Modified slides

PEDIATRIC Radiology

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General principles in Ped. Rad.

1. Radiation Safety and Dose Reduction:

- **Children are more sensitive to radiation** than adults, so minimizing radiation exposure is crucial.
- **Use the ALARA principle** (As Low As Reasonably Achievable).
- Prioritize **non-ionizing imaging modalities** (e.g., ultrasound and MRI) over X-ray or CT scans, especially in younger patients.
- **Adjust imaging protocols:** Tailor protocols according to the child's age, weight, and size (e.g., adjusting the kilovoltage (kVp) and milliampere-seconds (mAs) on radiographs or CT scans).

2- Choosing the Right Imaging Modality

- **Ultrasound (US):** Often the first-line imaging modality for pediatric patients, especially for abdominal or pelvic concerns (e.g., appendicitis, kidney anomalies). It's non-invasive, safe, and doesn't use radiation.
- **X-ray:** Fast and commonly used in trauma or bone-related issues, but requires careful consideration of the radiation dose.
- **MRI:** radiation-free imaging that is particularly useful for brain, spinal cord…long scan time? sedation
- **CT Scan**: This should be used cautiously due to higher radiation exposure, but it is useful in assessing complex fractures, head trauma, or abdominal emergencies when other modalities are insufficient.

3- Anatomical Differences in Children:

- Normal variants
- Incomplete ossification
- myelination

4- Technical Challenges

- Movements
- limited cooperation

5- Developmental Physiology and Imaging

- bone growth

6- Pathological Considerations

- congenital

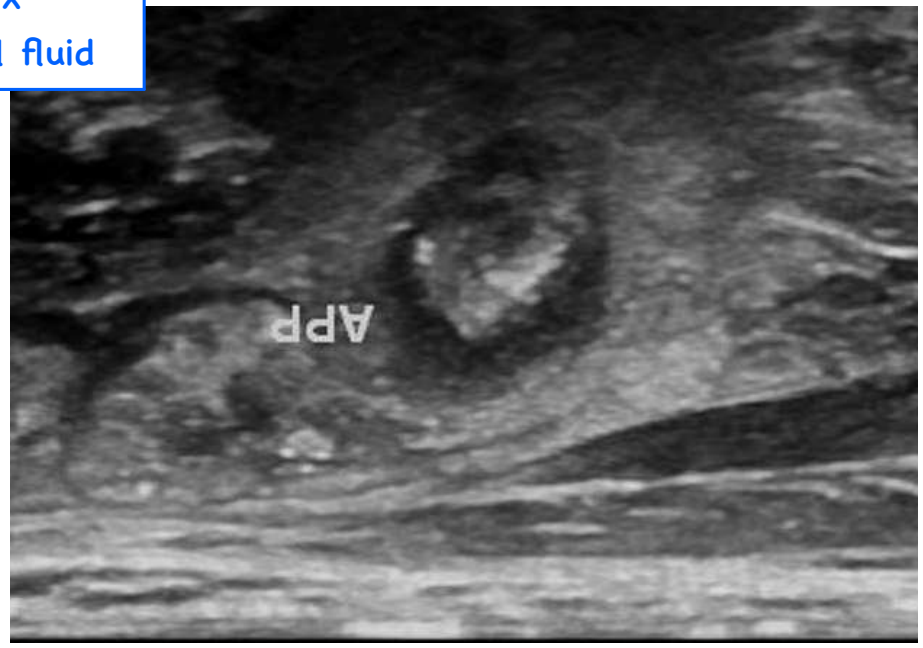
7- Parental Involvement and Communication

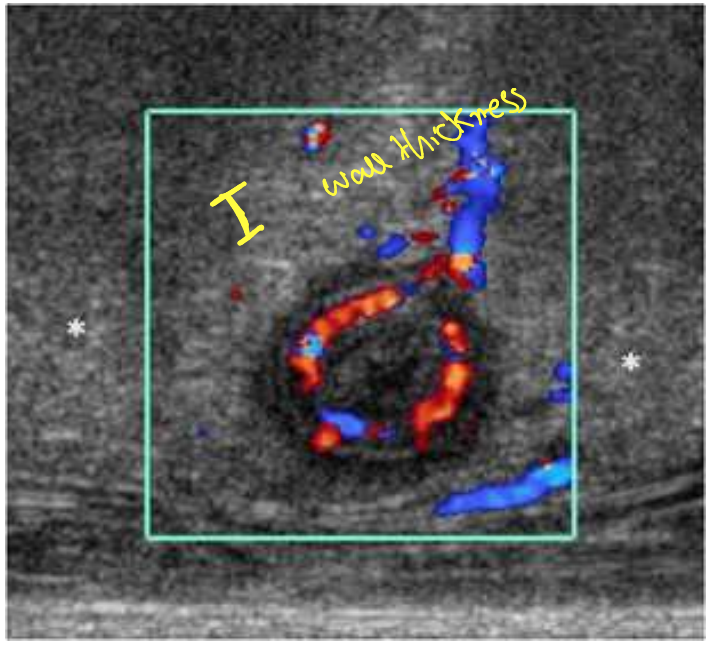
Q1

- A 7-year-old female patient presented to ER with 36 hours of abdominal pain, nausea, and loss of appetite.

- - What is your DDX? appendicitis, Ovarian torsion
- - What do you request imaging-wise? ultrasound

