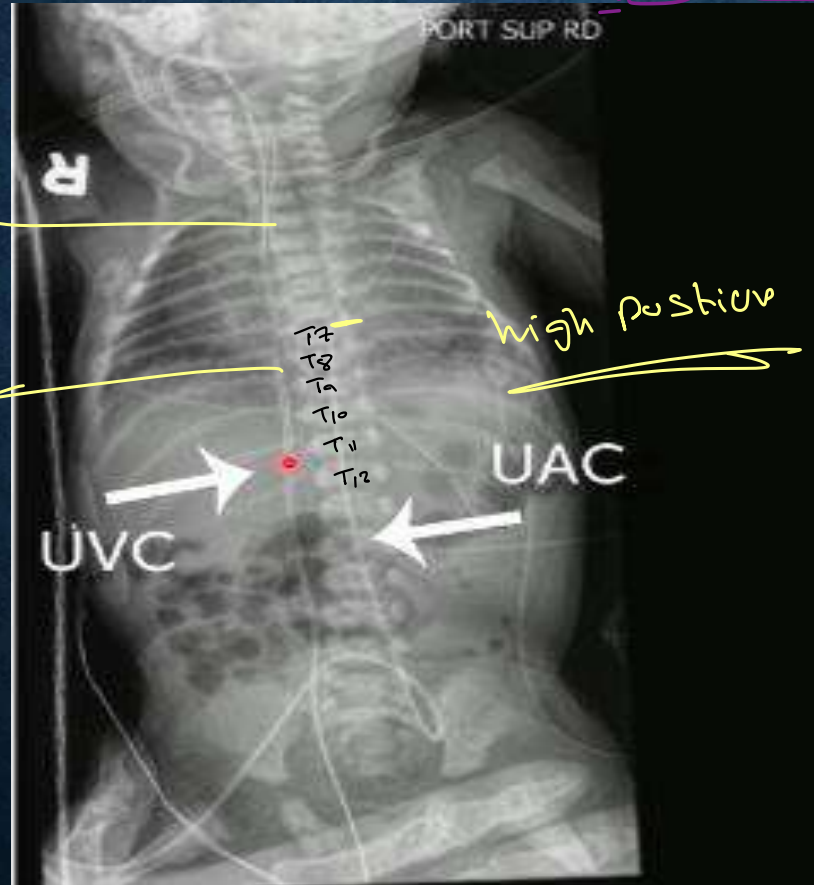
• Vein on the right

منه فليب

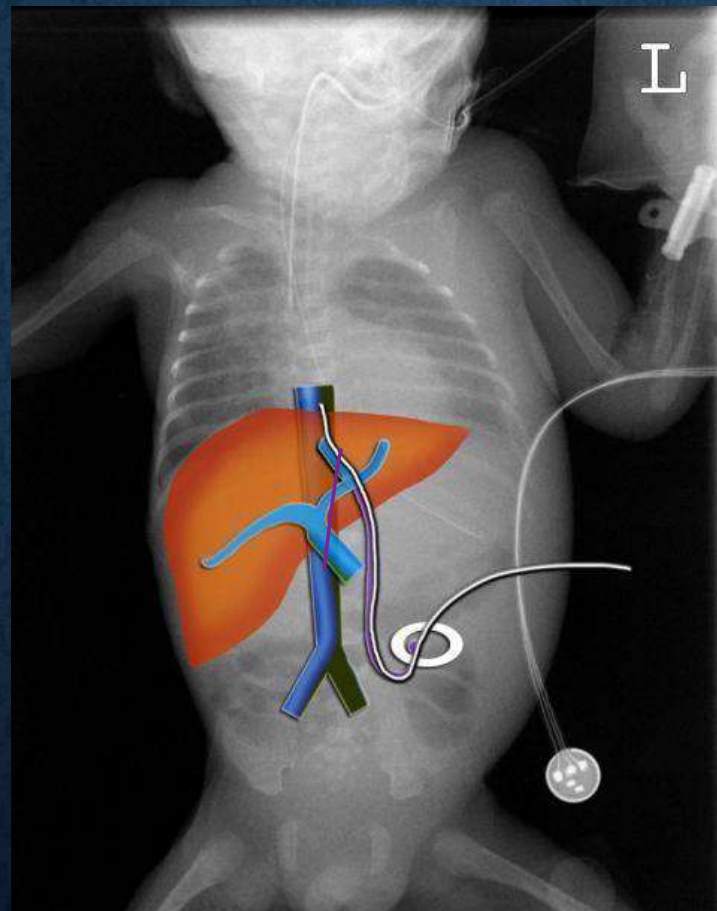
Right and left according to vertebral column

قناة ال UVC

at RA



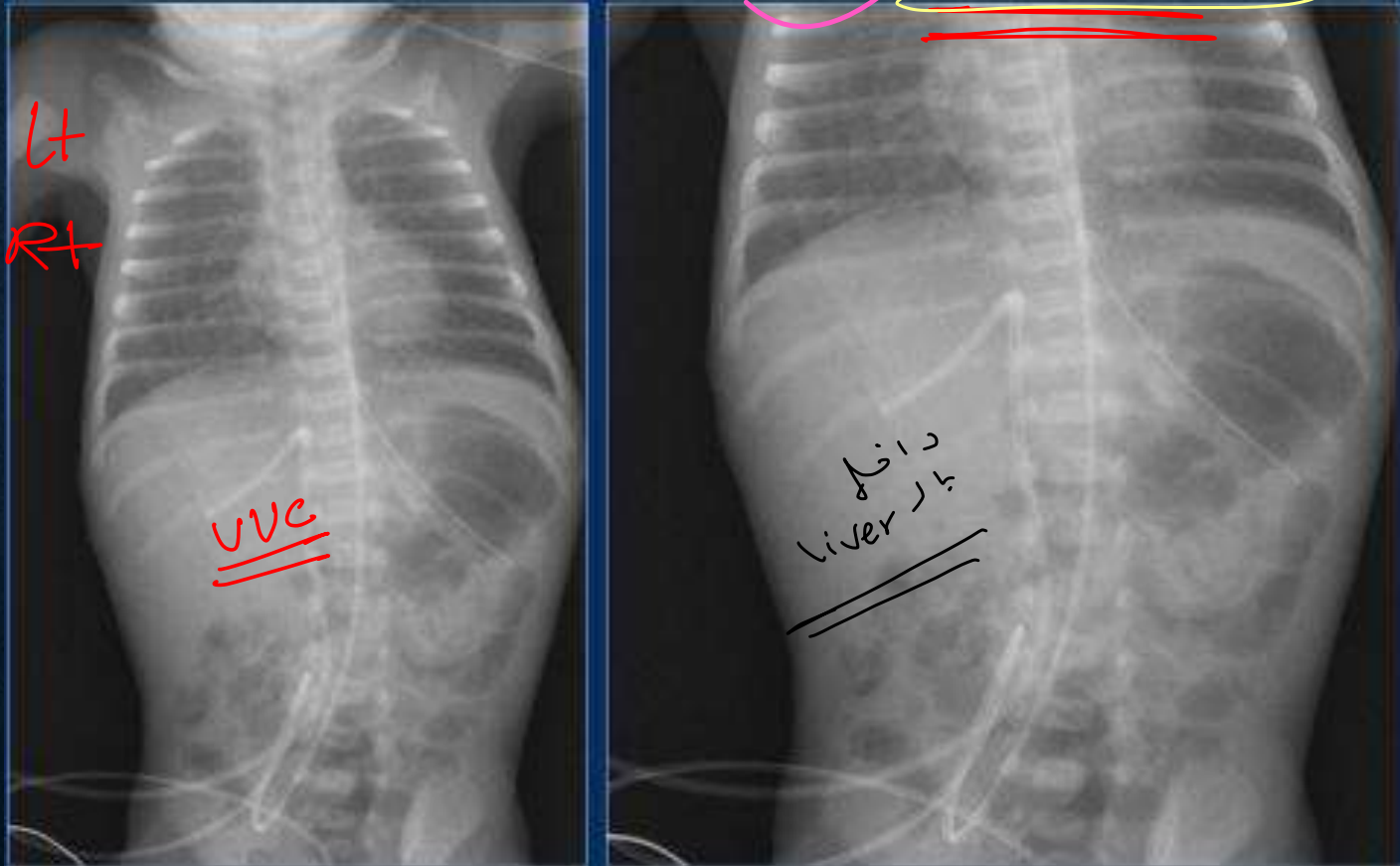
UVC



GOOD POSITION OF UAC BUT WHERE IS THE UVC!

Malposition in the liver

Aorta → Lt
IVS → Rt



CXR-SYSTEMATIC APPROACH

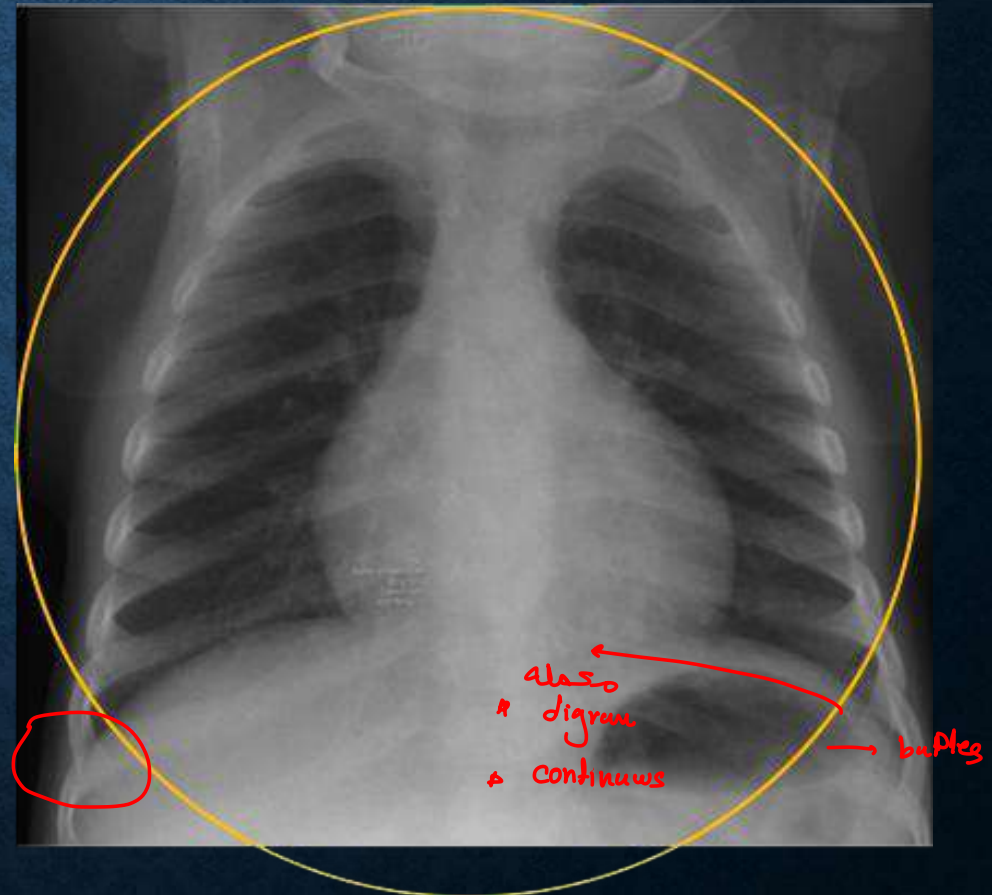


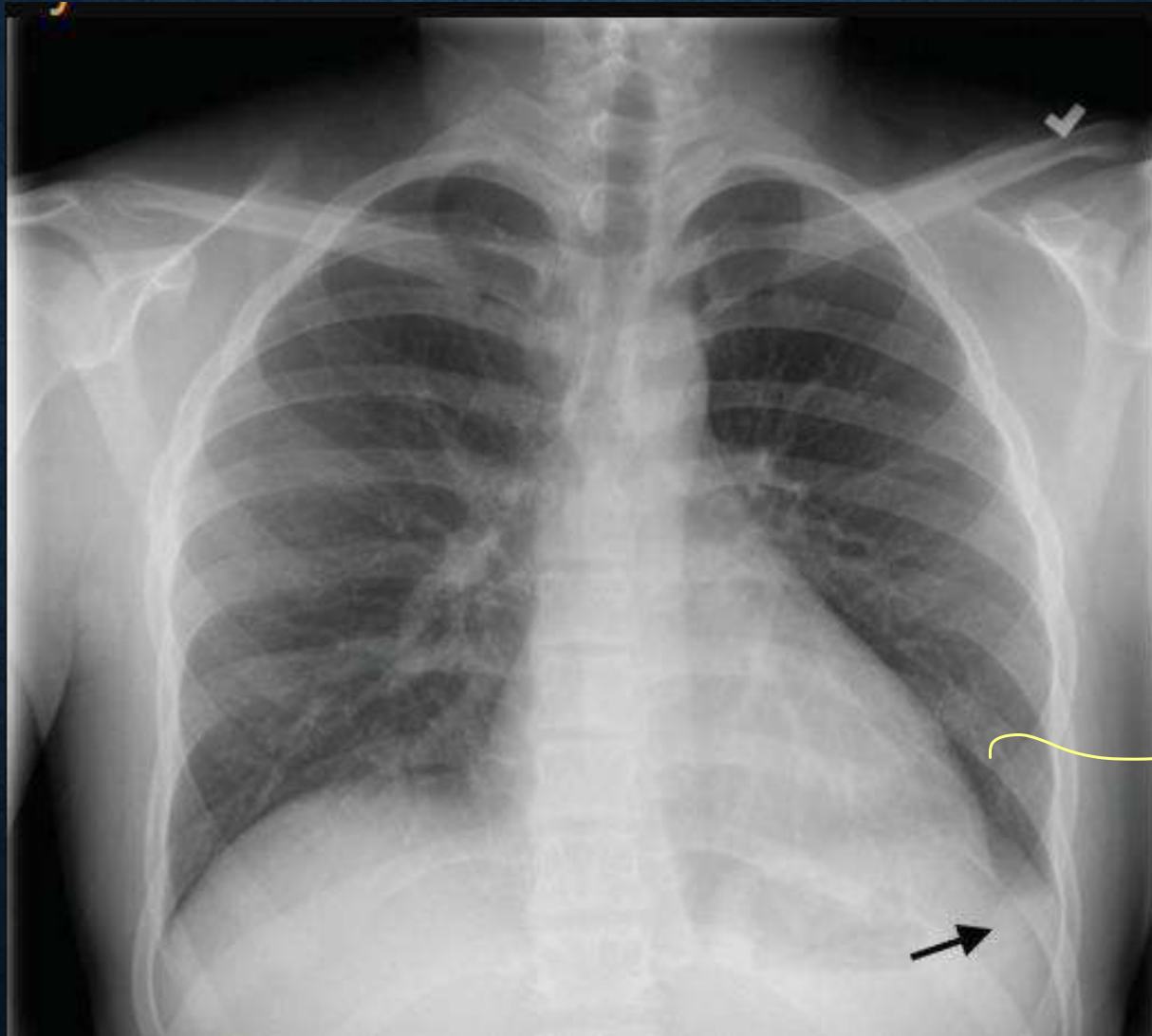
* Chest x ray ✓

FIRST CIRCLE

Bone
SC tissue
Costophrenic angle

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





→
lt. pleural
effusion

Small pleural eff. or atelectasis (lung collapse)


✦ Normal costophrenic angle should be sharp

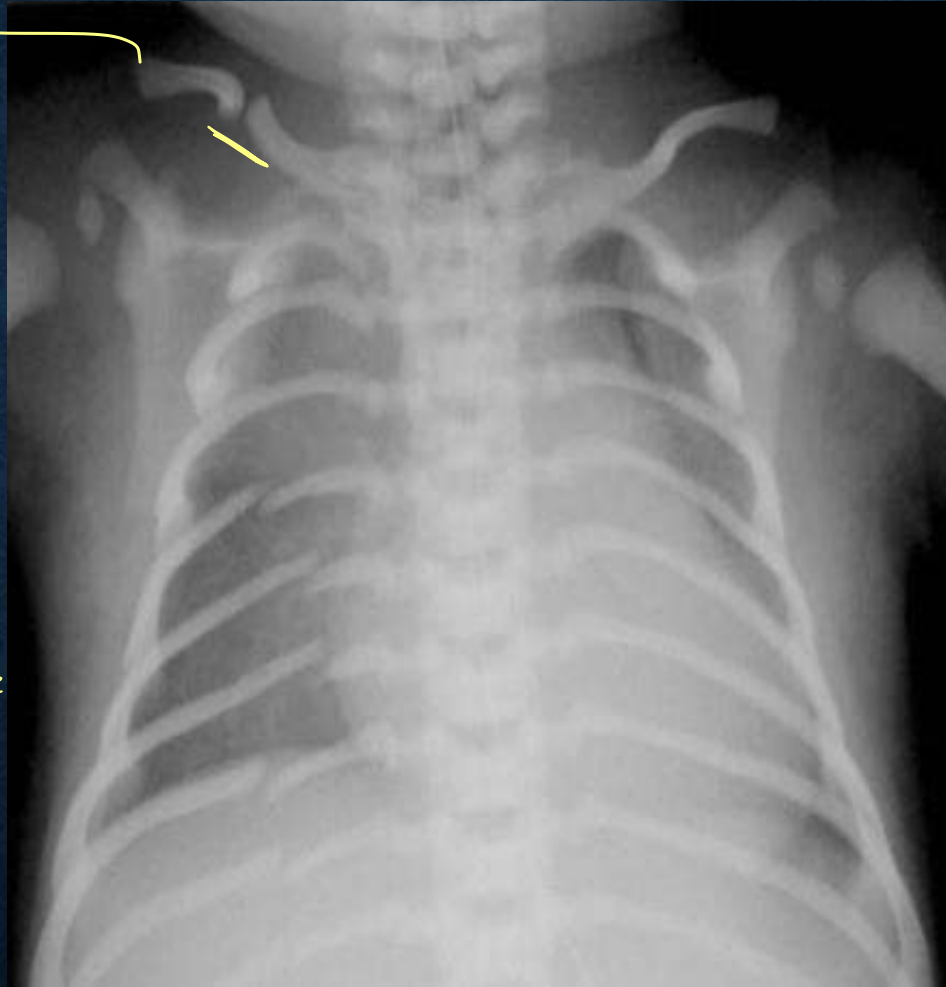
**BLUNTED LEFT COSTOPHRENIC ANGLE DDX
SMALL PLEURAL EFFUSION OR ATELECTASIS.**



دليل انه ← Callus formation
كسر قديم (Soft)
وعم بطيب

Rt. ribs
displaced
fracture

acute fracture
recent = sharp
Fracture



→ Abuse

multiple
fracture

✦ Old fracture » calus » new bone formation

✦ Sharp fractures + displaced

✦ 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

excluant injury

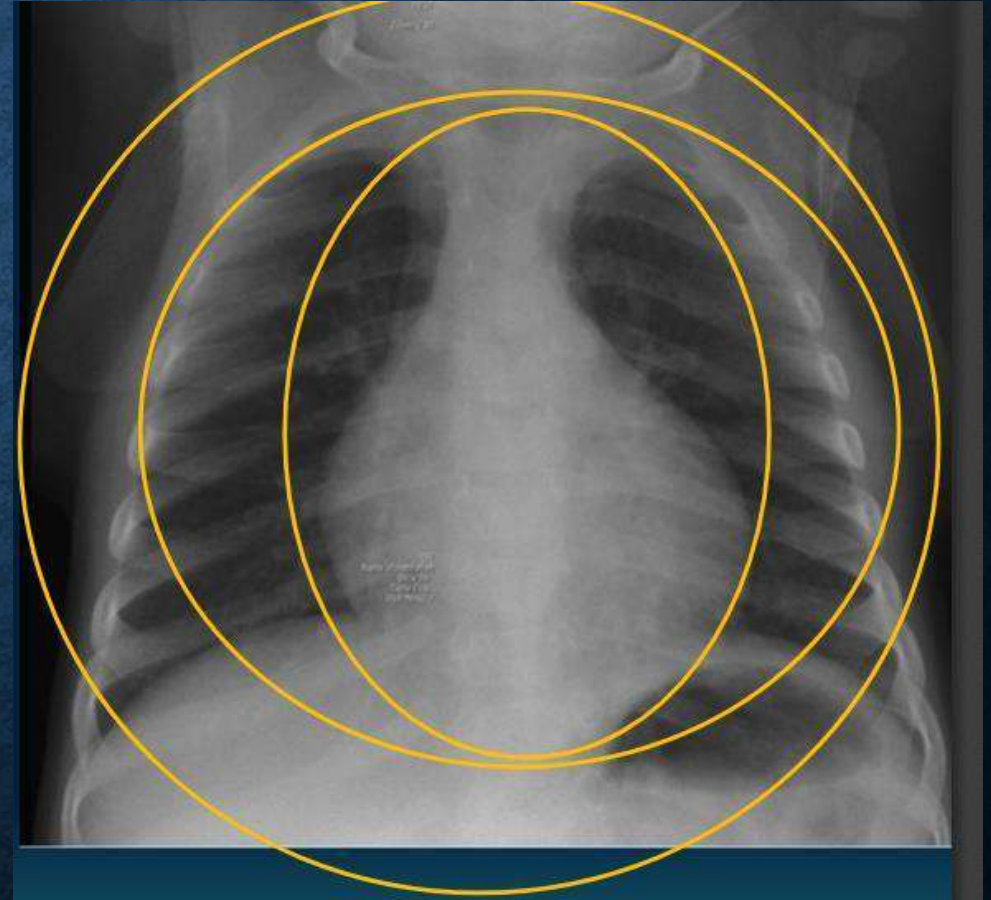
SECOND CIRCLE

- Lung parenchyma and vascularity

* History → febrile?, cough?, FB aspiration?

* Take insp. and exp. imaging for
nlts. (لا تفتقر بالصم)

* بس من شدة اصور insp → exp ممكن بس منظار
حنسي، ضاحنا بنقود.



ENDOBRONCHIAL FOREIGN BODY

Chocking and aspiration » inspiratory and expiratory X-rays

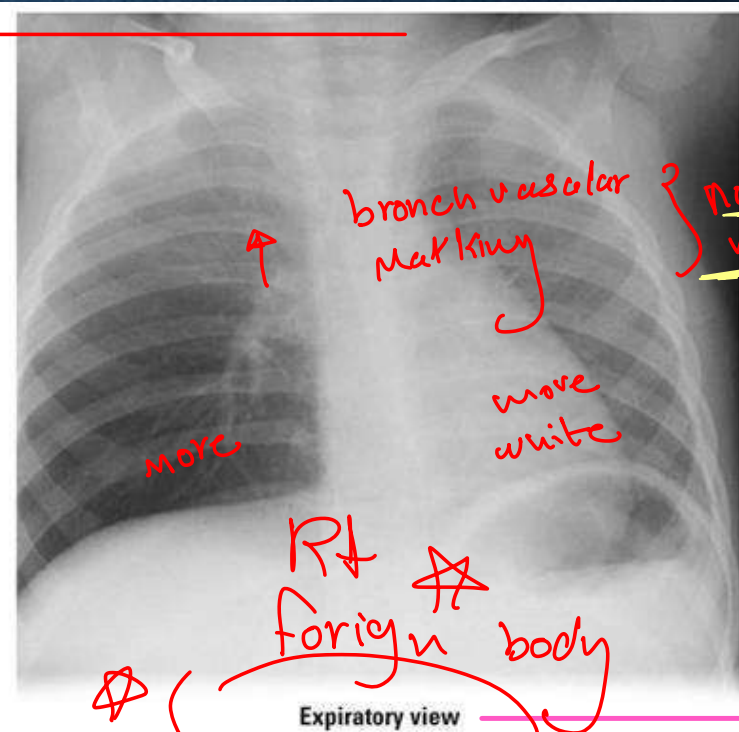
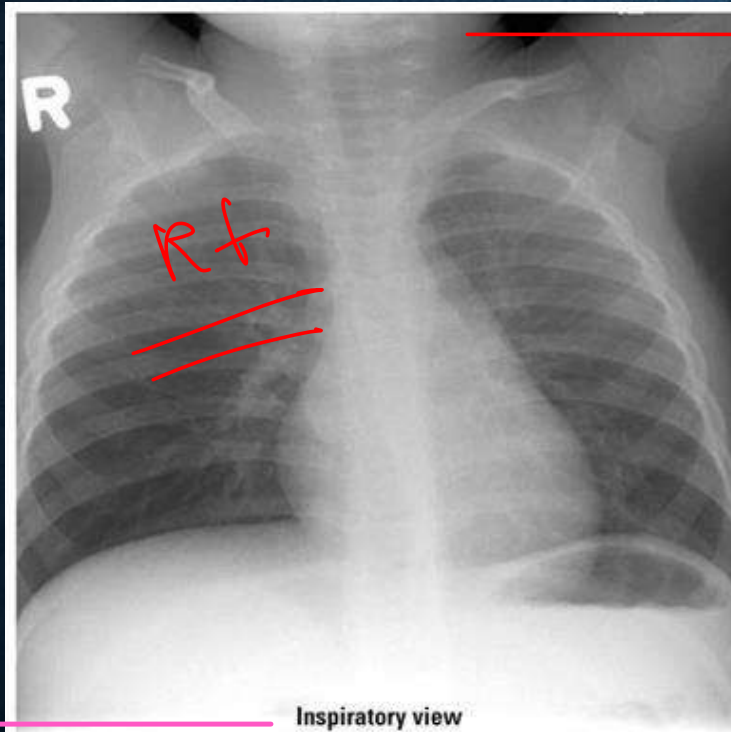


Figure 1. Right-sided air trapping (i.e., obstructive emphysema) due to partial obstruction (check valve) of the right main bronchus. The left side deflates during expiration but the right side cannot deflate. Mediastinum shifts toward the unobstructed side. When obstruction becomes complete, then complications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

No abnormal finding

bronchovascular marking

more white

Rt foreign body

normal white

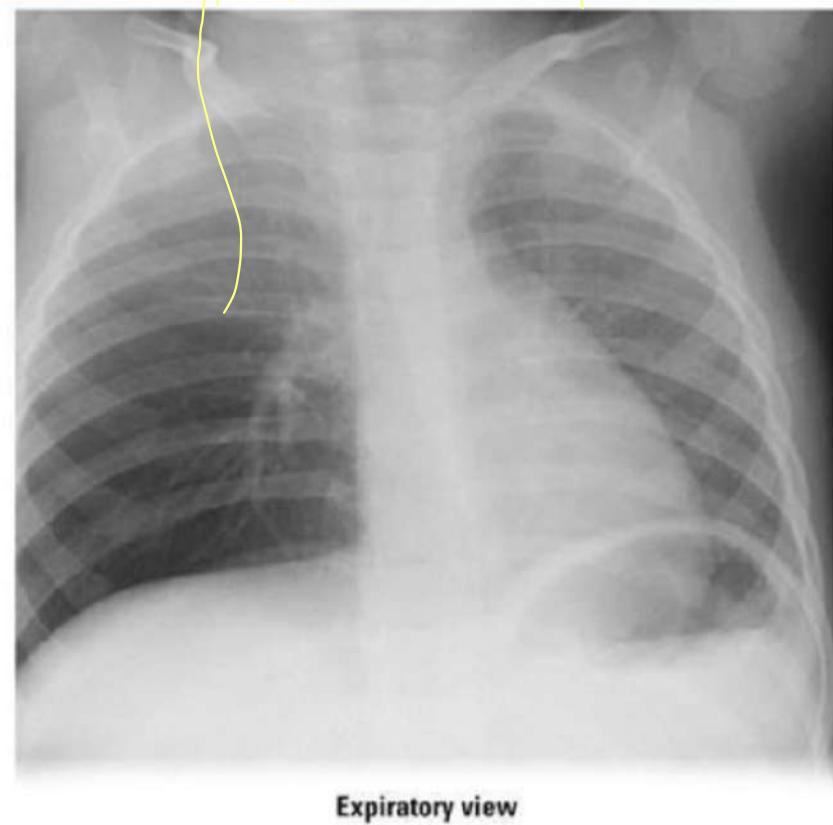
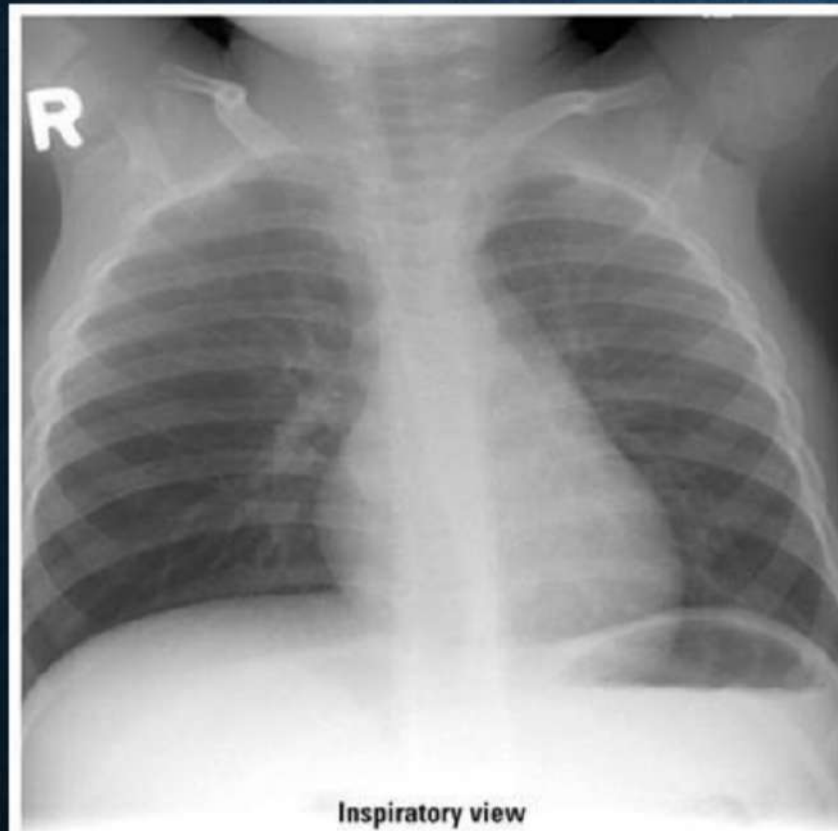
not PTX
vascular

Slight shifting

Air trapping in right lung » more black

contralateral

ENDOBRONCHIAL FOREIGN BODY



Rt. lung obstructed

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 markings are visible

Air trapping
on the right



(overexposure) ✂

LUNG PATHOLOGY: ALVEOLAR LUNG DISEASE

Also known air space disease

• Features of Airspace disease:

- ① • Air bronchogram (hallmark).
- ② • Respects lobar anatomy.
- ③ • Ill-defined borders except at fissures.
sharp.

• Airspace disease could be:

- ① • Partial: Ground glass opacity.
- ② • Complete: Consolidation.

1 Air bronchogram (Hallmark 🌟)

• القصبات مليانة هواء
• الحويصلات حوالها مليانة سائل
→ قيتين القصبات سودا جوا منطقة بيضا
وجوده بقوة يدل على alveolar pathology

2 Respects lobar anatomy

• المرض بيلتزم بحدود القصص
لأنه الـ alveoli بتنتشر ضمن نفس الـ lobe

3 Ill-defined borders

• الحواف مش واضحة
✗ إلا عند:
• fissures
→ هناك بتكون sharp وواضحة

◆ Partial filling → Ground Glass Opacity (GGO)

• في هواء + سائل مع بعض
يشوفني:
• أوعية دموية ✓
• bronchial markings ✓
• مش ماسكة الرئة بالكامل ✓
أمثلة: 🌟

- Early pneumonia
- Pulmonary edema (mild)
- ARDS (early)

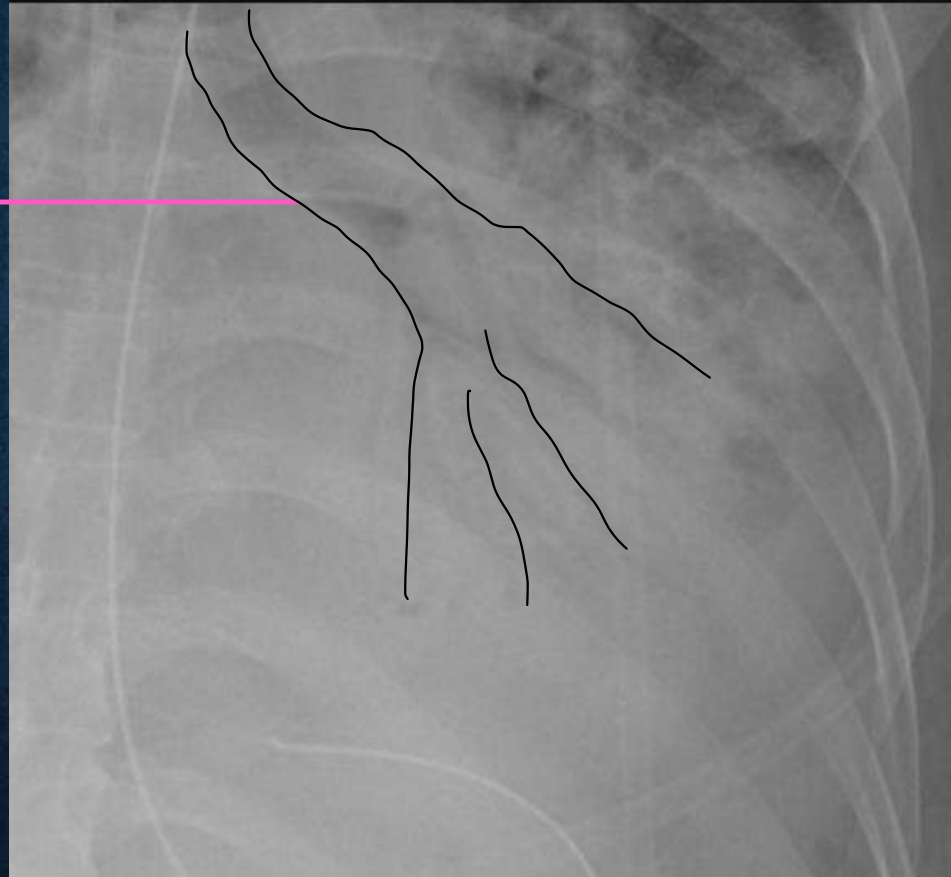
◆ Complete filling → Consolidation

• الـ alveoli ممتلئة بالكامل
• بتغطي:
• vessels ✓
• lung markings ✓
• غالبا معها air bronchogram واضح
أمثلة: 🌟

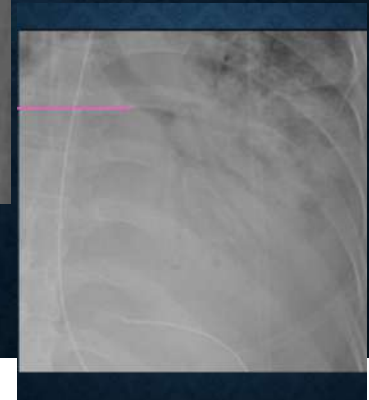
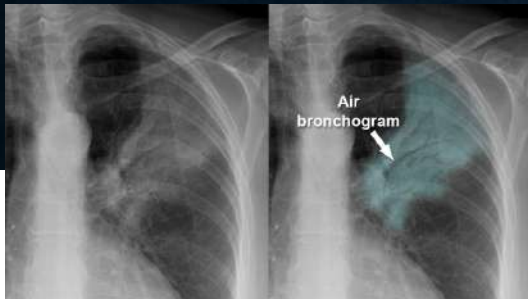
- Lobar pneumonia
- Aspiration
- Pulmonary hemorrhage

Air bronchogram (

Opacity of lung » air visible in bronchus



اكيد normally ال bronchi فيهم air
لما ال lung حوالهم 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)** rounded
- Pulmonary hemorrhage (blood).

pneum → دائره
موزعيه خبار

viral mostly

lower tract infections.