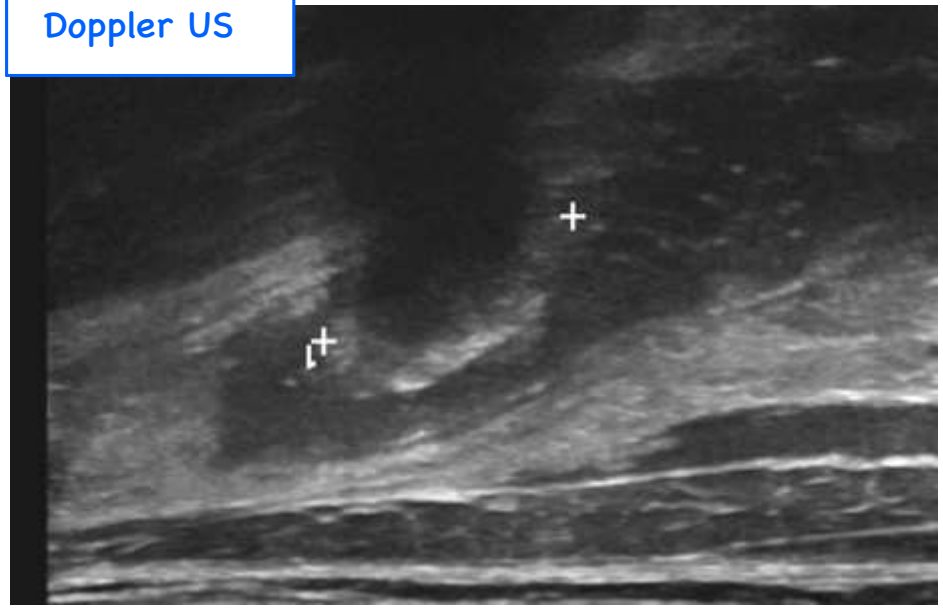
Dilated appendix
Periappendiceal fluid

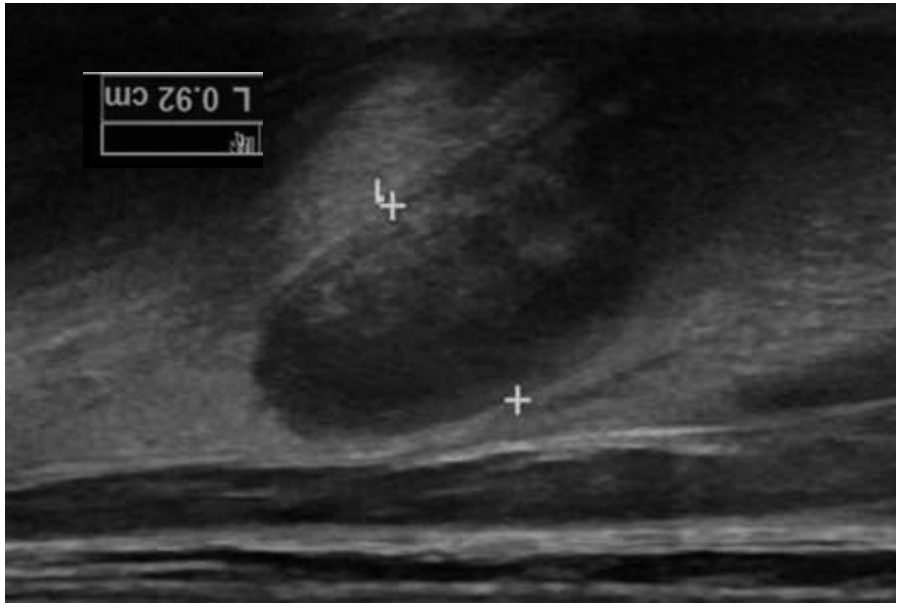




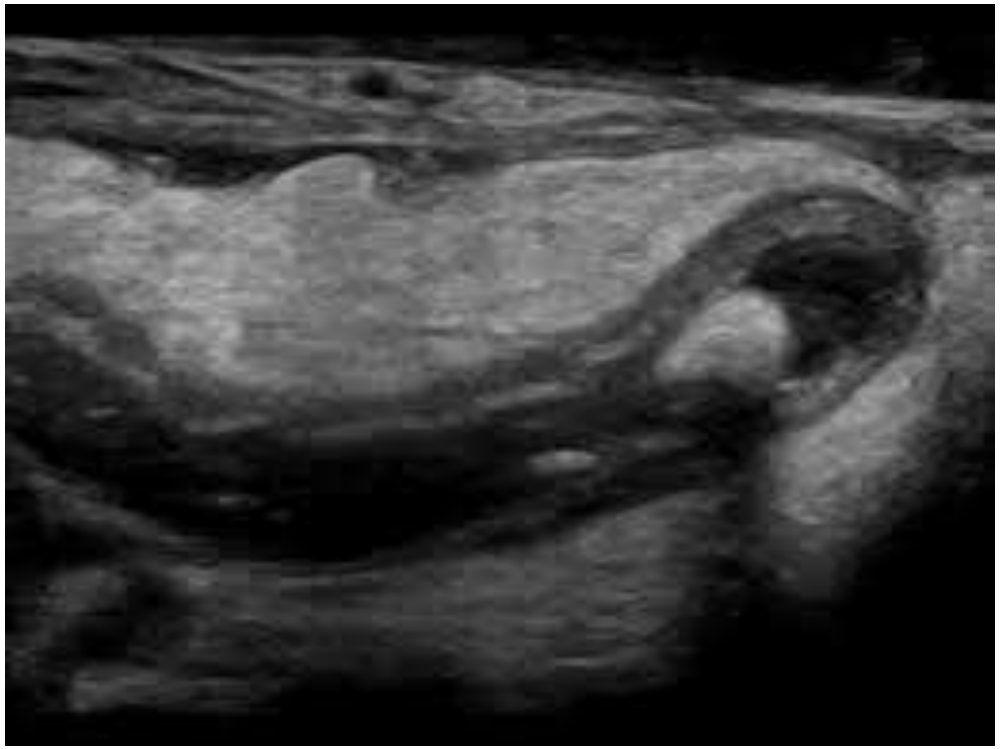
Doppler US

Ring line
Hyperemia sign

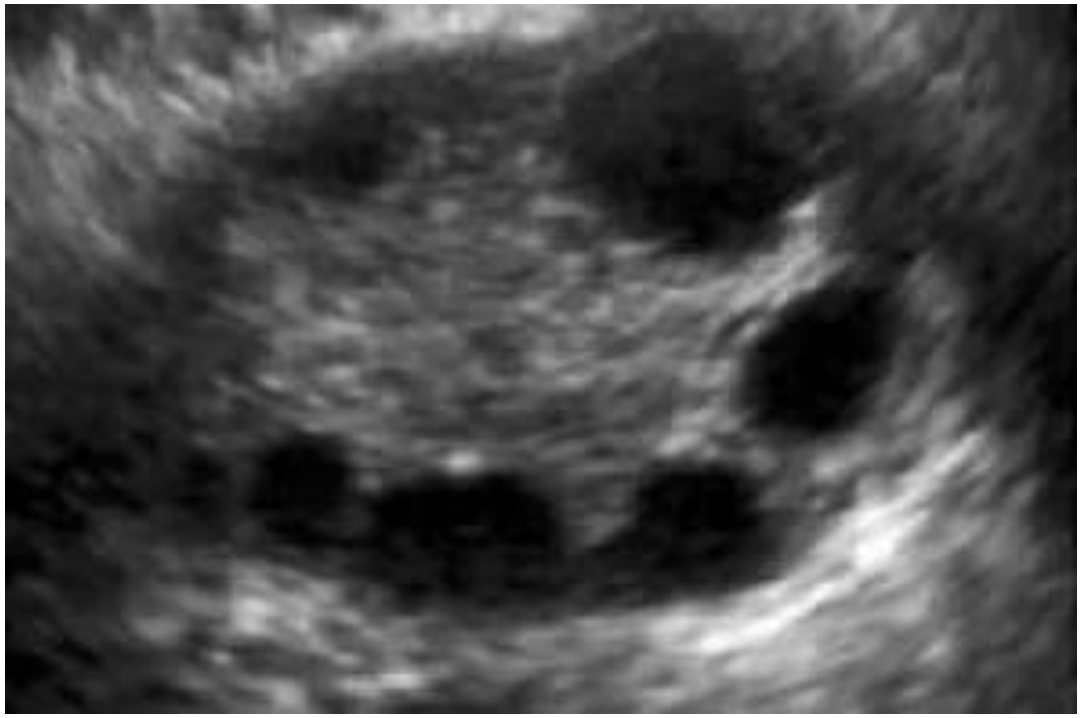




Thickened wall



Torted Ovary



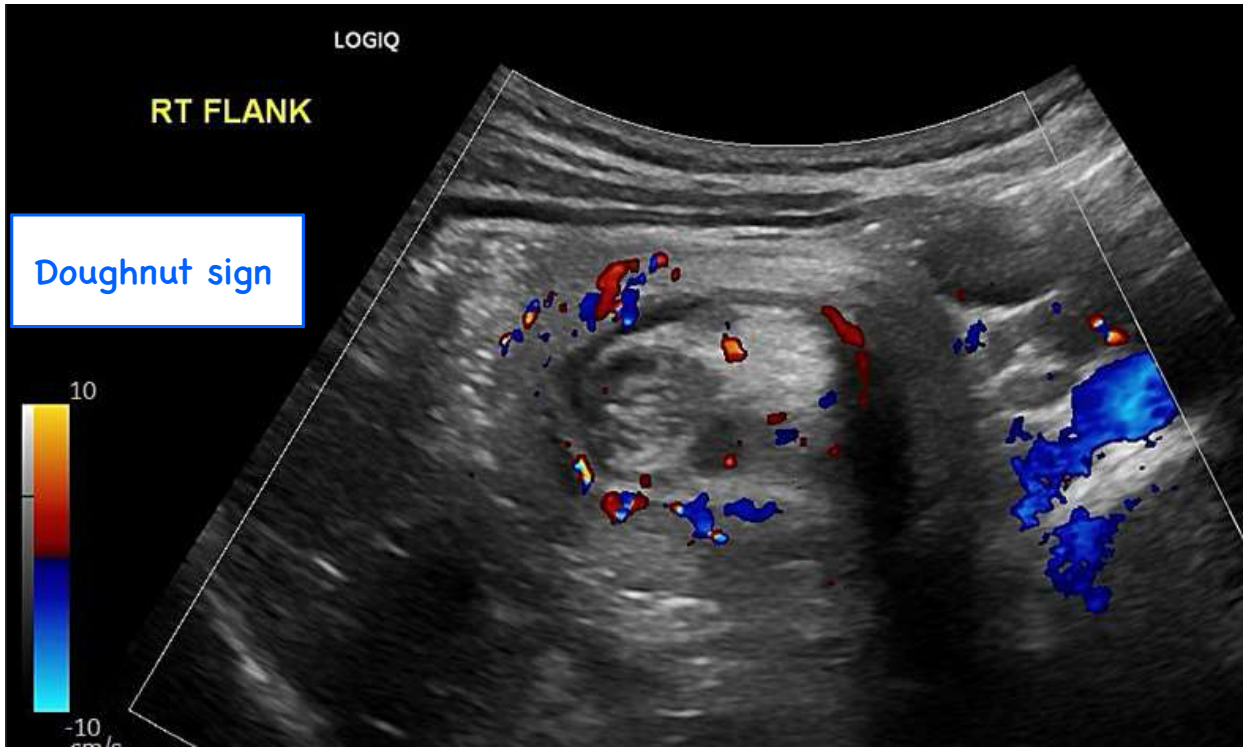
Normal Ovary

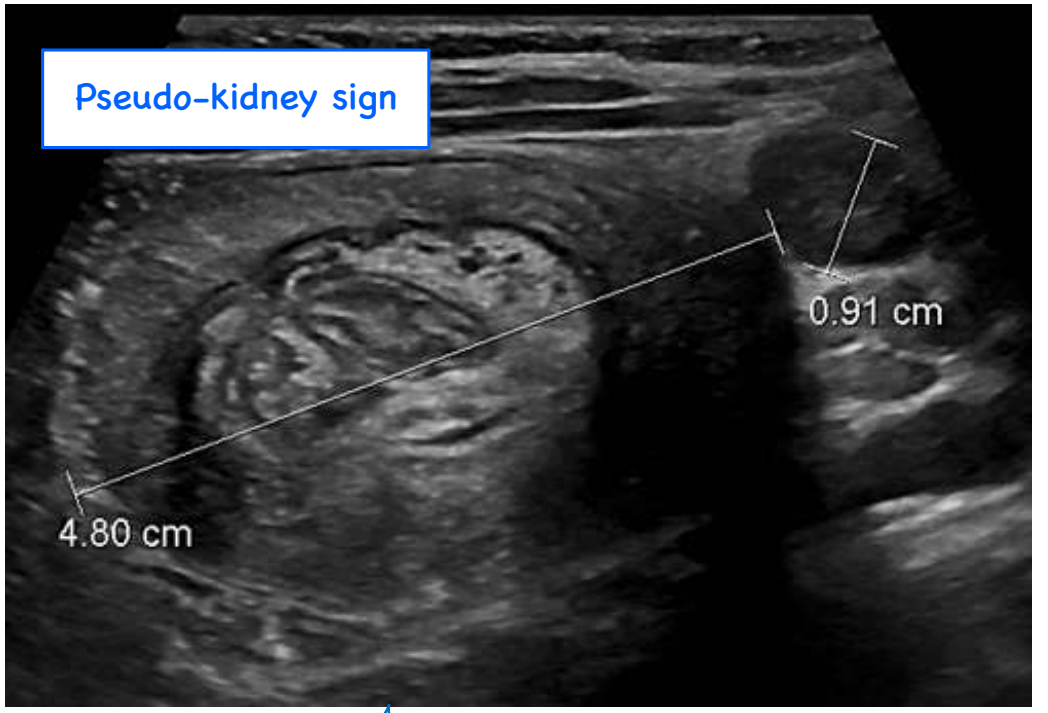
1. Echogenic medulla
2. Follicles pushed laterally, becuse the swollen central medulla compress follicles outward

Q2

- A 2-year-old boy, recurrent, intermittent abdominal pain for the last 16 hours.