- Etiology of LRI varies with age

★ Preschool **95%** (viral)

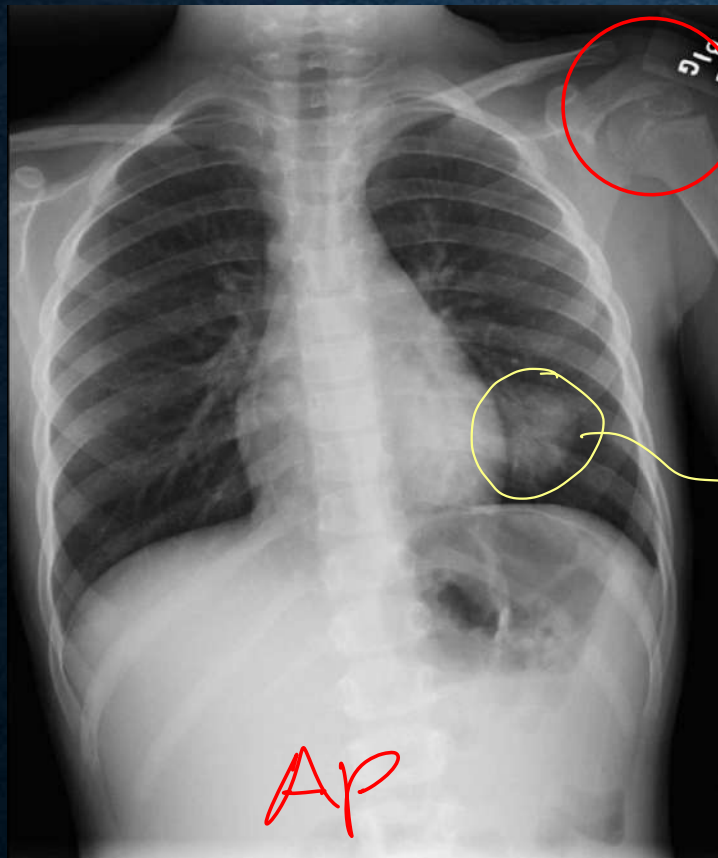
★ School age : Viral > Mycoplasma [30%] > streptococcal

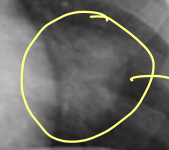
(Collaterals not mature) 

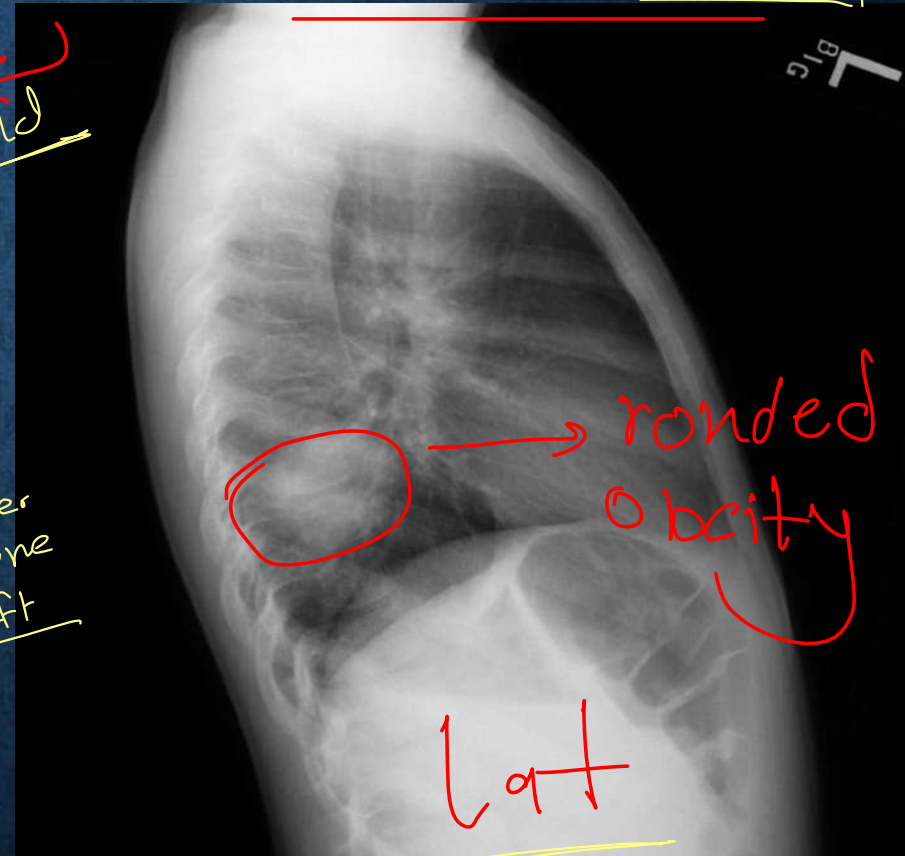
LLL ROUND PNA

ال pneumonia بتيجي بالاطفال rounded mass 

 Rounded pneumonia in left lower lobe 



 child 

lower zone left 



 rounded opacity 

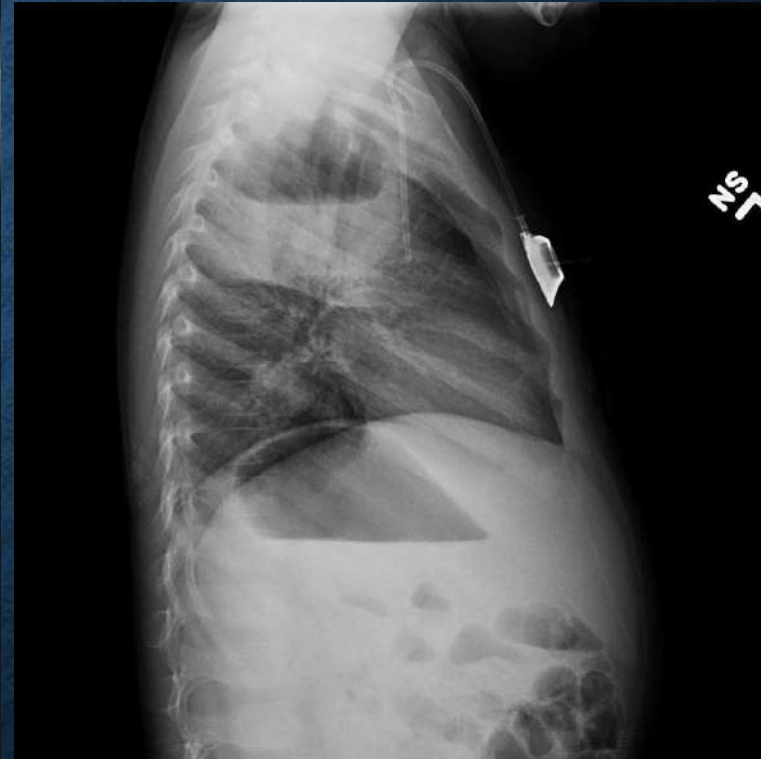
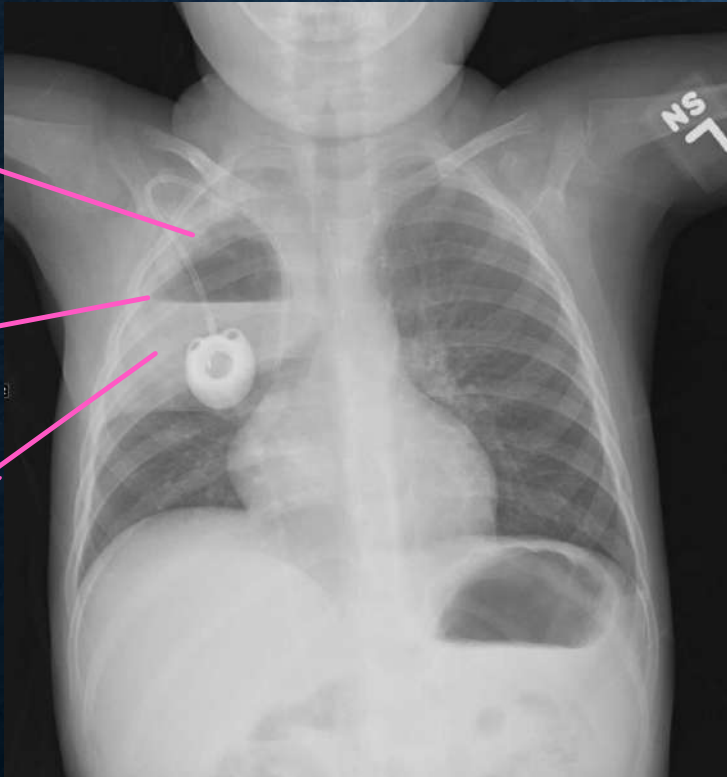
lower lobe 

ROUND PNEUMONIA

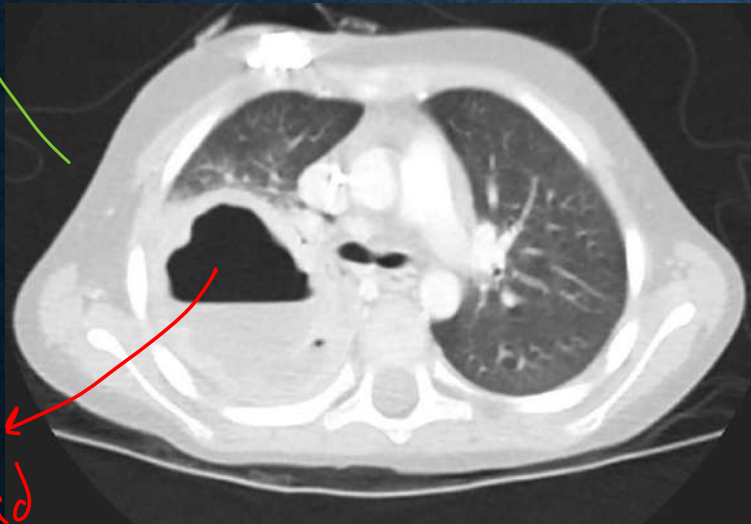
- Definition: Nonsegmental consolidation seen up to 8 years of age secondary to lung immaturity. Collateral pathways not well developed.

- Most common cause is Streptococcal pneumonia

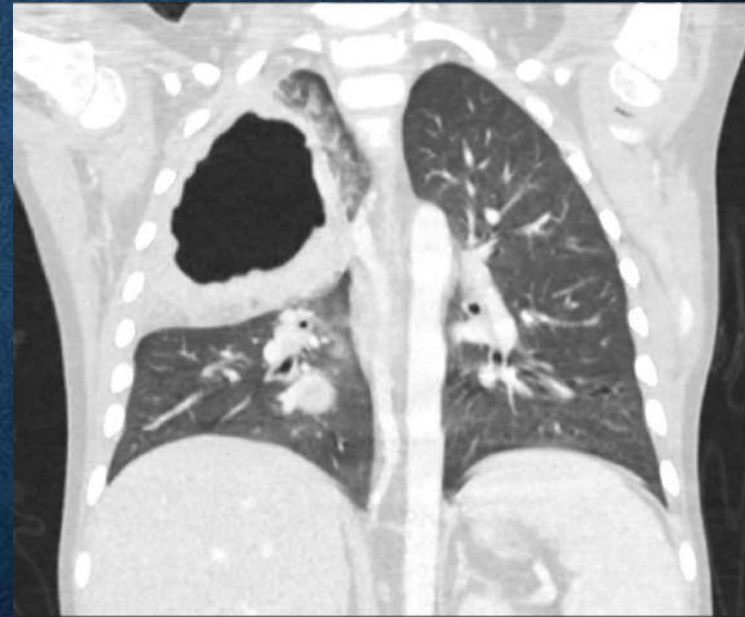
RUL CAVITARY/NECROTIZING PNA



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



Axial



Coronal

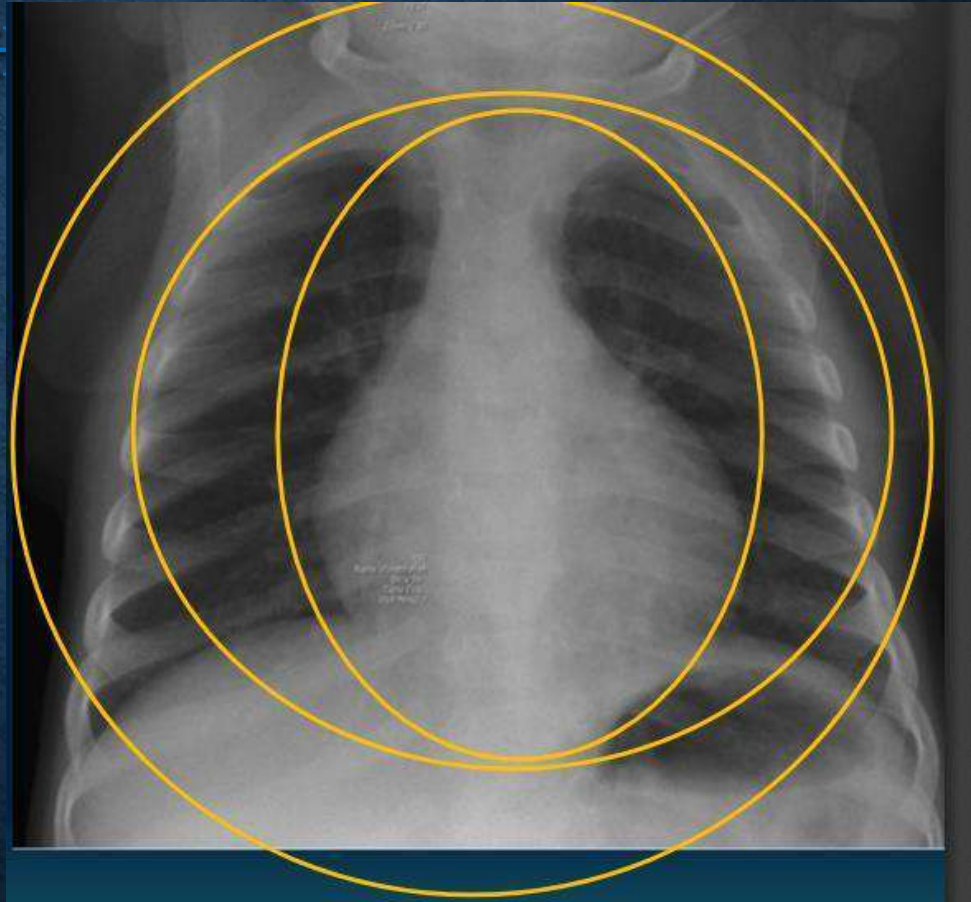
★
Lung window

CT →
اپنی کیس
lung

Air
Fluid

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



lat.
x-ray

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

↳ Narrowed trachea

+ Not life threatening

+ Barking cough ✓

AP ✓

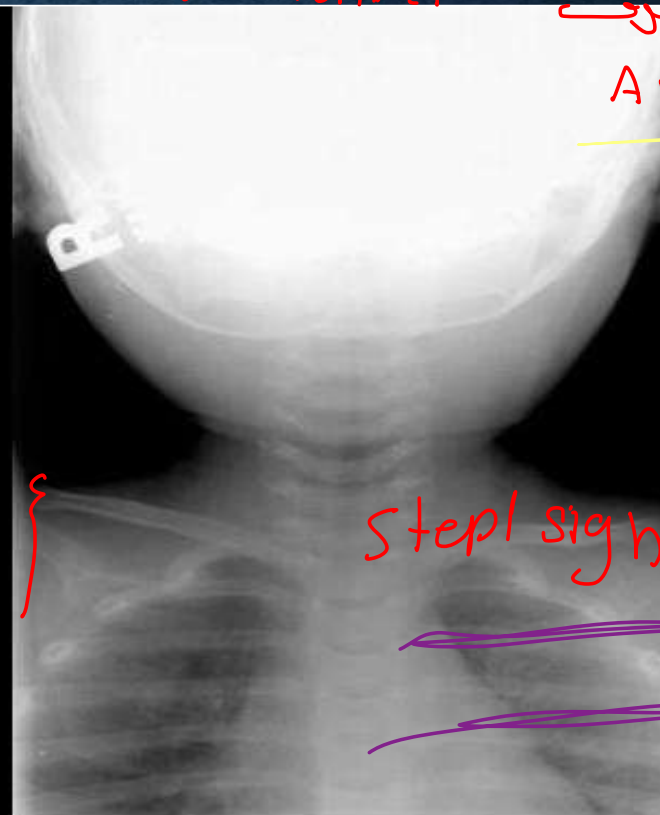


- Croup = viral + barking cough + stridor
↳ parainfluenza virus mostly
- X-ray: Steeple sign
inspiratory
- العلاج الأساسي: Steroids



lt
epiglo

Thumb sign



AP

step sign

X Frontal

سفر

AP x PA

Distinguish this disease from previous

imp

~~★~~ Mediastinal mass

4 Ts

✓

Anterior

✓

Middle

LWS
cysts

✓

Posterior

neuro

Thymus

Lymphadenopathy

Neurogenic
Tumors

Teratoma germ
cell Tumors

Lymphoma/
leukemia

Neuroblastoma
Ganglioneuroma

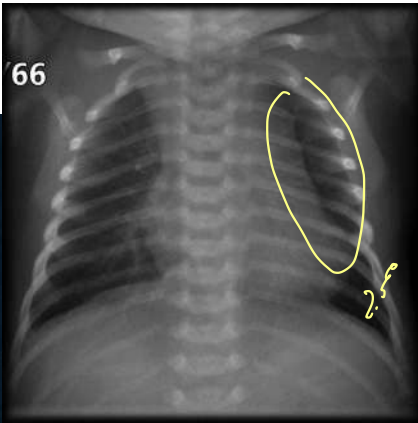
Thyroid

Bronchogenic
cyst

Neurofibroma

Lymphoma

Thoracic aorta



THYMUS

⇒ normal organ
⇒ عفاار

- ✦ Anterior mediastinum
- ✦ Costochondral indentations (wave sign)
- ✦ Notch sign
- ✦ Sail sign
 - Never compressive → if compressed → it's pathology
 - Change with position/inspiration-expiration
 - normally change, but if tumor → fixed

Notch Sign →

1 Costochondral indentations – Wave sign

• حواف الـ thymus متموجة
• بسبب ضغط الأضلاع والغضاريف عليه
• علامة طبيعية ✓

2 Notch sign

• وجود (notch) من:
• الـ thymus
• والـ cardiac silhouette
• يفرقه عن mediastinal mass

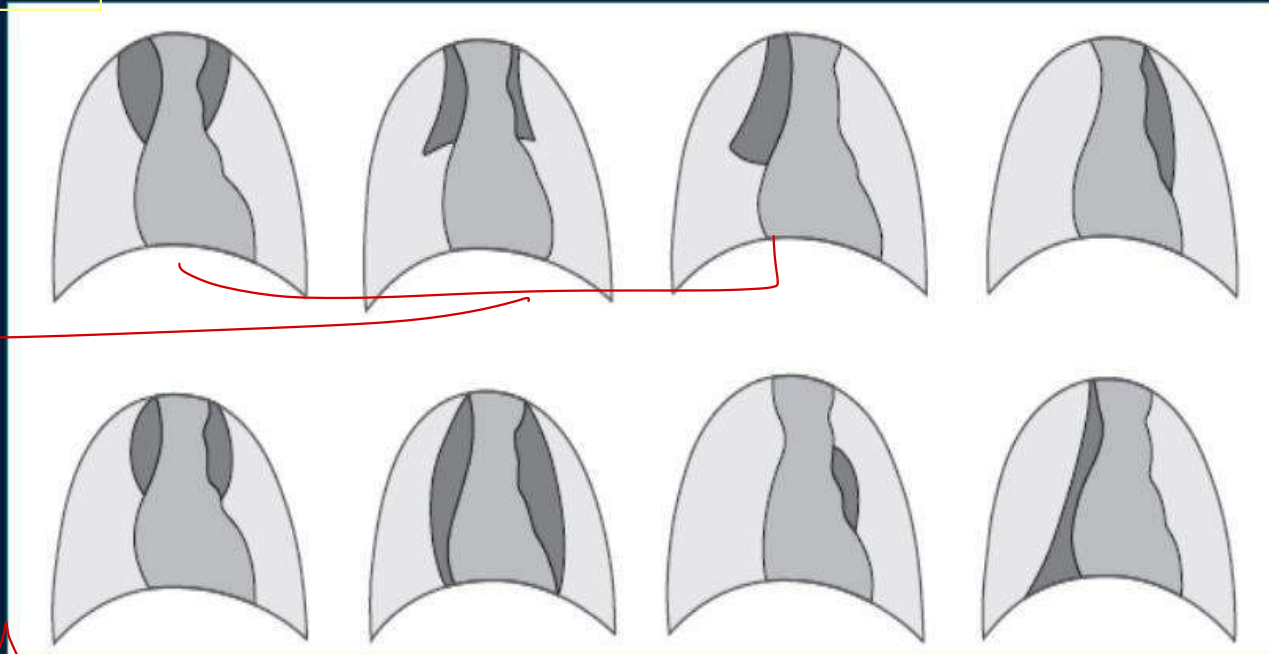
3 Sail sign 🚢

• خاصة بالجهة اليمنى
• شكل الـ thymus مثل شراع السفينة
• شائع جدًا عند الرضع



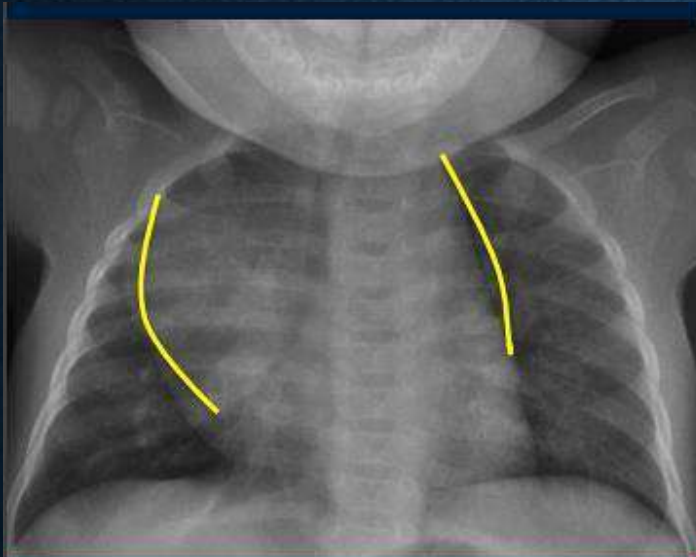
◇ Thymus: Various shapes and sizes

Normal until the age of 16

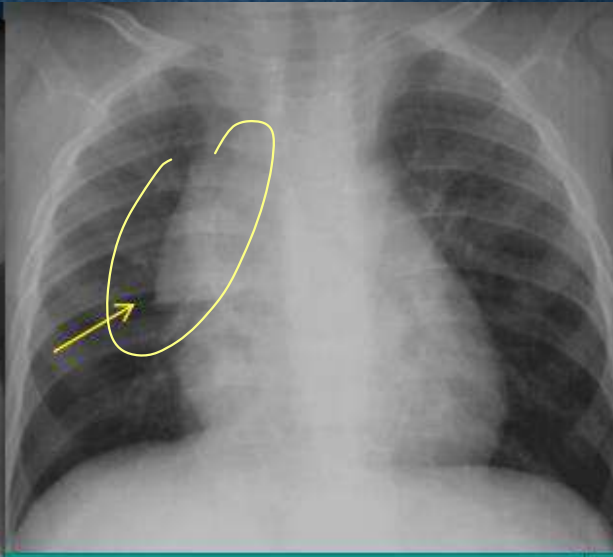


most
common
normal
in children

normal →



2 month old



7 month old

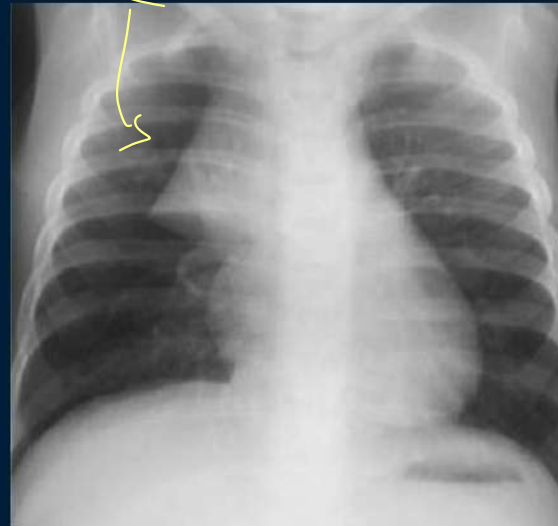


16 year old

افتنف



Asymmetric hypertrophy of the right lobe of the thymus



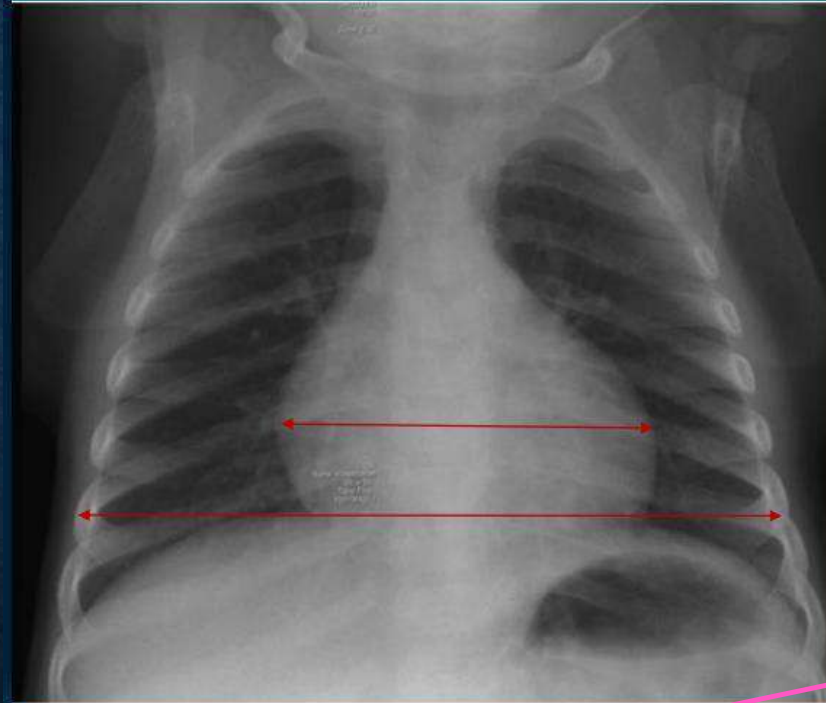
« **sail sign** » triangular appearance
Hypertrophy of the right lobe
Angular corner flattened
at the right minor fissure



اشعار سینه

THIRD CIRCLE- HEART

Cardiothoracic index



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

✱ لأنه اولاً بنصورهم AP و ثانياً في

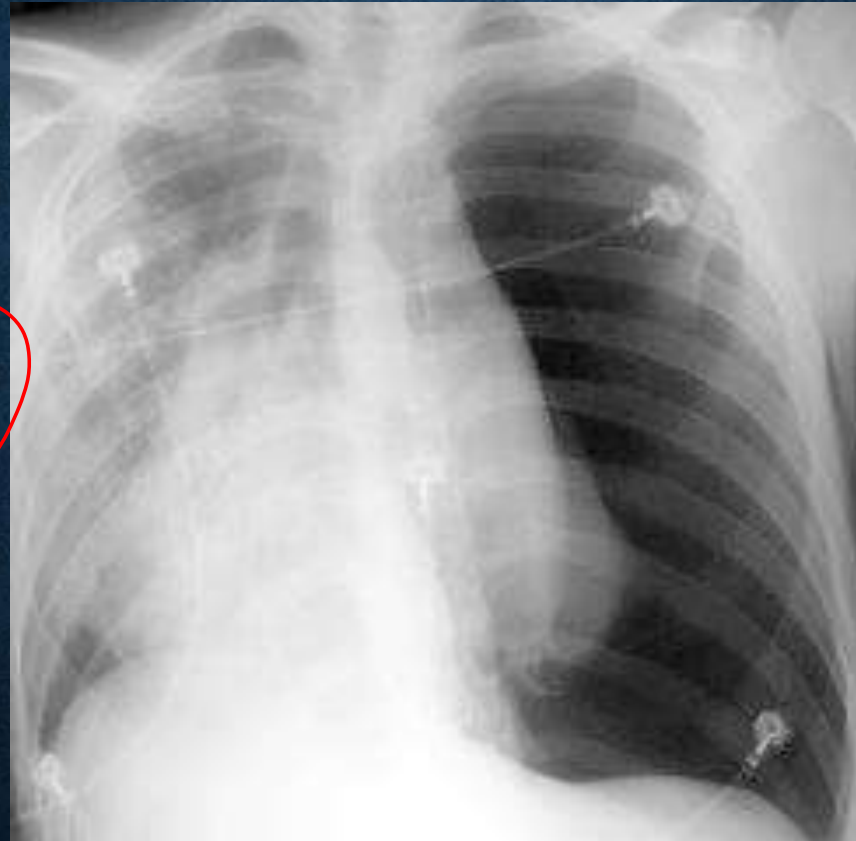
كثير congenital anomalies

بالأطفال 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

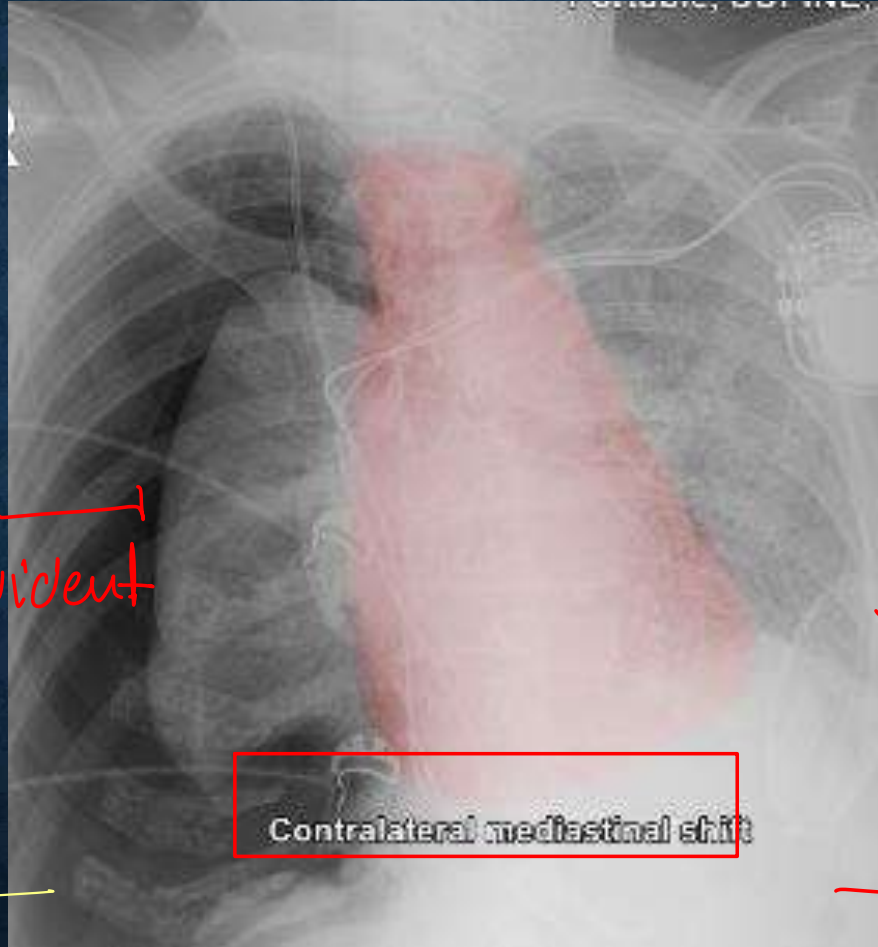
Diaphragm » differences in height on both sides

Cardiopulmonary compromised

سودا
باحت
Vascular markings

* Tension

* Lt. compressed lung due to PTX.