- - DDX? Intussusception
- - Imaging ? Ultrasound, X-ray with contrast

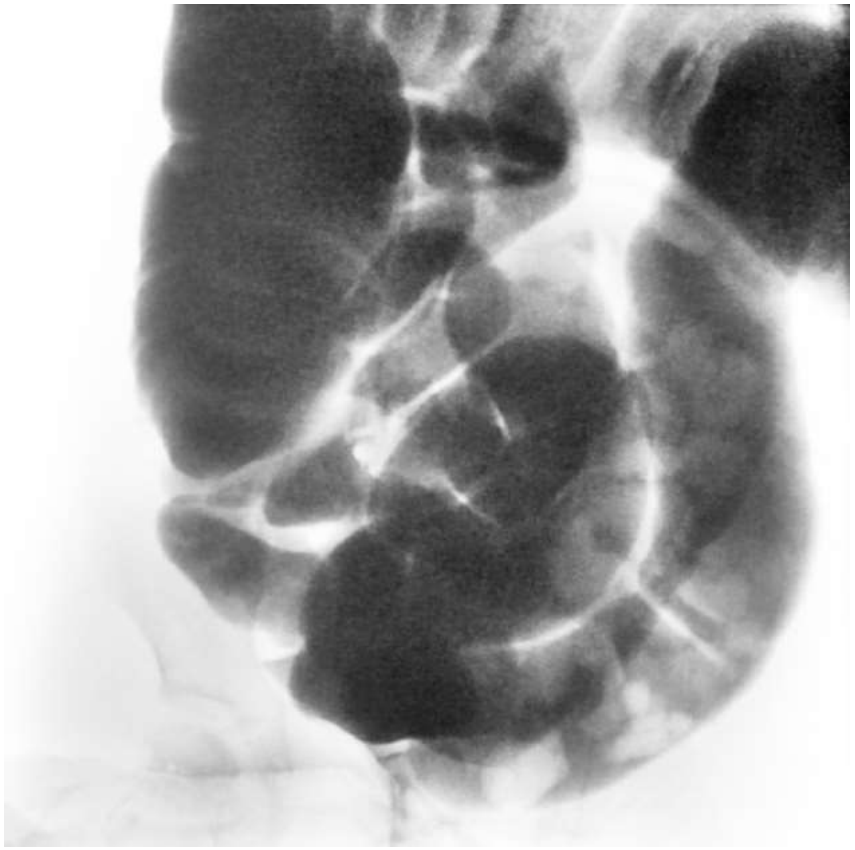

LOGIQ
RT FLANK
Doughnut sign
10
-10


Pseudo-kidney sign
0.91 cm
4.80 cm

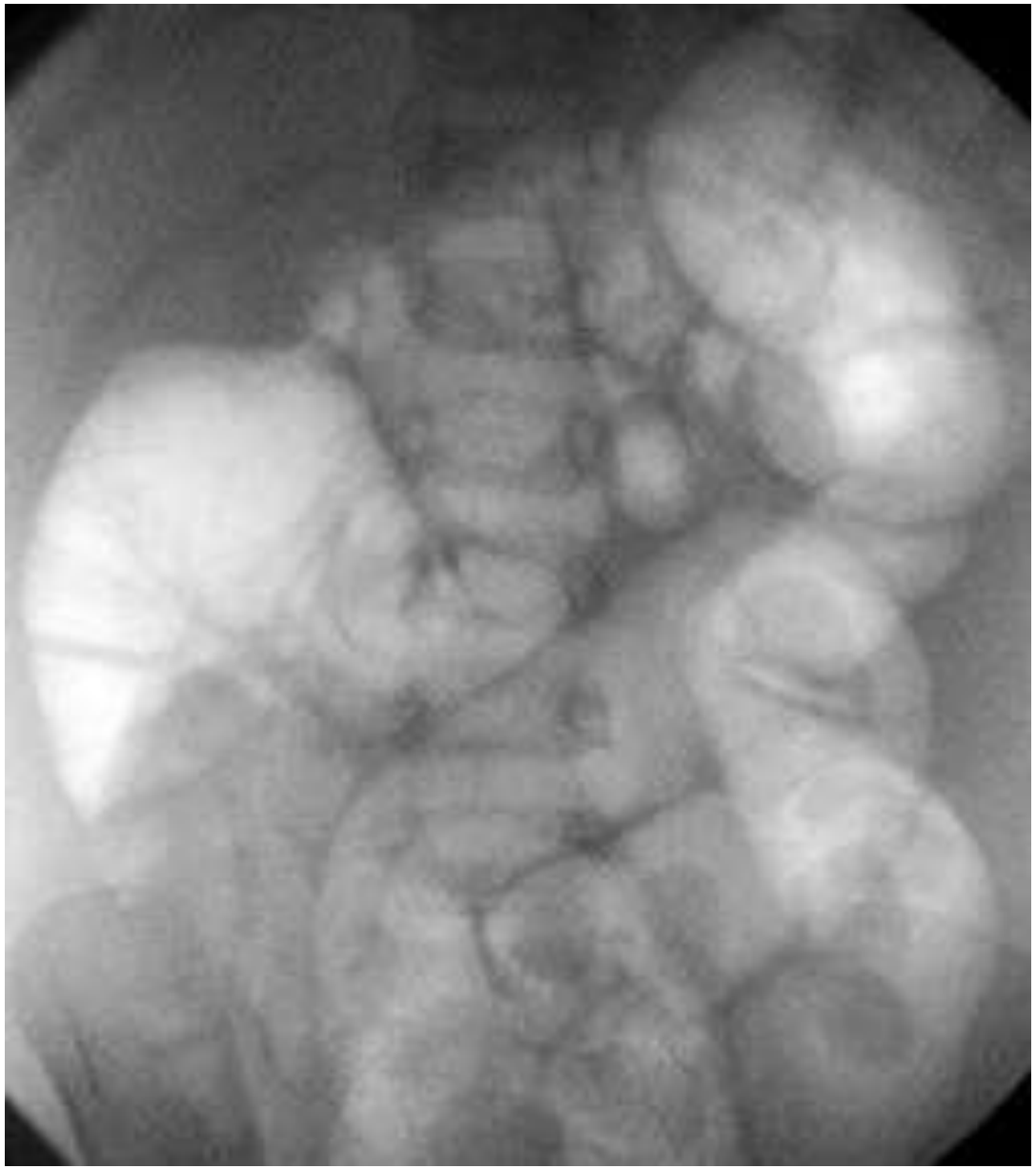

RT FLANK

sudden cut off

of contrast



Claw sign



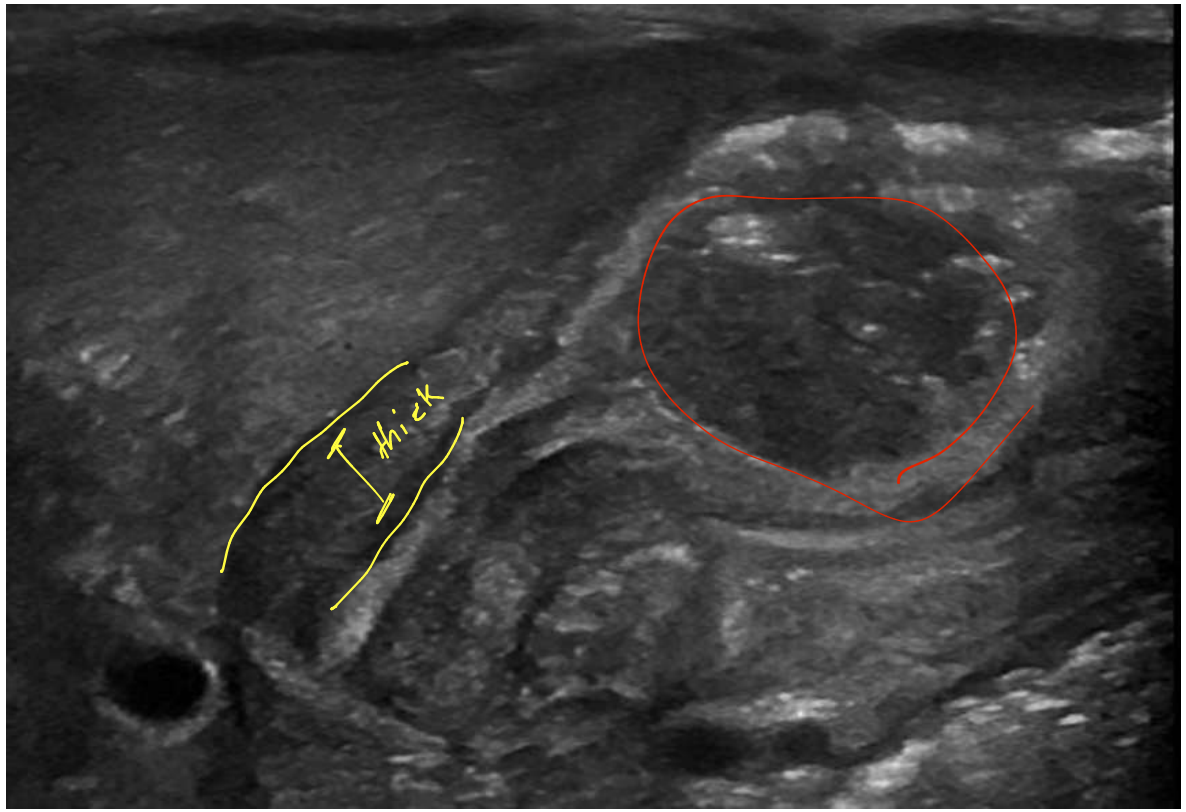
Q3

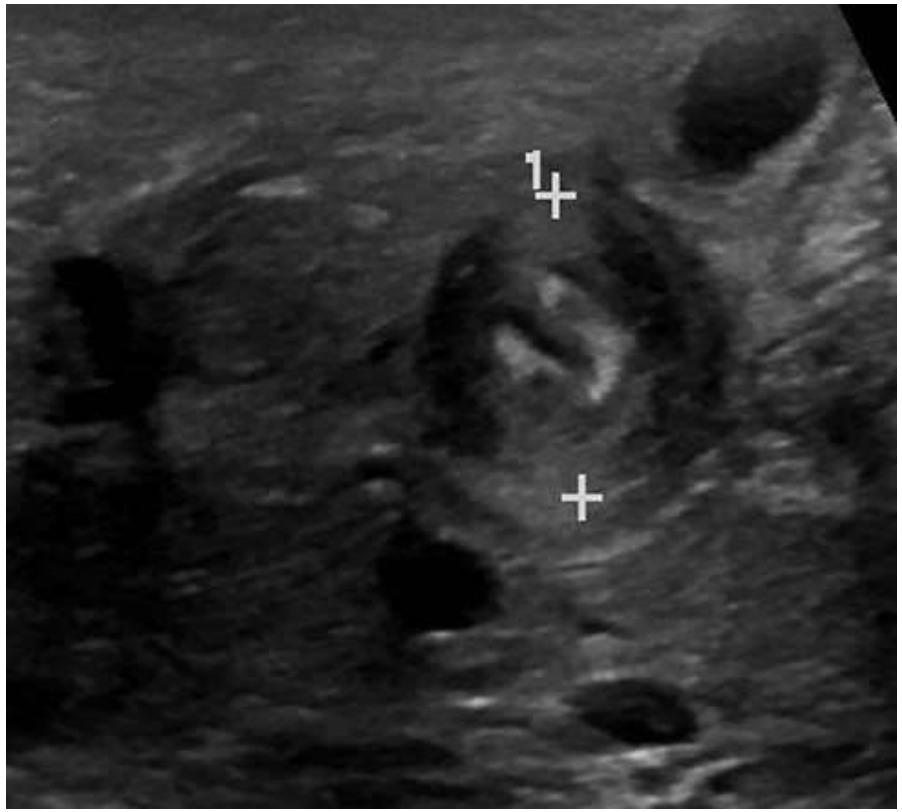
- A 5-week-old male baby, recurrent vomiting, not gaining weight?