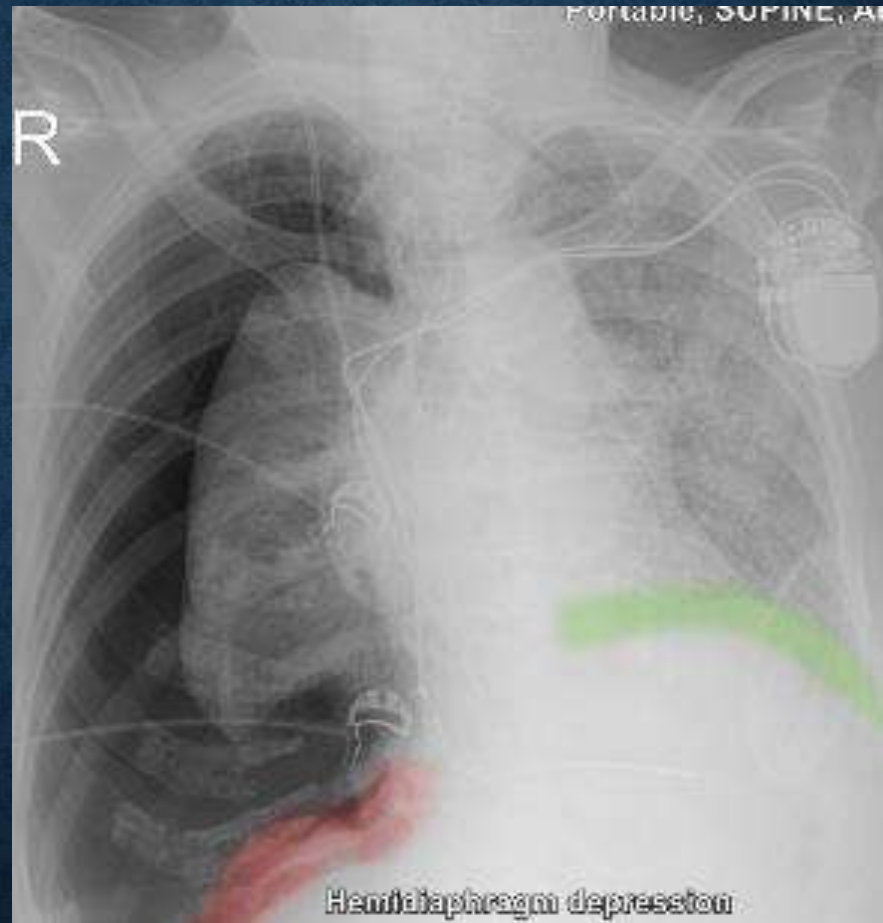
no
vascular
marking

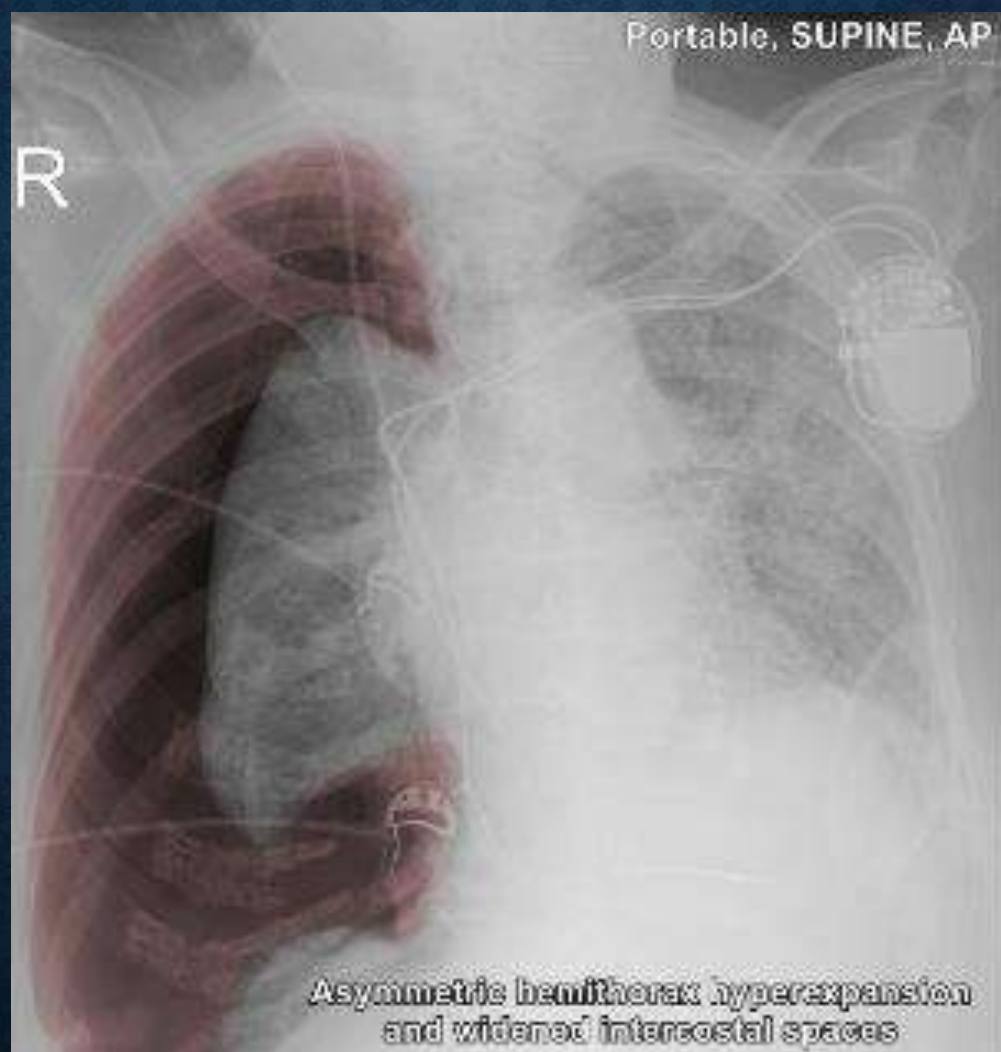
wider

Contralateral mediastinal shift

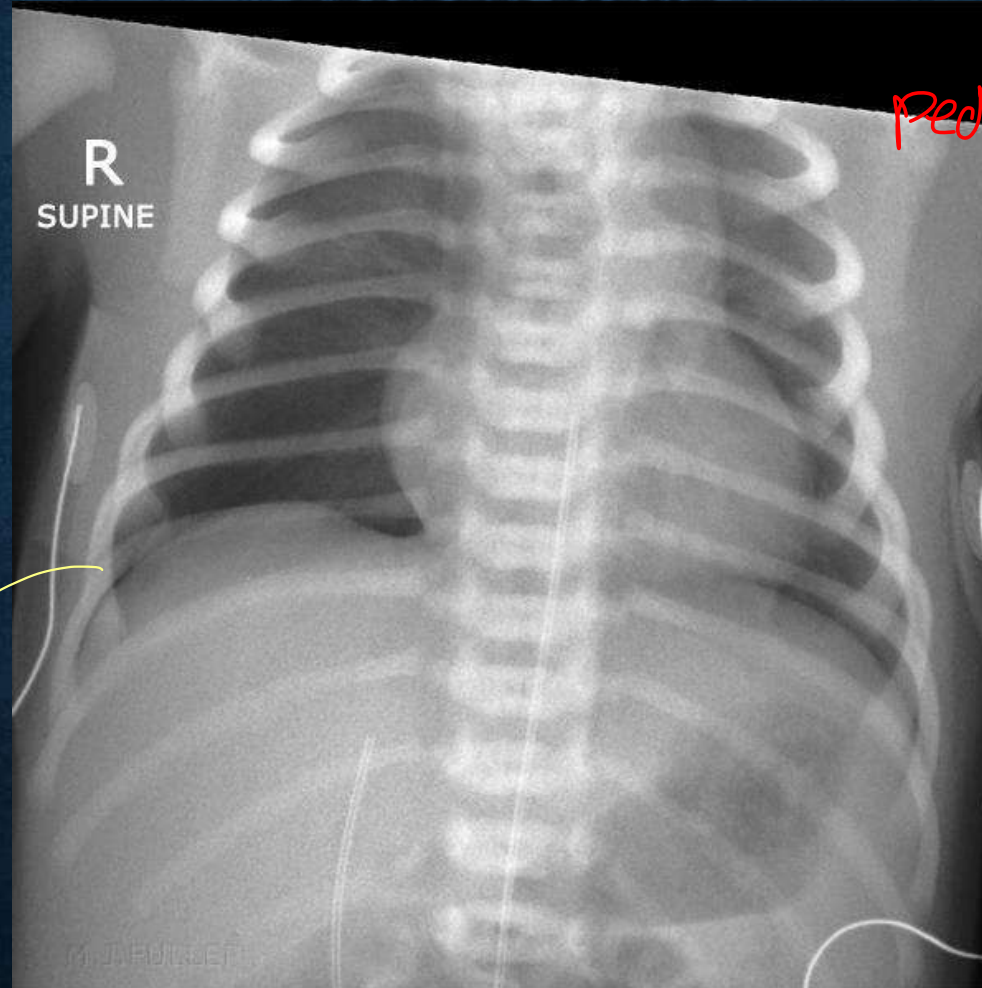
flattening
in diaphragm

depressed
diaphragm





RIGHT DEEP SULCUS Sign



اسود
Sharp

Sharp
اكثر

Predict

دایما بال pneumothorax ال

air لانه اخف بطلع لفوق و

بکبر لتحت لو زادت کميته،

الطفل اذا ما كان قادر يوقف

ناخذ erect position بنصوره

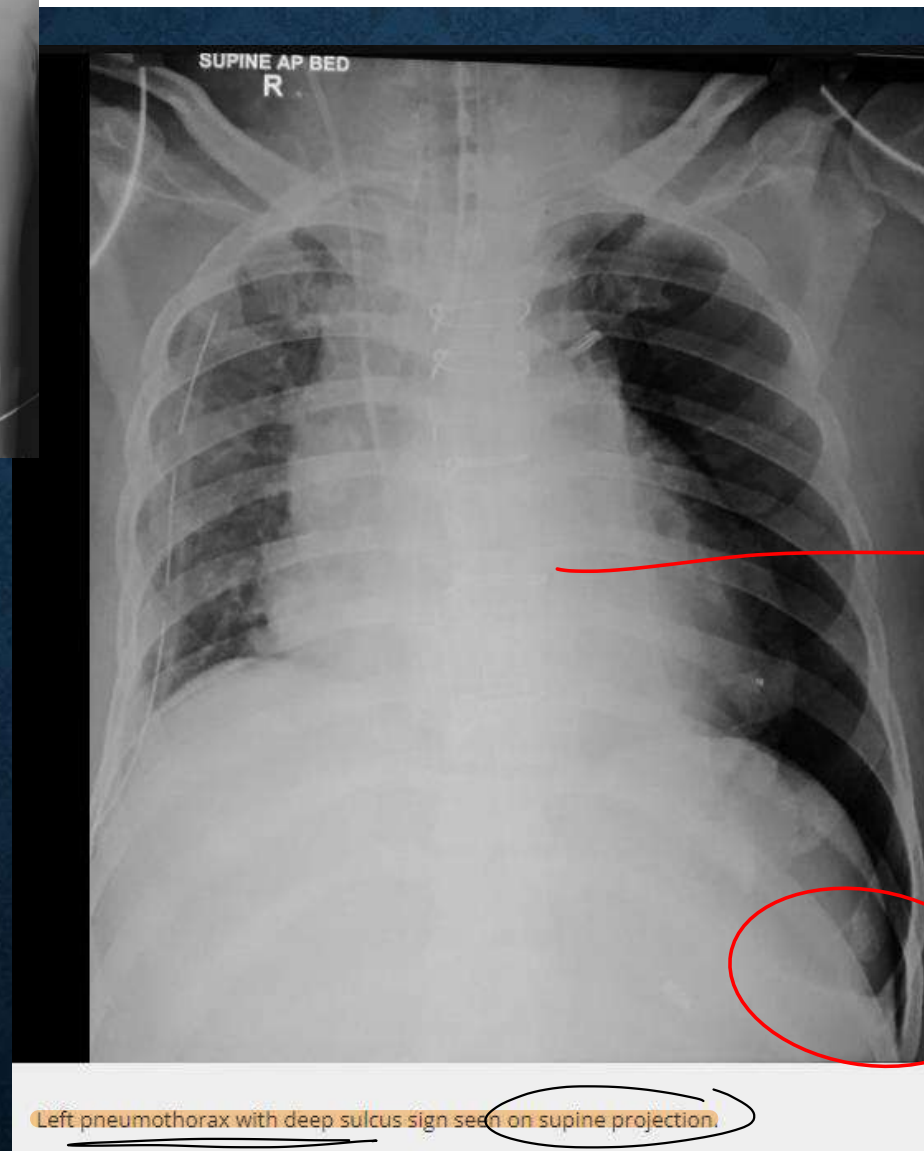
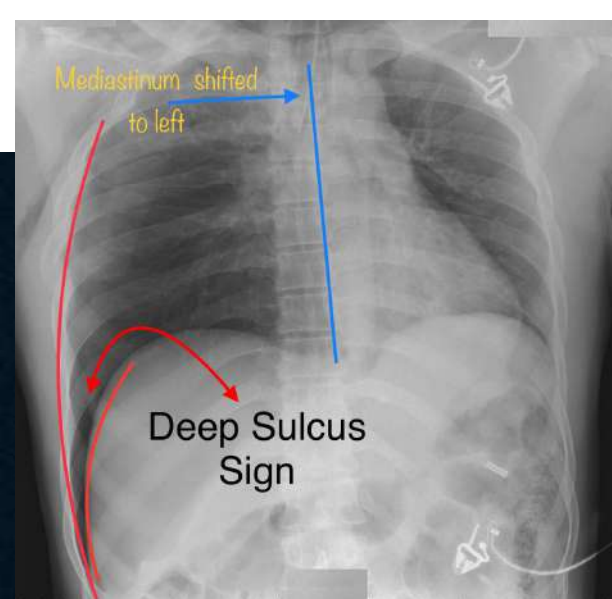
supine or lateral و وقتها