- - Differential diagnosis? Pyloric stenosis
- - Imaging? Ultrasound

Hypertrophic pyloric muscle—> which lead to obstruction

Wall thickness





Normal pylorus

Idiopathic thickening of gastric pyloric musculature ➔ progressive gastric outlet obstruction.

Pyloric stenosis is relatively common
~ 2-5 per 1000 births,

Symptoms usually begin between 3 and 12 weeks of age

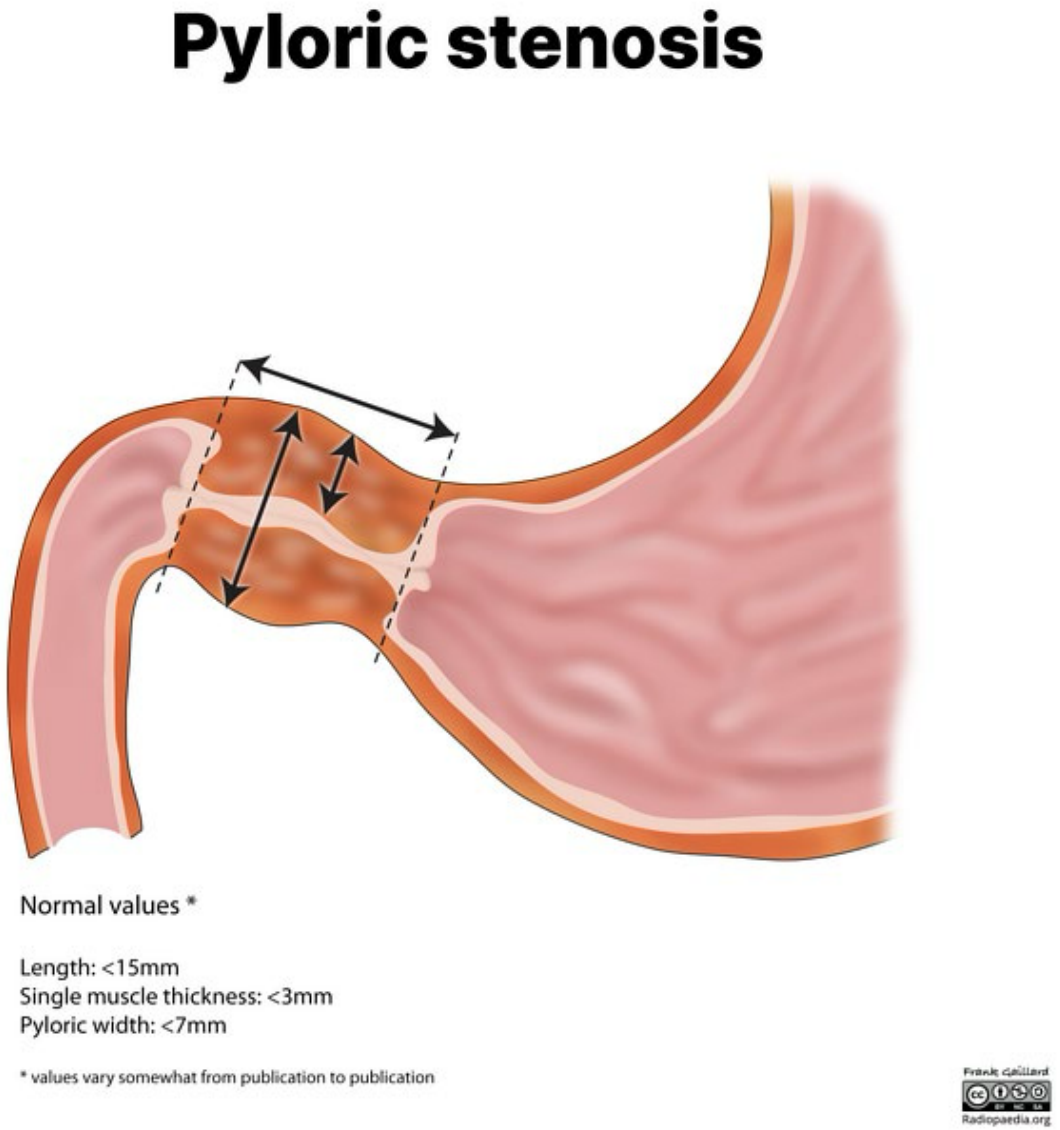
male predilection (M:F ~4:1).

More commonly seen in the **White** population, less common in India, and among Black and other Asian populations.

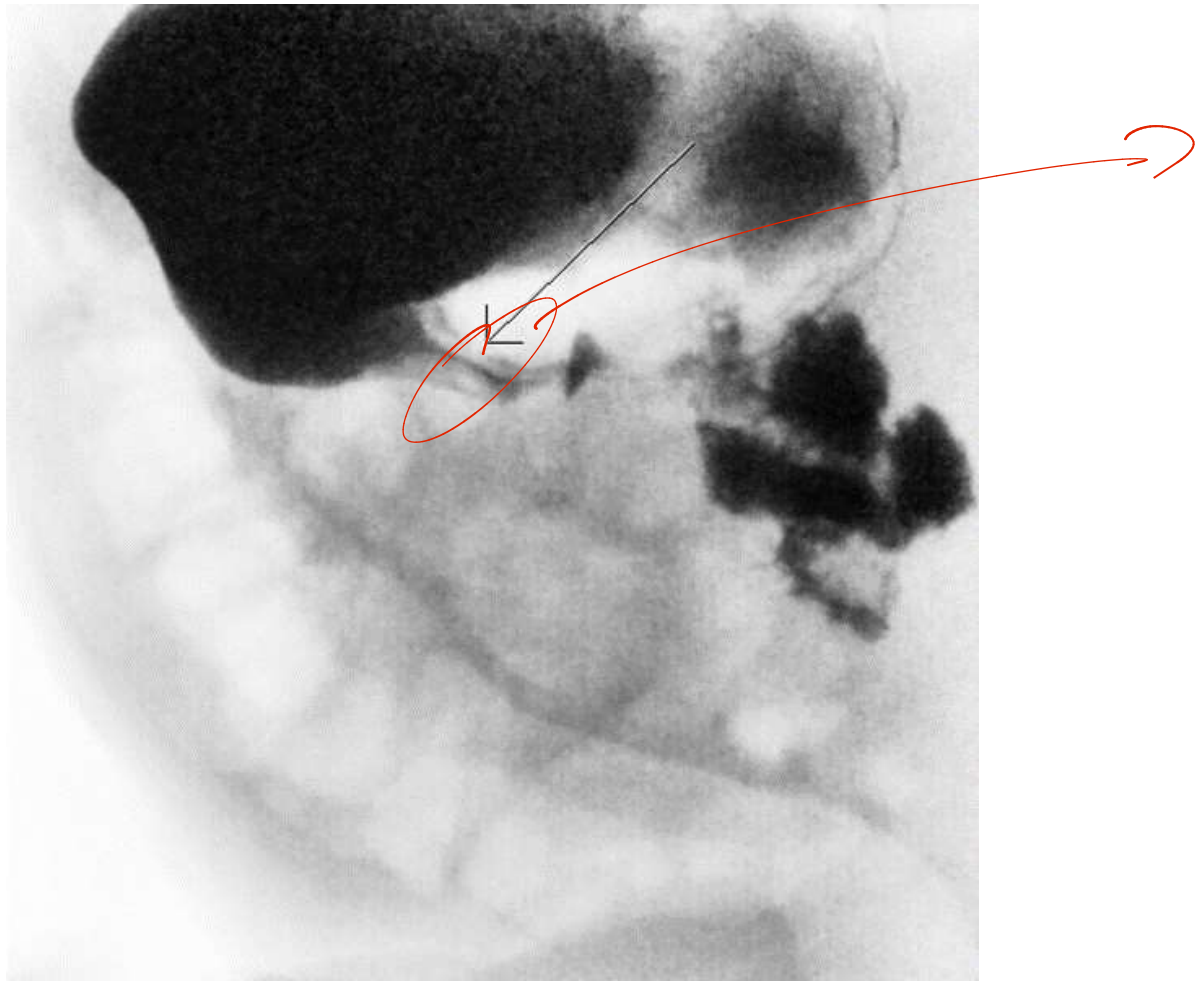
<u>Risk factors</u>

- **First born**

- **maternal history of pyloric stenosis**



https://radiopaedia.org/articles/pyloric-stenosis-1



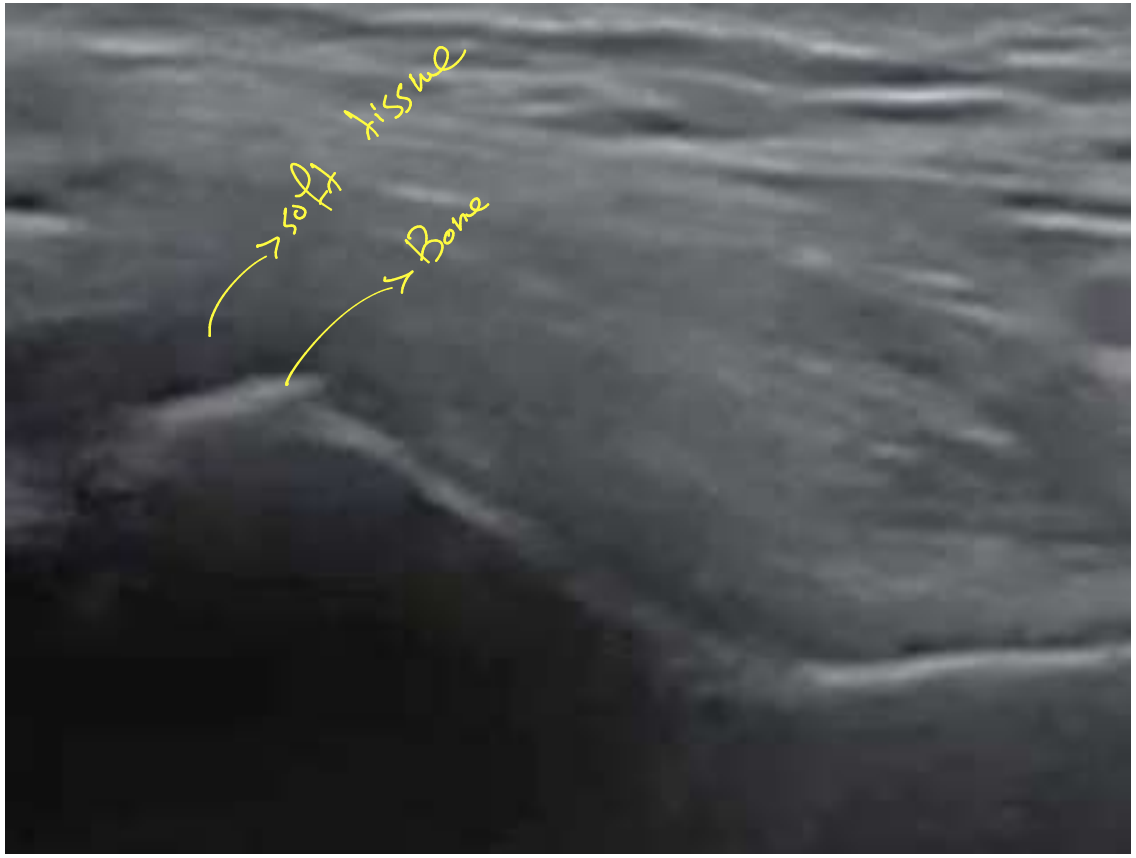
Q4

- A 5-year-old by, non-weight bearing on the right side for the last 24 hours, low-grade fever