اكثر مكان بروحله الهوا هو ال

costophrenic angle و بتصير

sharp کثير و لونها اسود اكثر

من ال angle الطبيعية

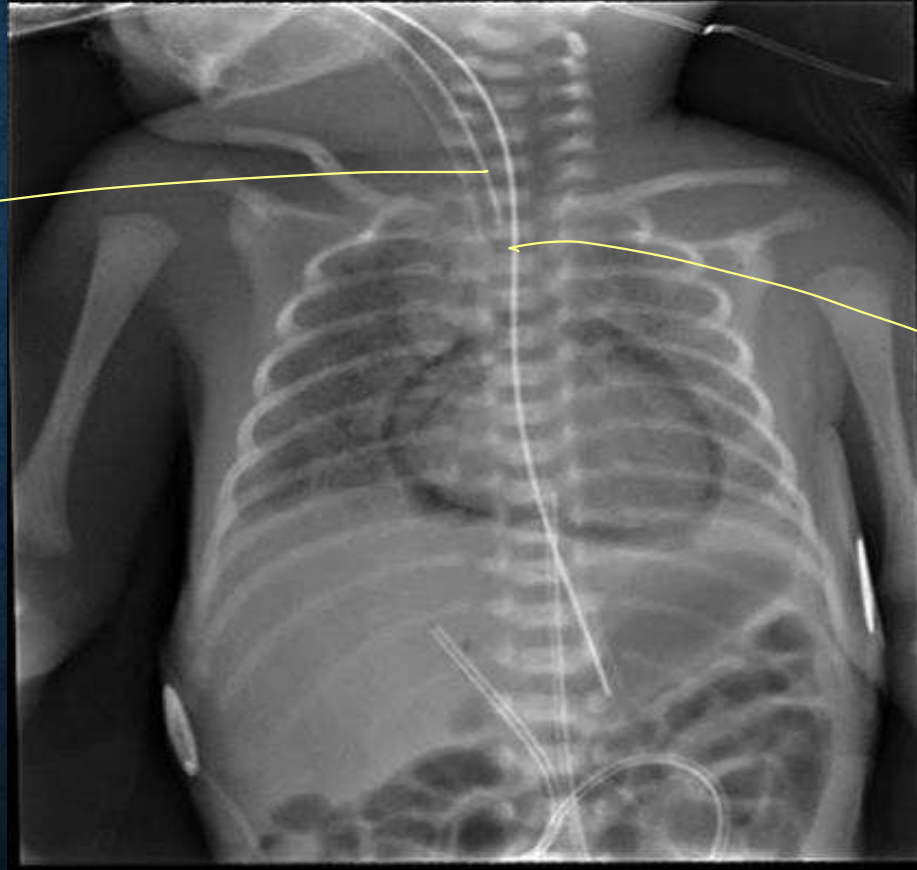


→ pneumothorax

منایکشر
Air
نزلت لکھت

PNEUMOPERICARDIUM

✦ Air around the heart

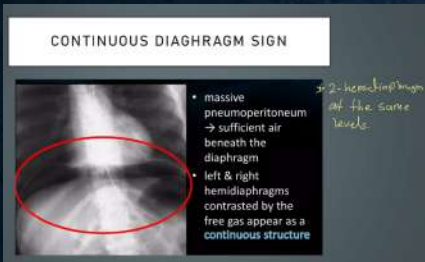


X-ray

ETT

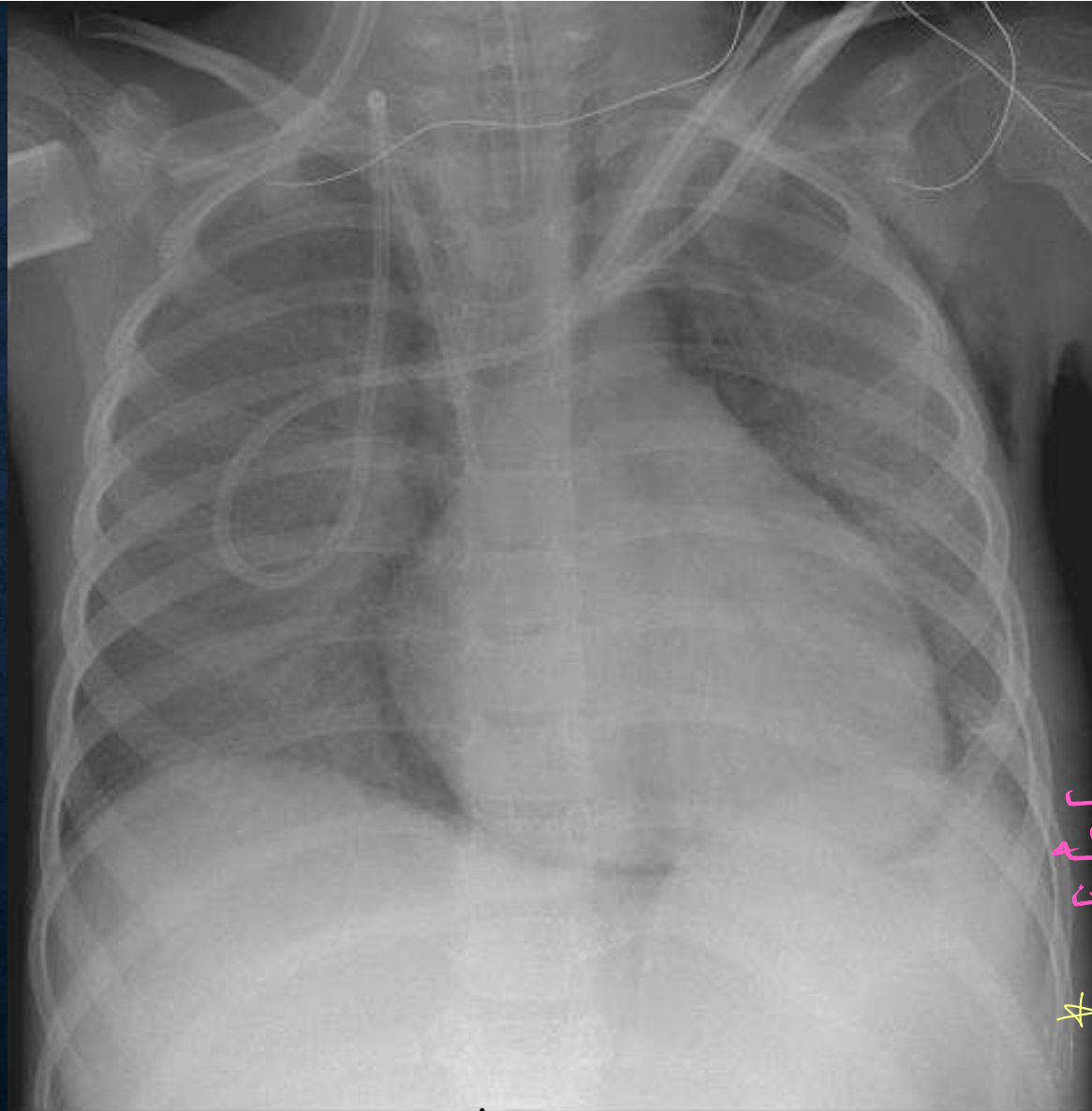
OGT

pneumopericardium



CONTINUOUS DIAPHRAGM SIGN

Continuous diaphragm sign



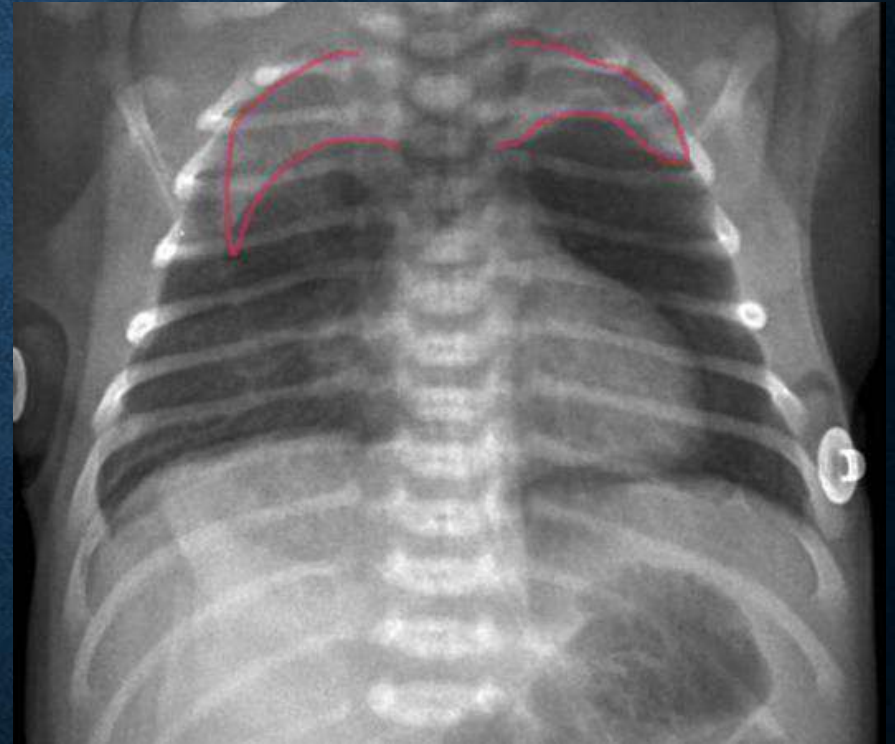
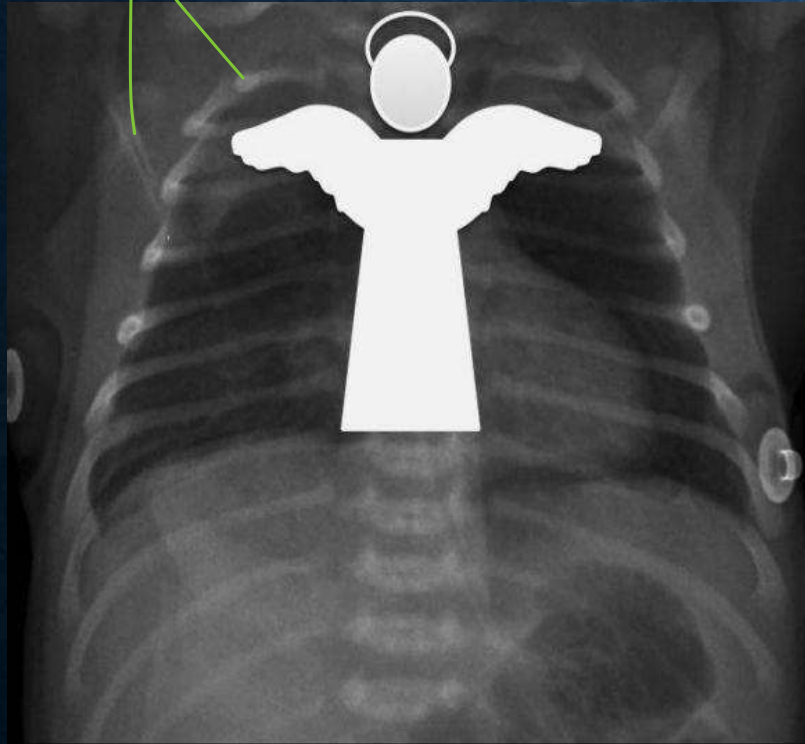
دائما بال heart في اشفي
اسمه silhouette يعني اشفي
بخبي على اشفي يعني مثلا
pneumonia تخبي ال
border of the heart
fluid يخبوا ال diaphragm ..
و دائما ال heart and
diaphragm لازم ما ينفصلوا
عن بعض اذا بين بينهم فراغ

يعني هوا هاد دليل
pneumopericardium او هاد
الاشي اكبر الي هو
pneumomediastinum
اللي تتحطه
بالامتحان

* pneumoperitoneum
تحت ال diaphragm

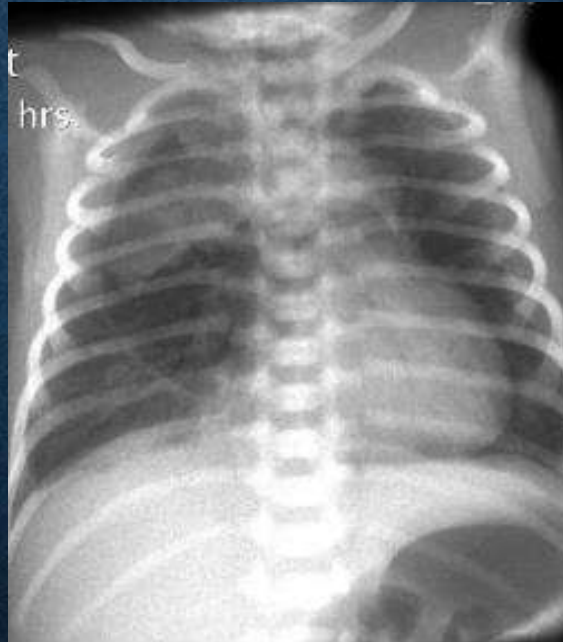
pneumomediastinum

Angel wing sign



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.

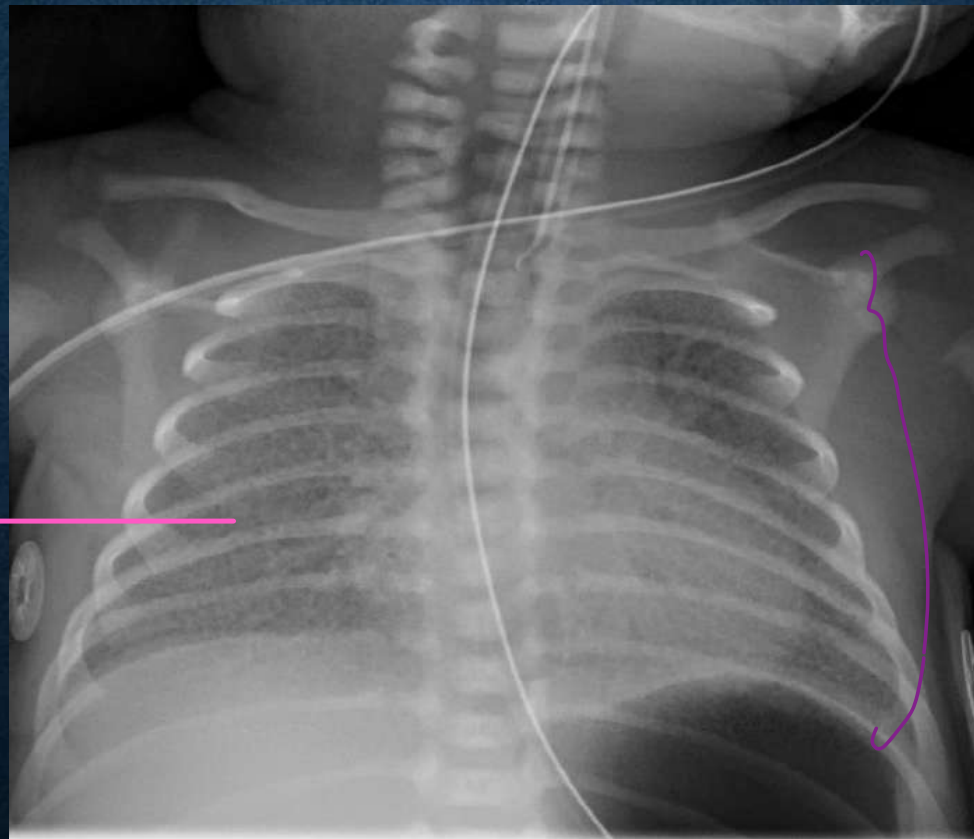


NEWBORN X-RAY PATHOLOGY

2 DAYS OLD PREMATURE INFANT WITH TACHYPNEA

CASE 1

= surfactant insufficiency = respiratory distress



★ Grainy lung or ground glass appearance

→ ARDS

من وکند من وکند

25/1

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

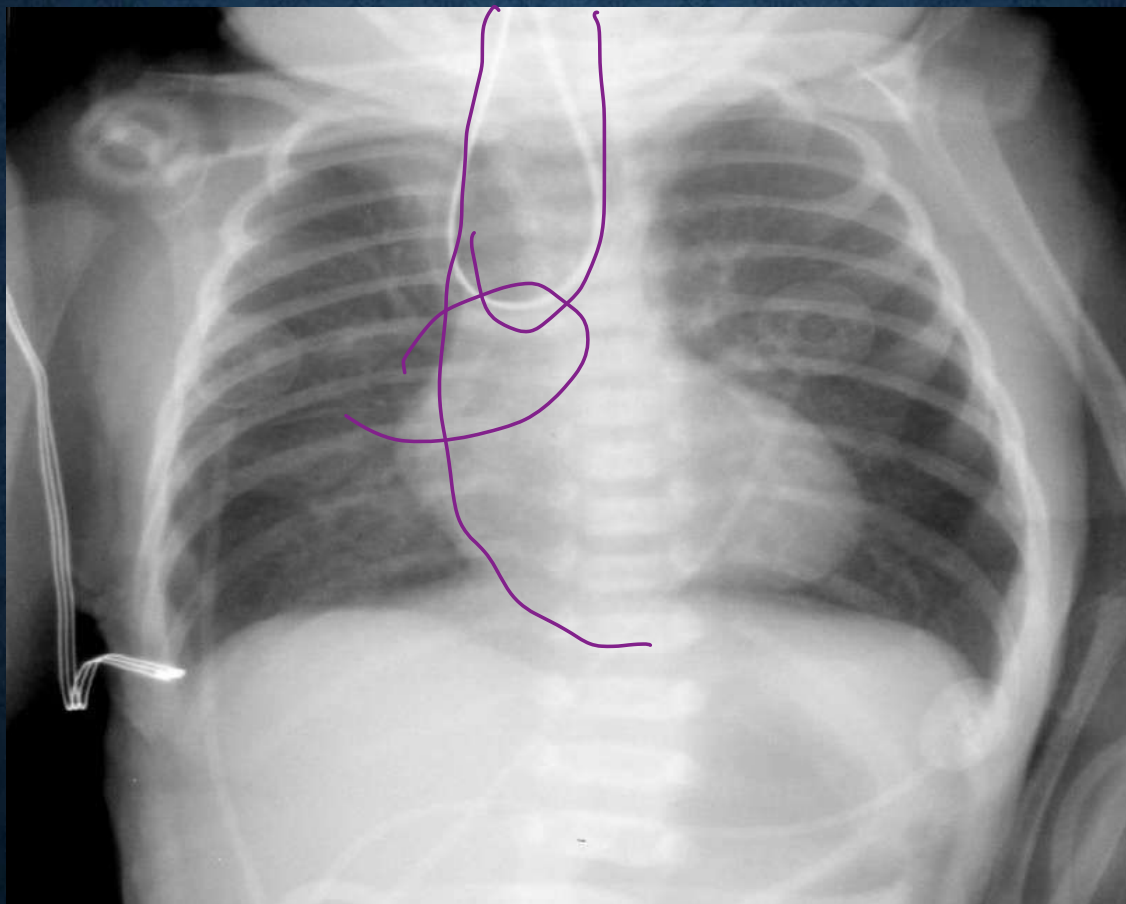
CASE 1:

CASE 1: A NEONATE WITH PERSISTENT VOMITING



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

Gas in
stomach?
air

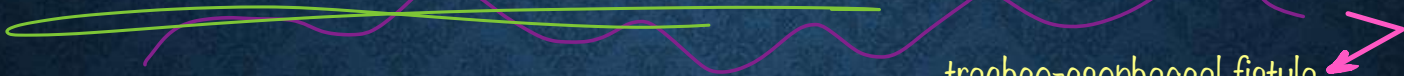


prox.
no air in stomach

FINDINGS:

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

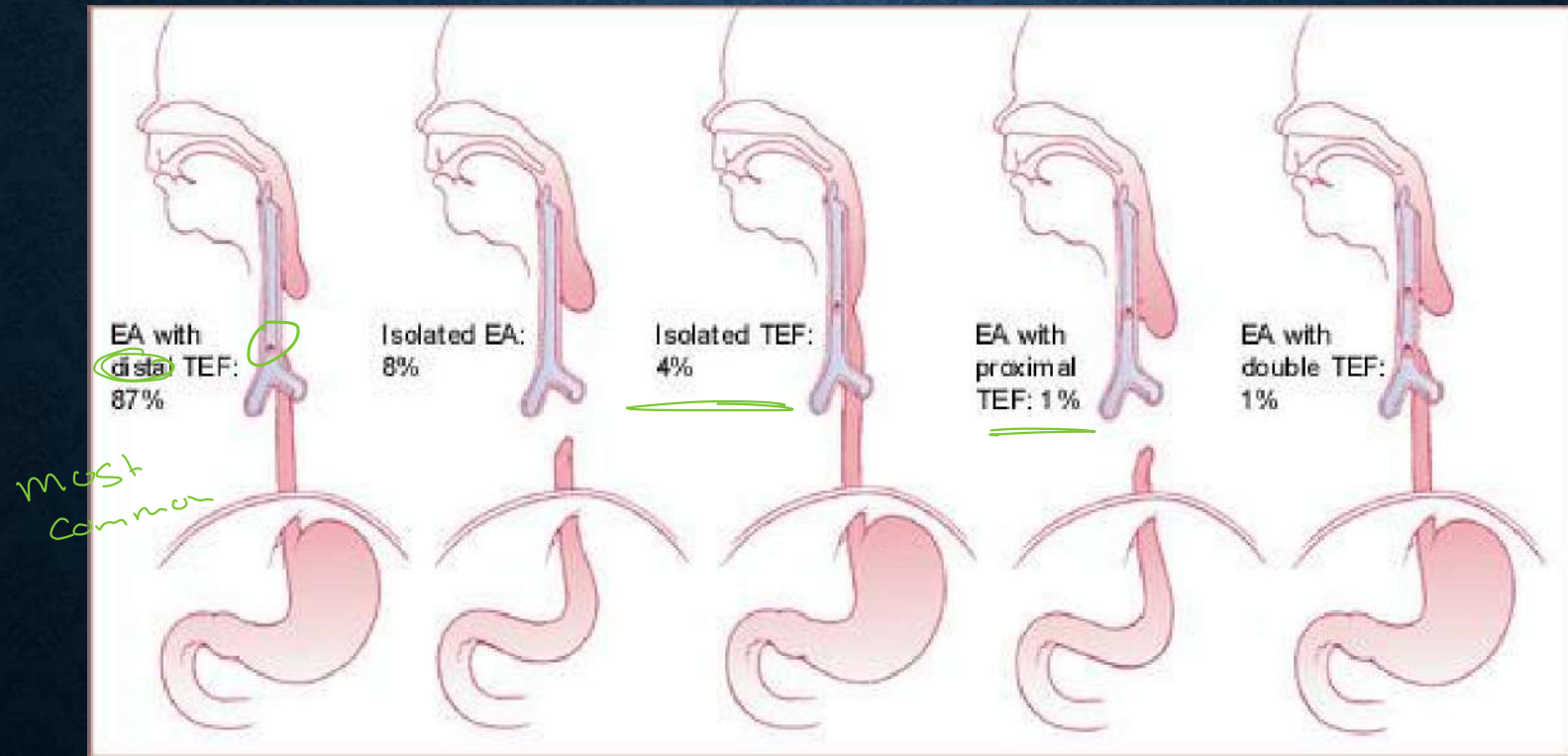
DIAGNOSIS: ESOPHAGEAL ATRESIA WITH TEF

A hand-drawn green underline is positioned beneath the word 'ESOPHAGEAL'. A pink wavy line starts from the left, passes under 'ESOPHAGEAL', and continues under 'WITH TEF'.

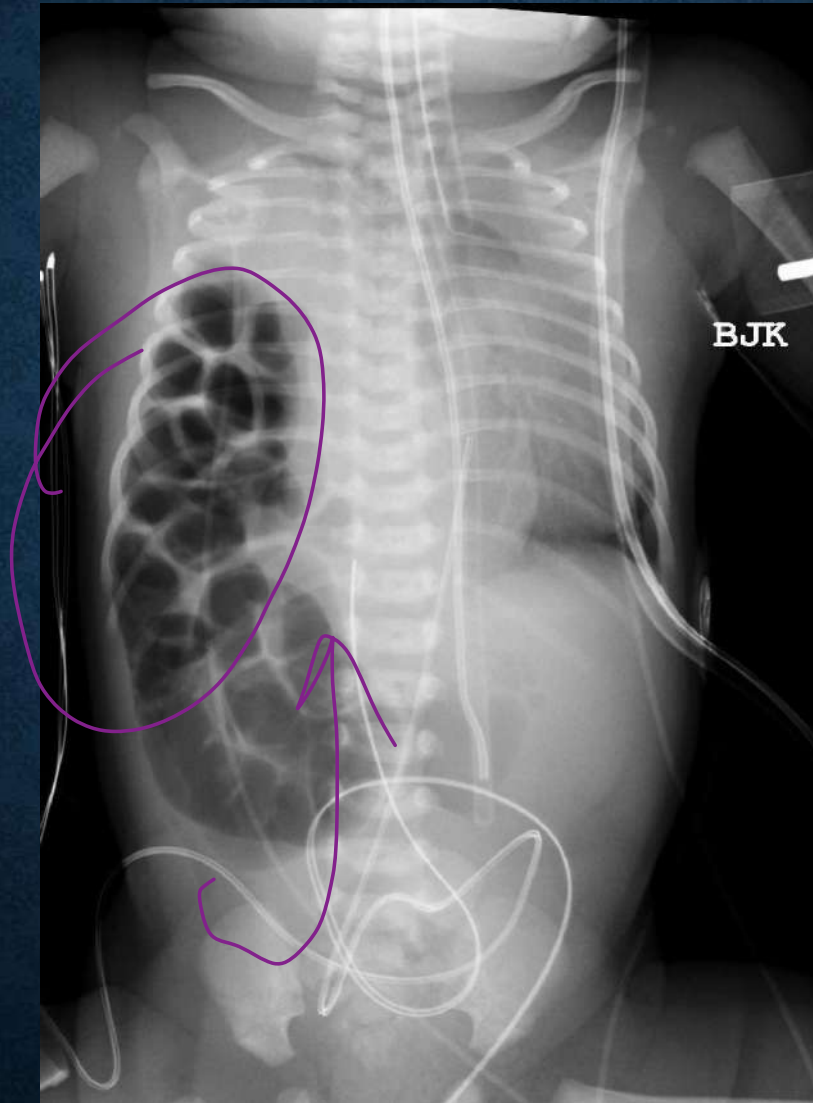
tracheo-esophageal fistula

A pink arrow points from the right towards the underlined text 'tracheo-esophageal fistula'.

ESOPHAGEAL ATRESIA / TE FISTULA



CASE 2:
NEWBORN WITH RESPIRATORY DISTRESS



Chest
Abdomin
X-ray

FINDINGS:

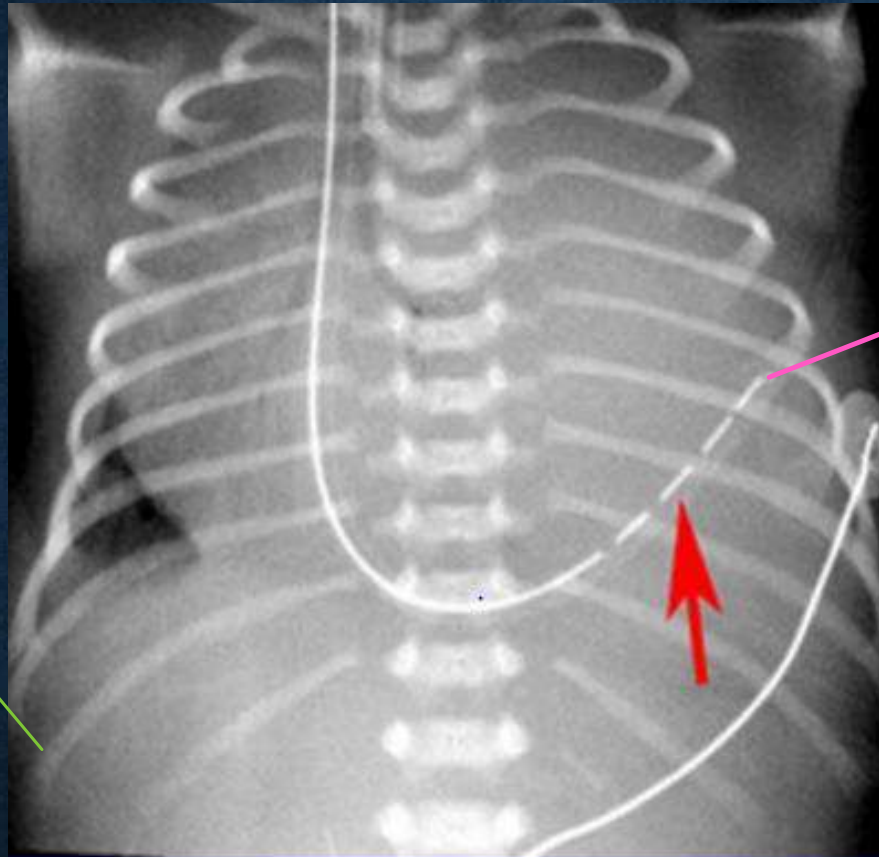
MULTIPLE BOWEL LOOPS SEEN IN THE RIGHT HEMITHORAX



DIAGNOSIS

CONGENITAL DIAPHRAGMATIC HERNIA





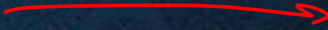
NGT

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 


ultrasound  Stomach

✦ Landmark of the pylorus » gallbladder

Axial



Muscles of pylorus

✦ علامات يكون مع 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



* Duodenal
atresia
* web and mid
gut Volvulus

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. DD?

down to

DIAGNOSIS: DUODENAL ATRESIA



CASE 7
NEWBORN WHO FAILED
TO PASS MECONIUM

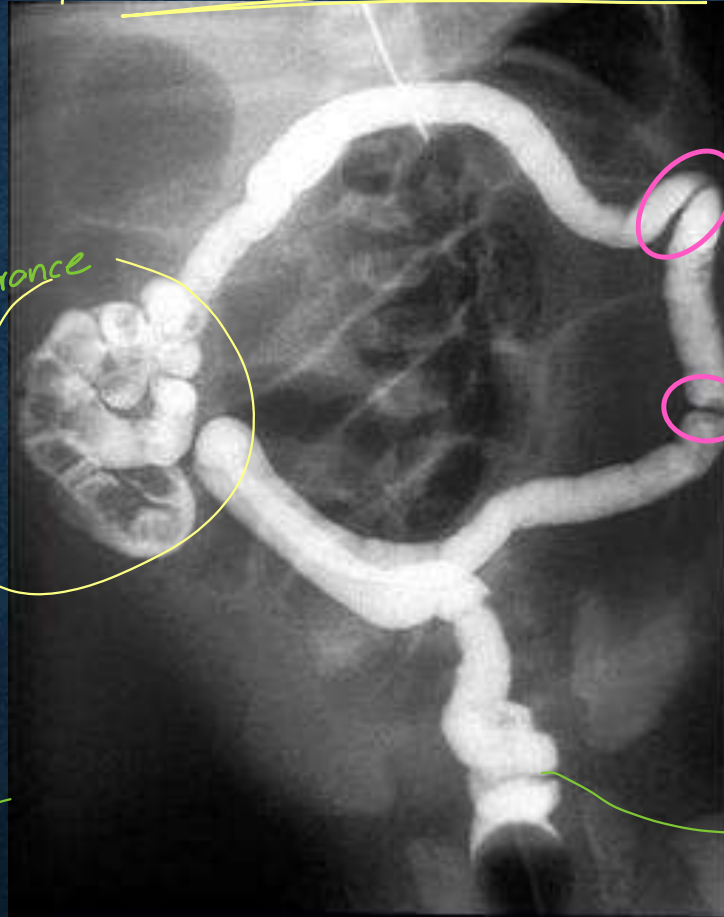
Ileal atresia / meconium ileus

enema

Soap and bubble appearance

* mottled appearance ✓

* meconium stuck in ✓



✦ Filling defect

✦ Large bowel » small caliber

✦ Small bowel » large caliber

→ Colon is small

USS

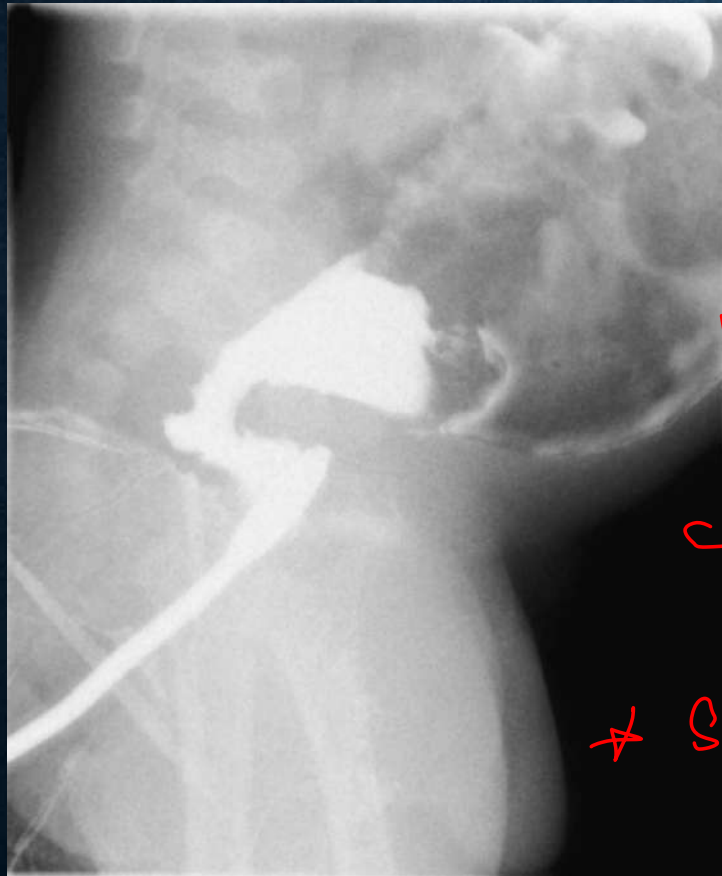
IMAGING FINDINGS

- 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.

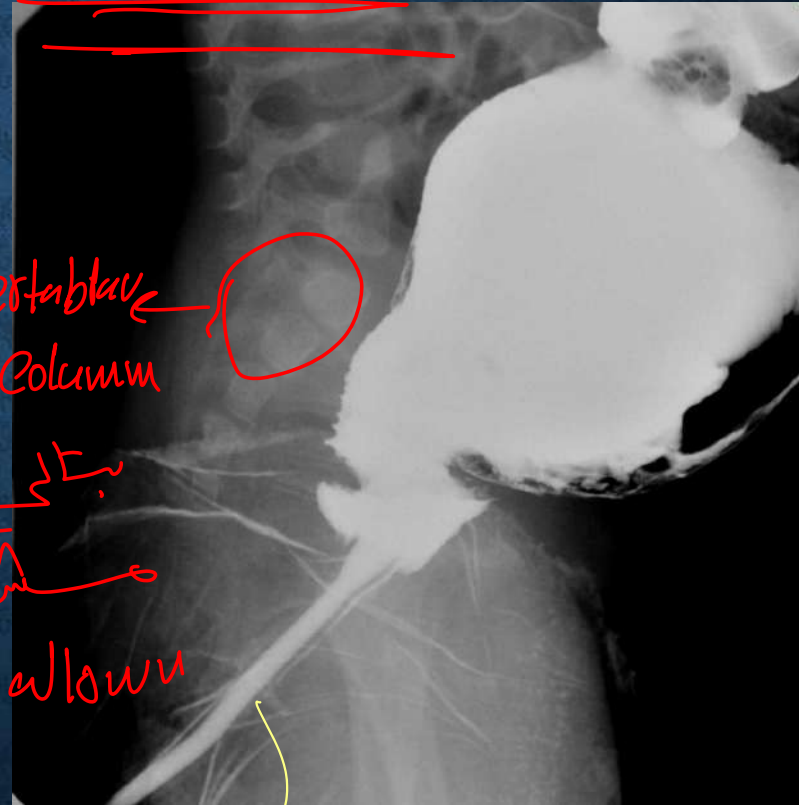
DIAGNOSIS: MECONIUM ILEUS VS. ILEAL
ATRESIA (BOTH ARE SURGICAL)

CASE 8

Barium enema lateral projection early filling phase



* Sacral bone » landmark



catheter tip



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)

R:S → 1:1
or
2:1 / < 1:1 → Airsh --

**DIAGNOSIS:
HIRSHPRUNG'S DISEASE**



↑ more

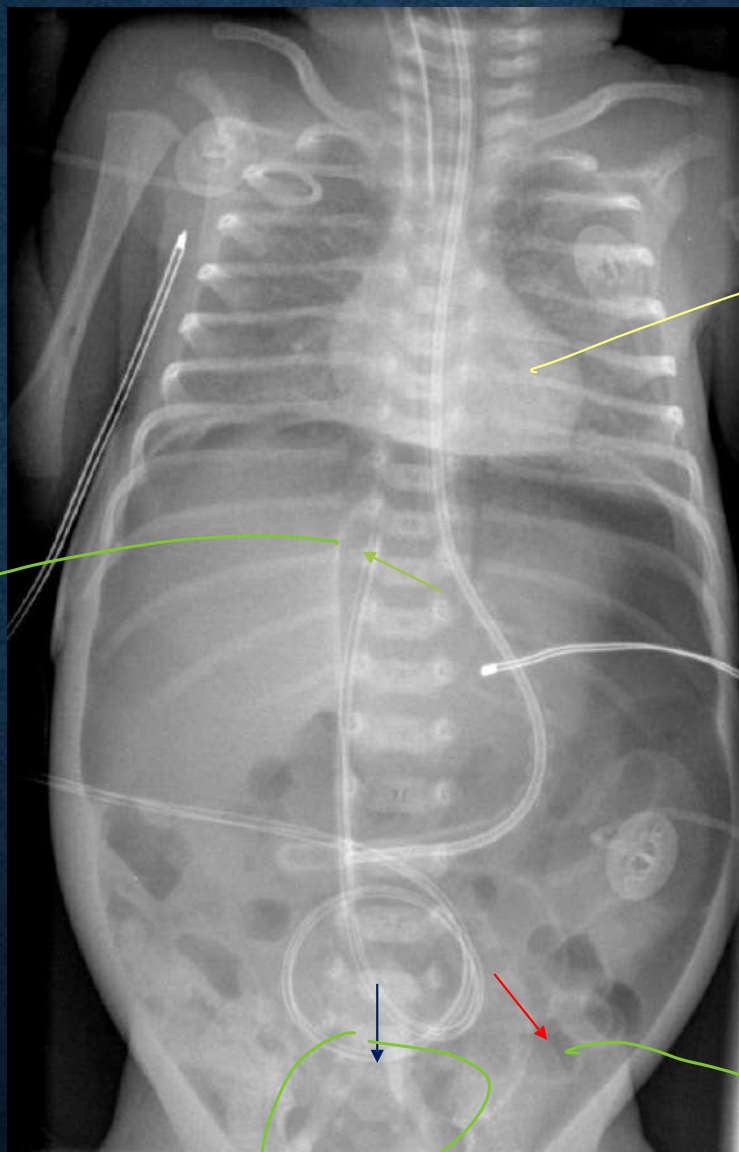
no ganglion

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

CASE 12

sever

falciform
lig.