Dx: Septic arthritis

Modalities of imaging: Ultrasound (first choice) , x-ray but not sensitive in acute phases
The good standard one is MRI but expensive

right



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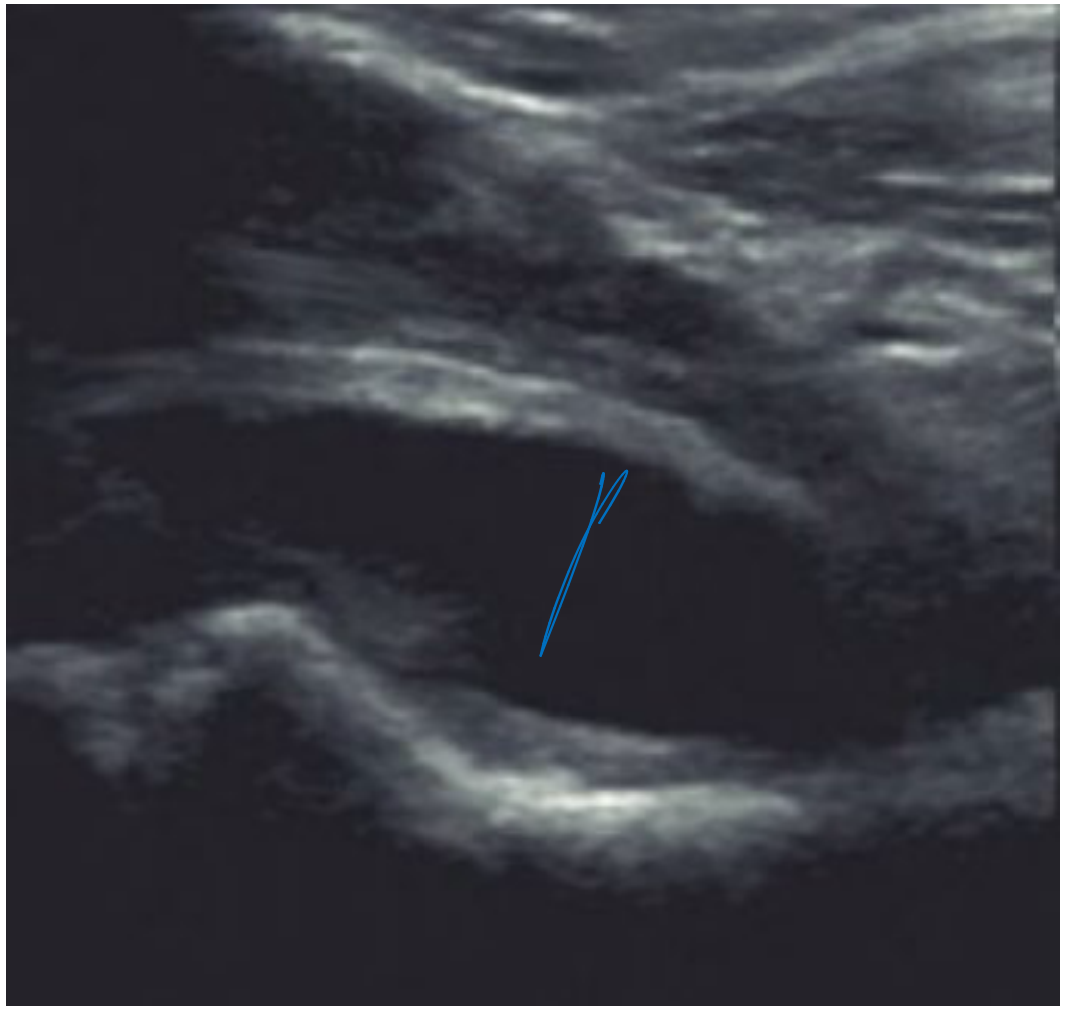
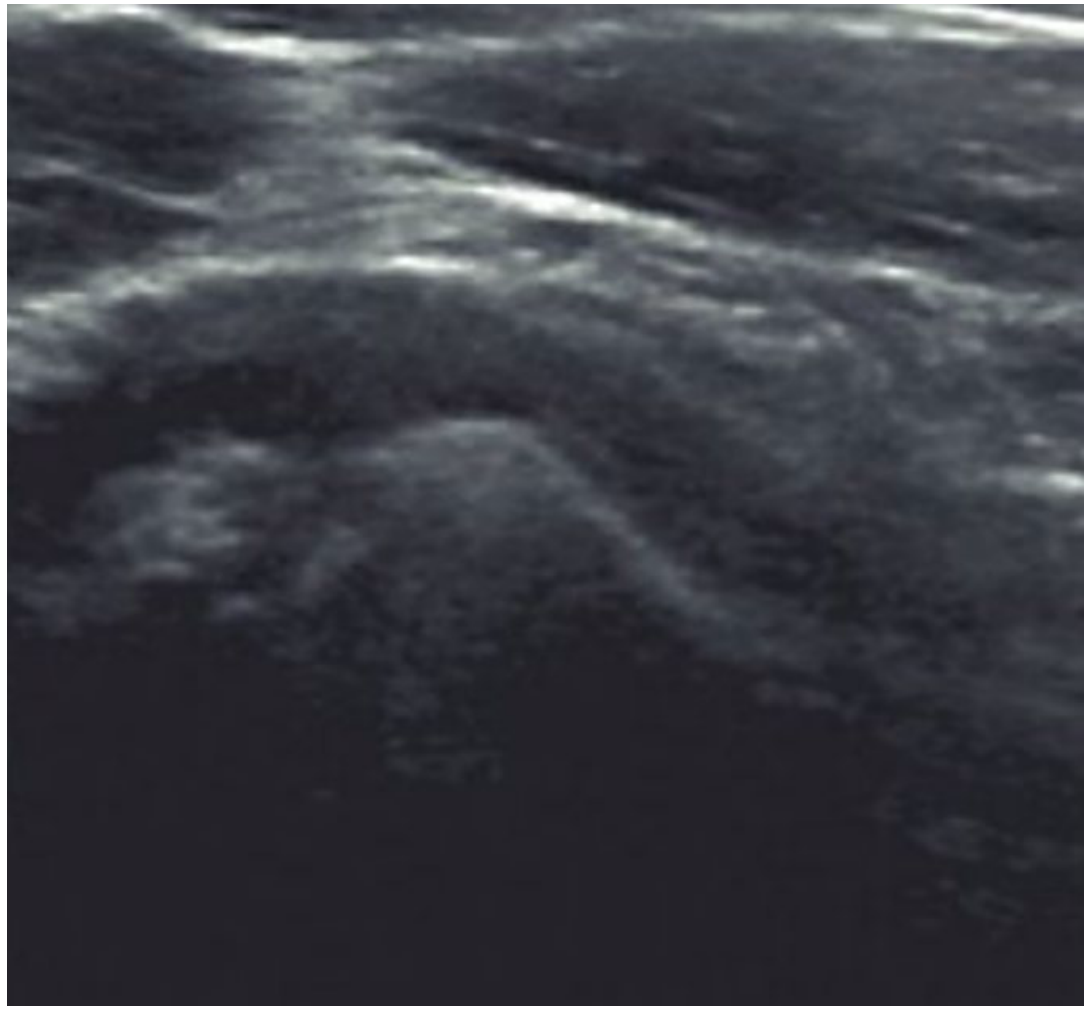


right

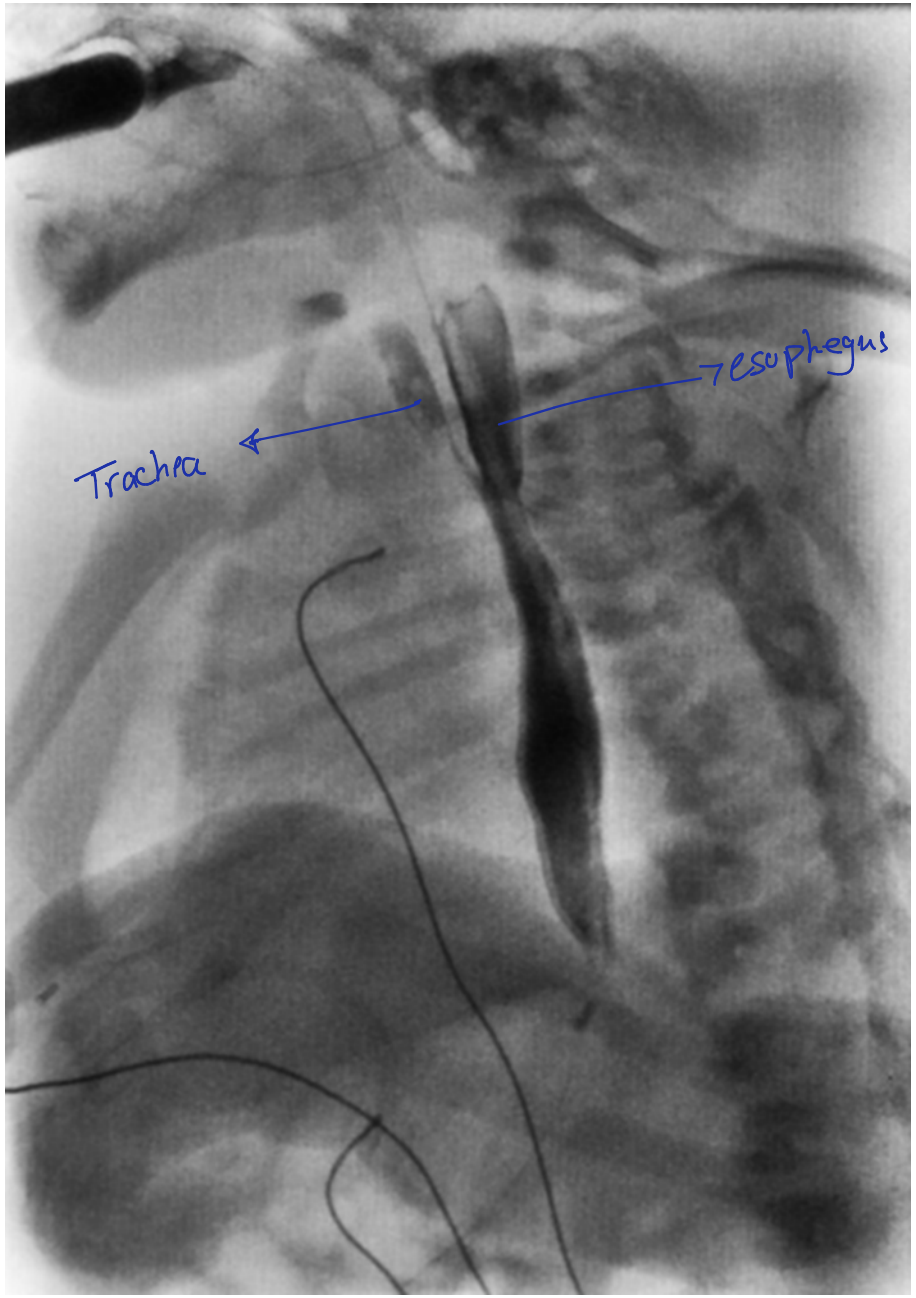


left

Q5

- A 6-week-old baby has recurrent coughing or choking while nursing or taking a bottle.
- Frothing or drooling from the mouth.
- Vomiting.
- Difficulty breathing while feeding.

- - Differential Dx? Esophageal atresia
- - Imaging investigations? X-ray- barium swallow

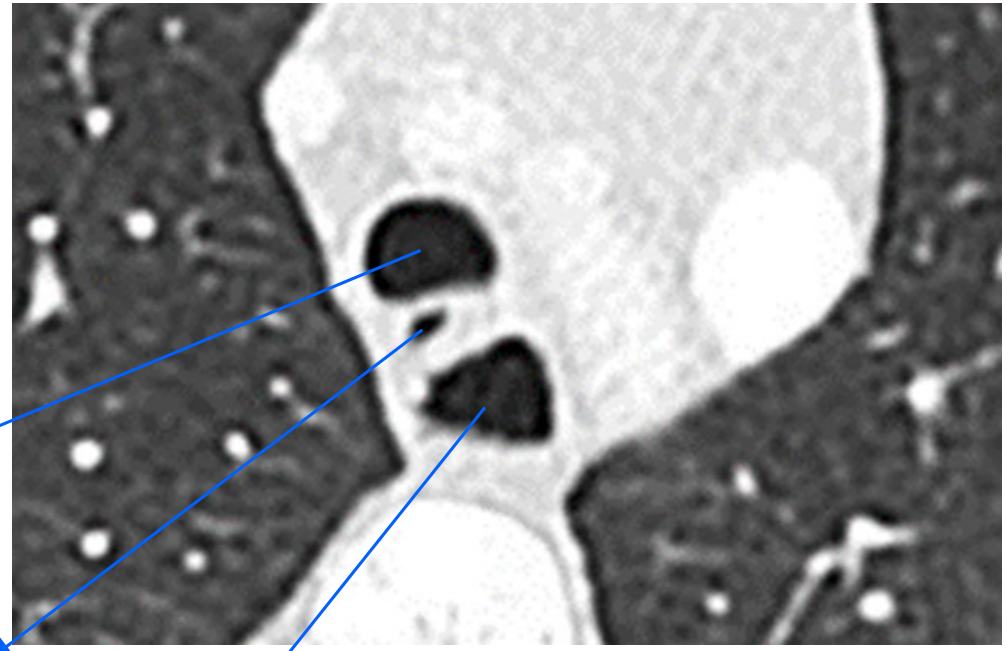

Trachea
Oesophegus

Tracheoesophageal fistula

Isolated fistula
H-type

~4%

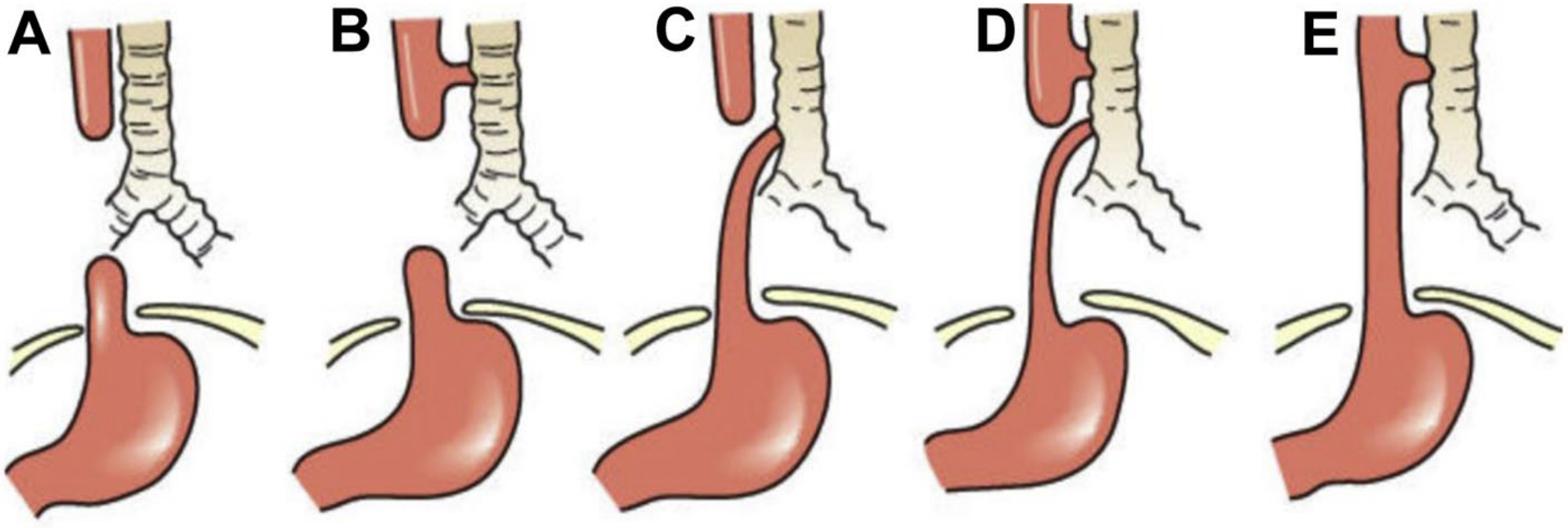
Axial CT scan



Trachea

Fistula

Esophagus



8%
- Atresia alone, no fistula
- Small stomach, gasless abdomen
- Usually has a long gap between the esophageal ends
- Gross type A

1%
- Proximal tracheoesophageal fistula
- No distal fistula
- Small stomach, gasless abdomen
- Often has a long gap between esophageal ends
- Gross type B

86%
- Most common abnormality
- Gross type C

1%
- Proximal and distal fistulas
- "Double Fistula"
- Gross type D

4%
- No atresia of the esophagus
- Congenital tracheoesophageal fistula
- H or N fistula
- Gross type E

VACTREL Association

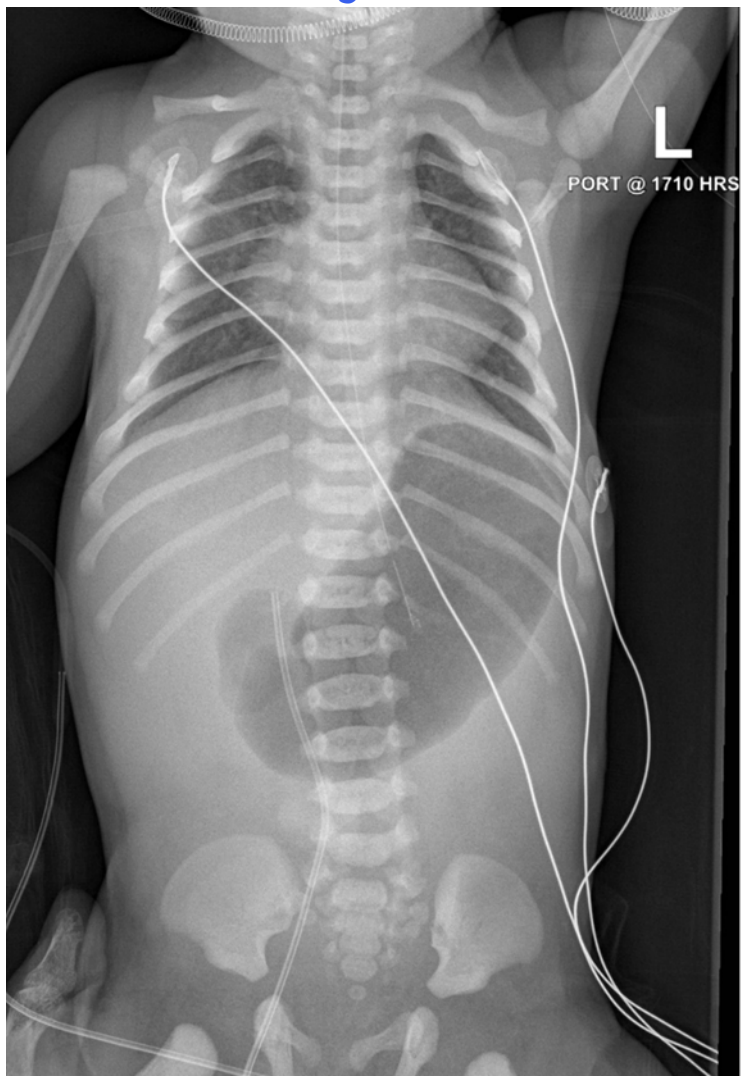
- **V**ertebral
- **A**norectal
- **C**ardiac
- **Tracheoesophageal fistula**
- **R**enal
- **L**imb