heart & dia
abdomen & dia

Football
regular
sign
double wall

Rigler's

N → inverted V, common iliac veins

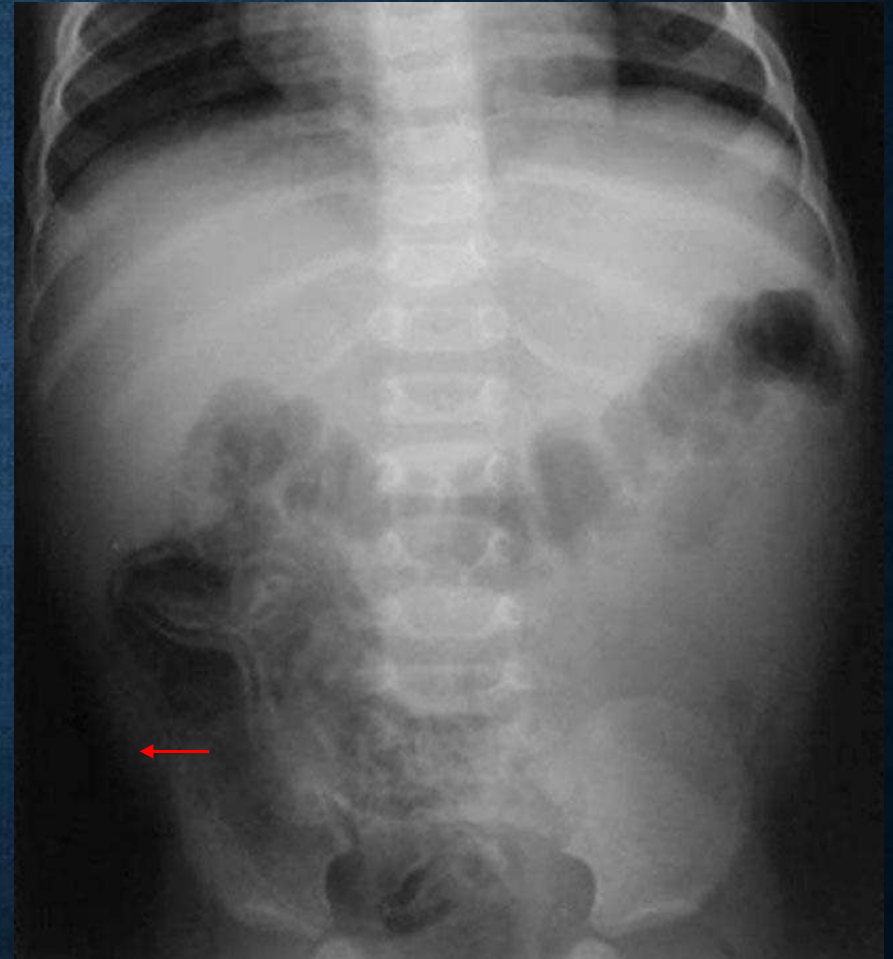
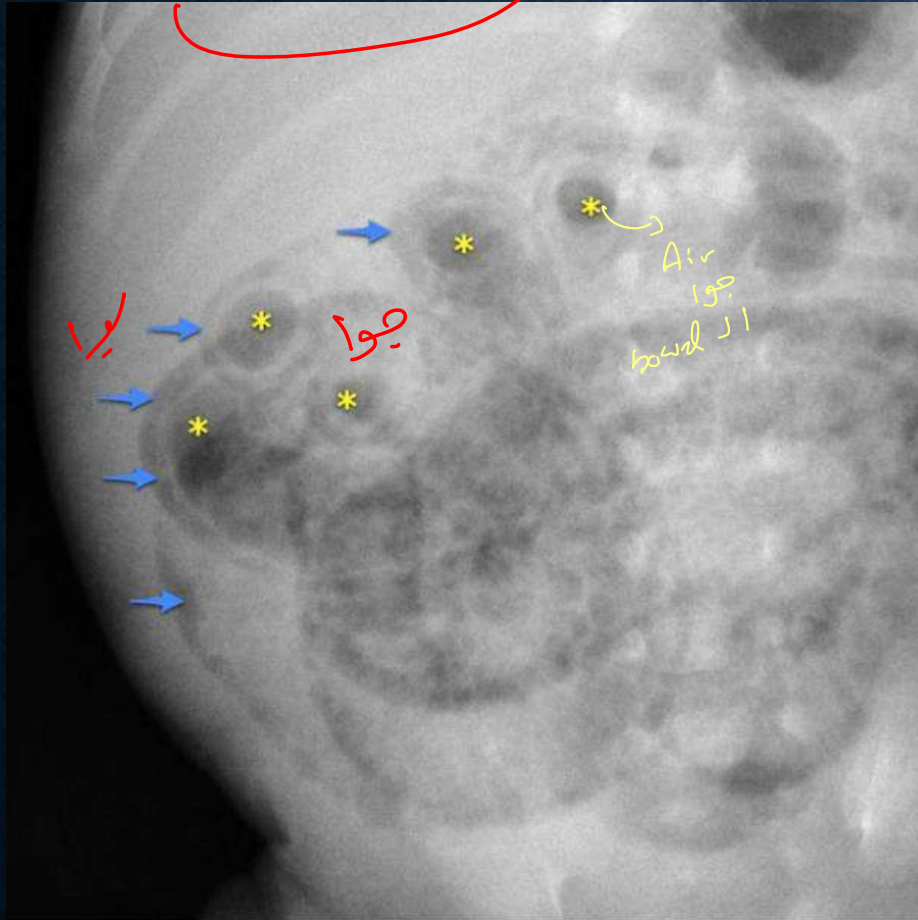
IMAGING FINDINGS

- Large amount of free intraperitoneal air (pneumoperitoneum) outlining the falciform ligament (^{green} ~~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

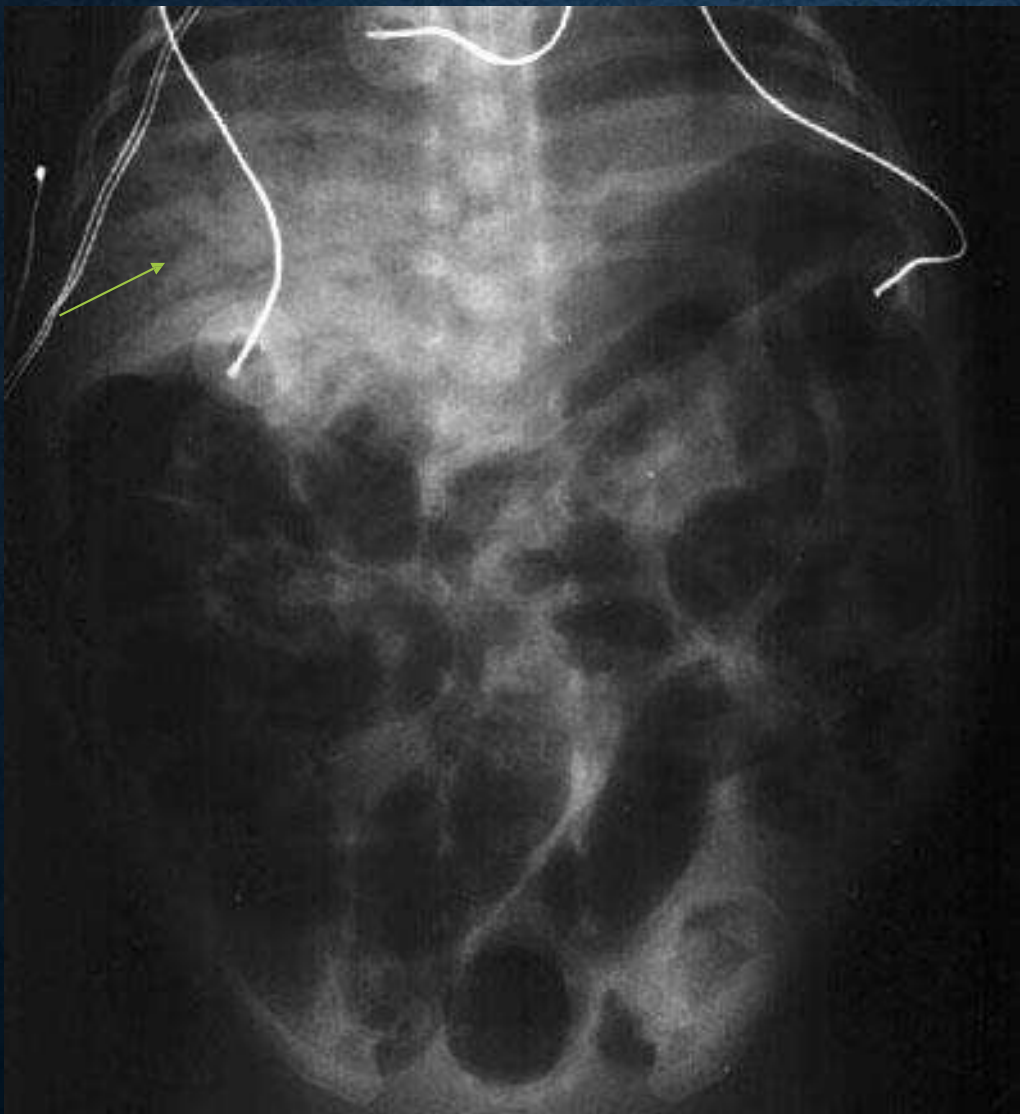
CASE 13

✚ Rigler sign



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

Green ↑
Ported
Venuhs



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

Imaging Findings – Hallmark

◆ Pneumatosis Intestinalis ★

- Gas within the bowel wall
- Pathognomonic for NEC ★
- Appears as linear or bubbly lucencies along bowel wall

◆ Portal Venous Gas

- Gas tracking into portal vein → liver lucencies
- Seen in severe NEC

junction ديجا
DJJ on the right

Malrotation

Barium follow through

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

مفروضنا
على يسار



مكون
الحفود

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

Telescopy 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. ✓

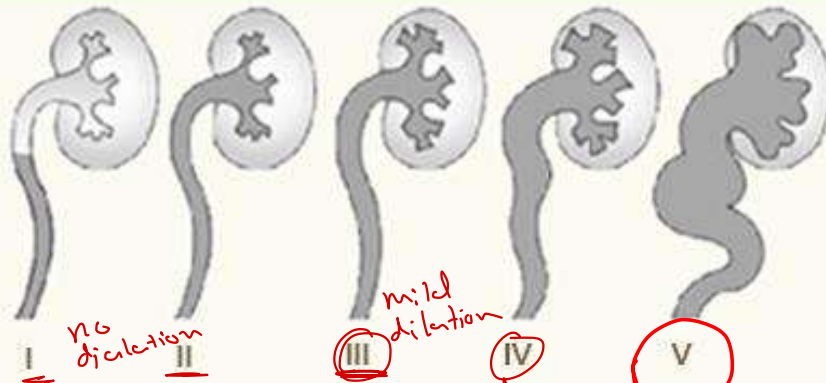


MICTURATING CYSTOURETHROGRAM (MCUG)

↙ 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.
↳ for active 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.

oblique, post urethral valve, only during micturition → active reflux.



Grade

I
II
III
IV
V

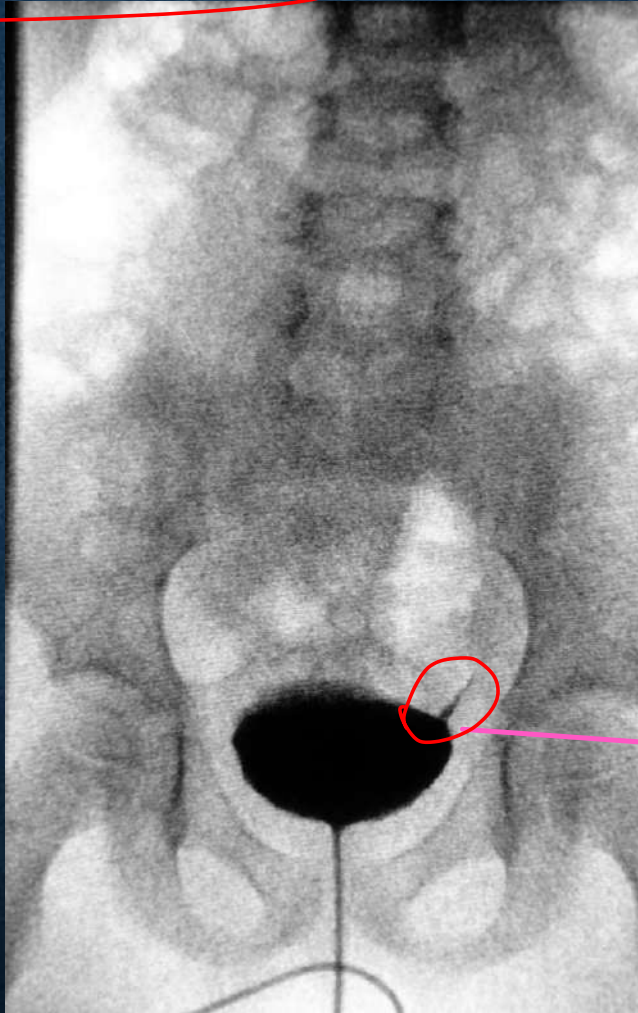
Into a nondilated ureter
 Into the pelvis and calyces without dilation
 Mild to moderate dilation of the ureter, renal pelvis, and calyces with minimal blunting of the fornices
 Moderate ureteral tortuosity and dilation of the pelvis and calyces
 Gross dilation of the ureter, pelvis, and calyces; loss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

Description

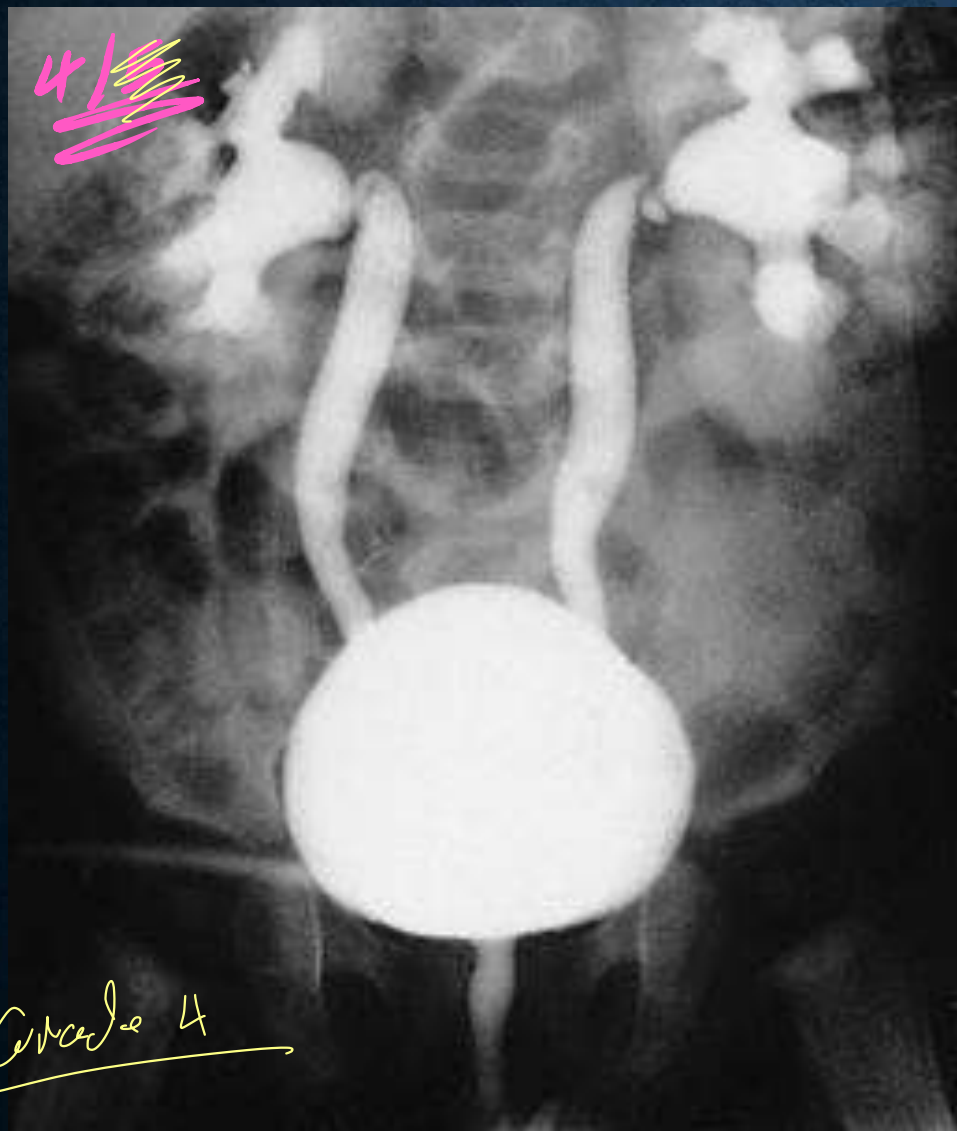


Vesicoureteric Reflux

* passive → without
mictration
* Active → with
also ?
Post. urethral valves



Grade I, left ureter



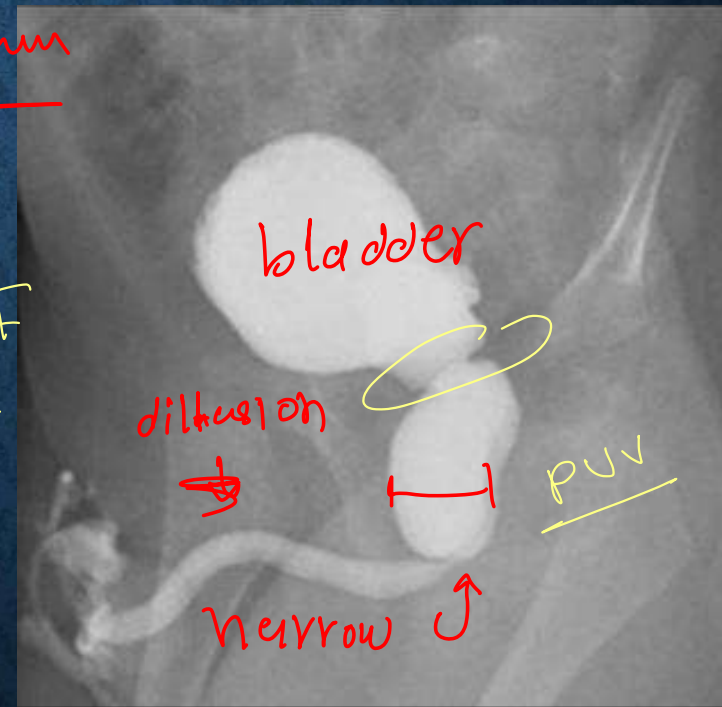
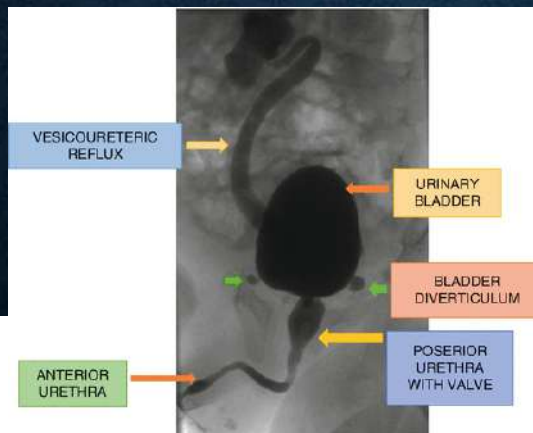
Posterior urethral valve

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

MCUG ✓

* cathogram

Distal dilated → may cause RF



THANK YOU