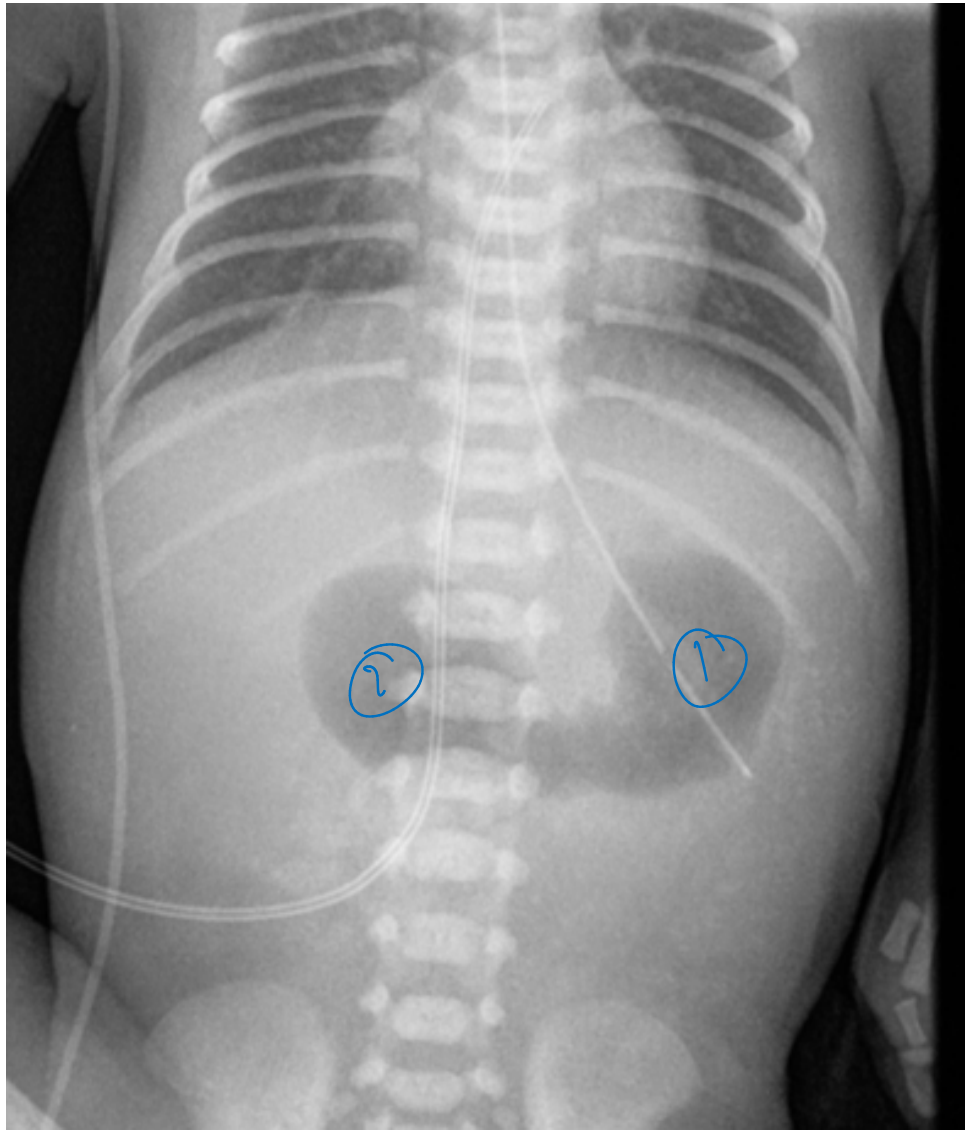
Q6

- A 12-hour old baby. Paucity of gas in the abdomen. Air is seen in the stomach and proximal duodenum
- - DDX? Duodenal atresia

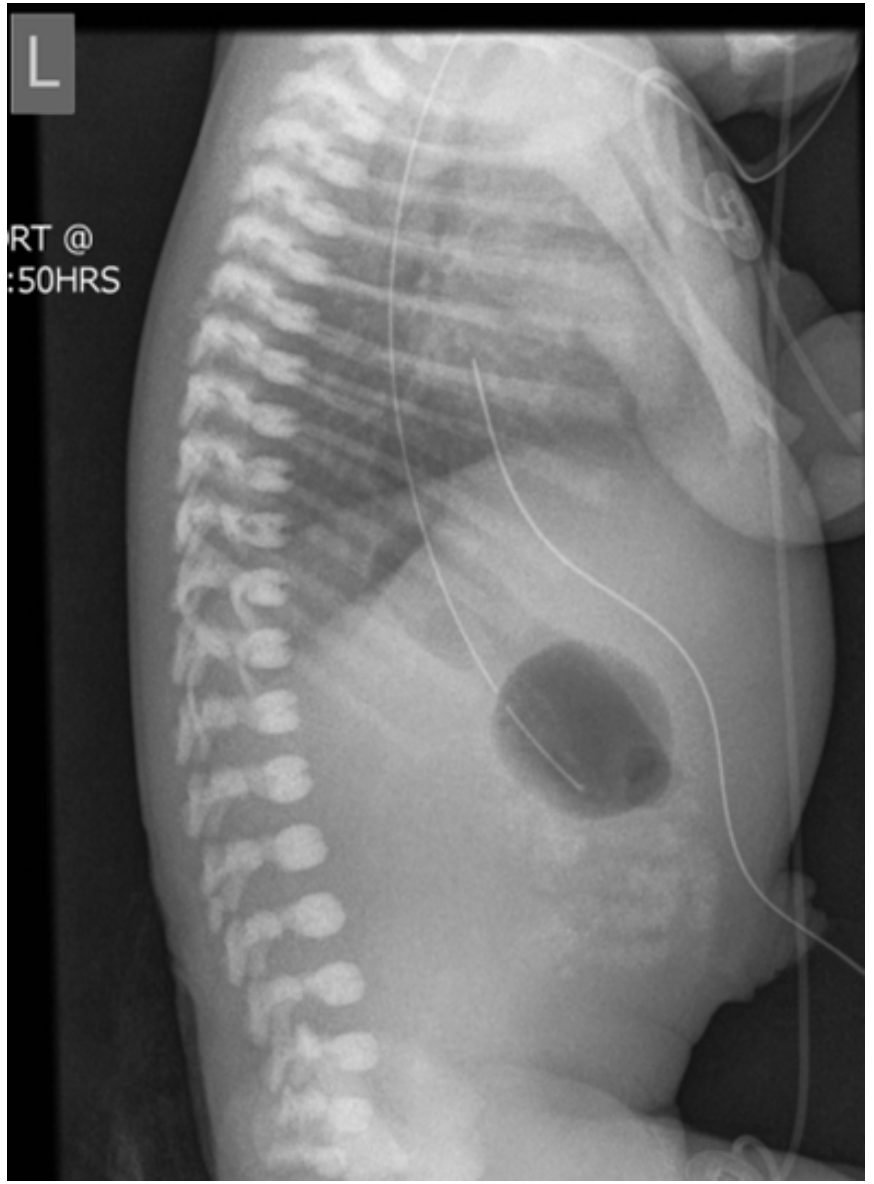
  Best modality: X-ray

Double bubble sign





Double bubble sign

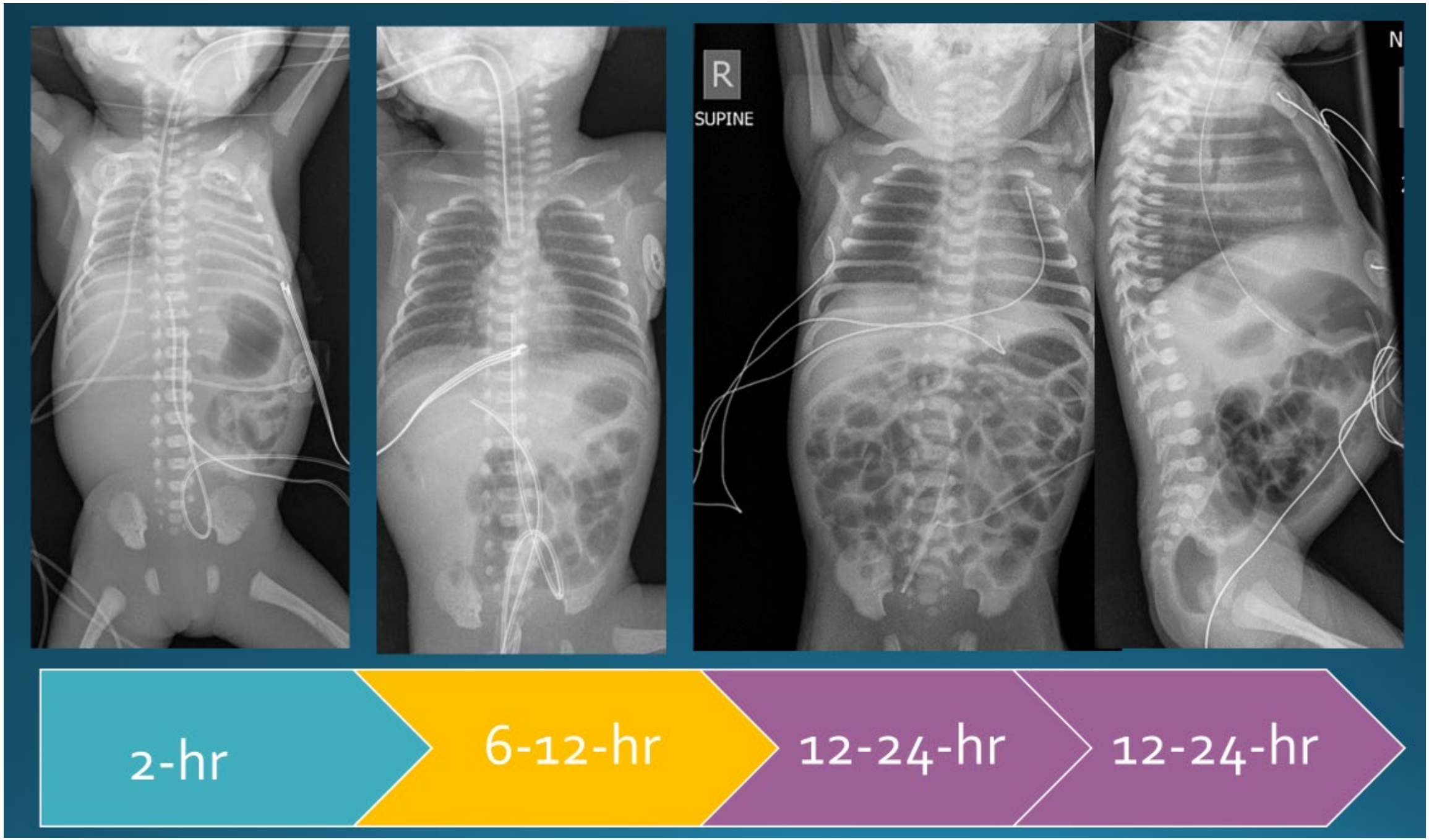


Duodenal Atresia

- **Double Bubble sign**

- Duodenal atresia

- Results from failure of recanalization of the solid duodenal tube. Most often the atresia occurs distal to Vater's ampulla


R
SUPINE
2-hr
6-12-hr
12-24-hr
12-24-hr

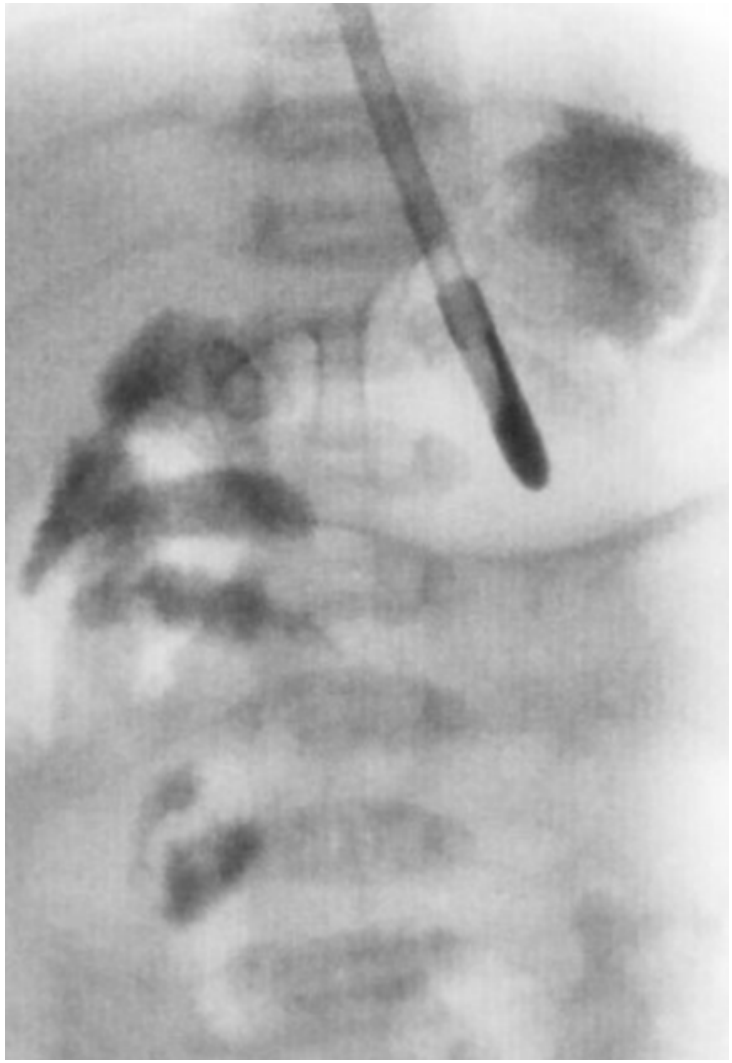
Q7

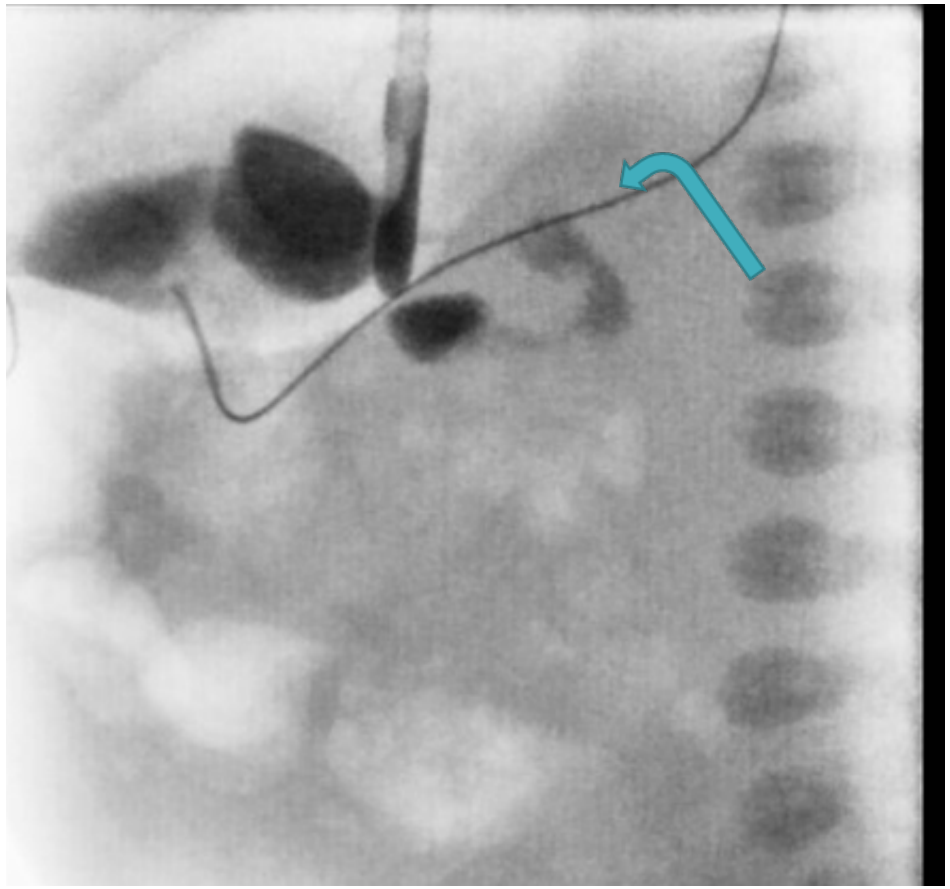
- 39 weeks, 0-day, bilious vomiting Emergent

  Dx: volvulus

  Request X-ray

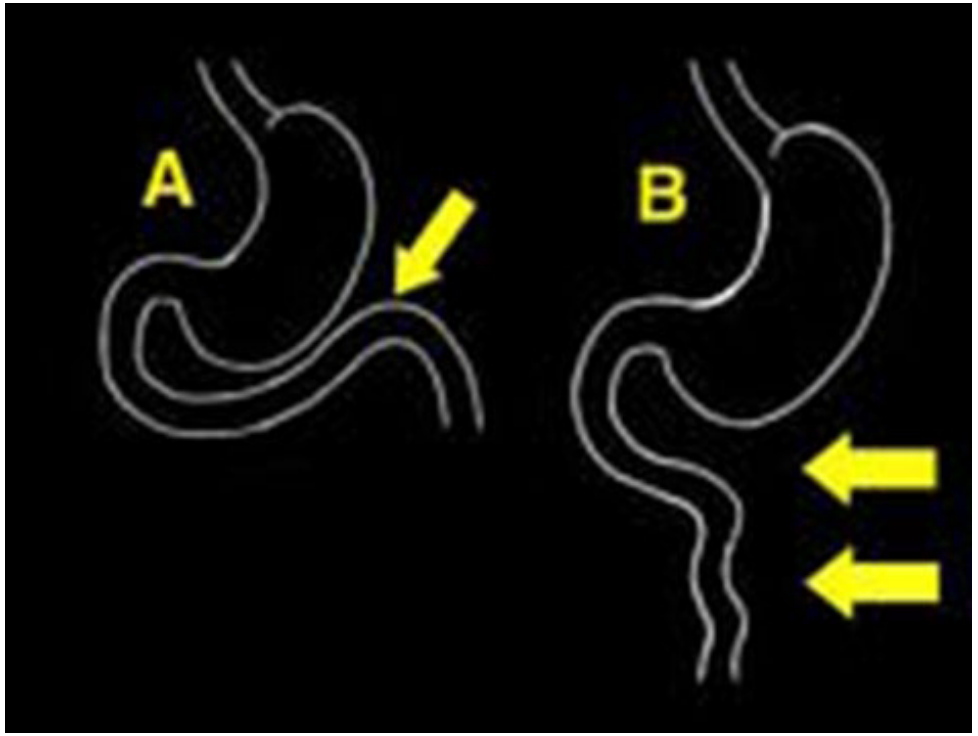
The main risk factor for volvulus → malrotation

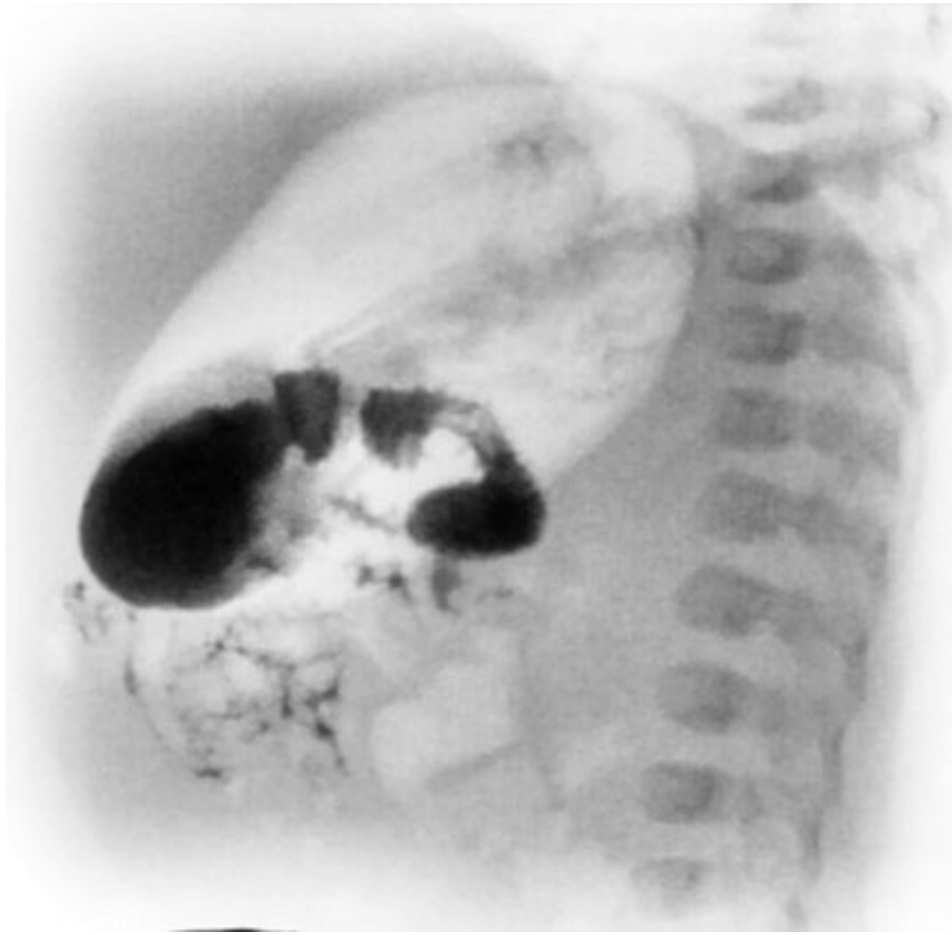


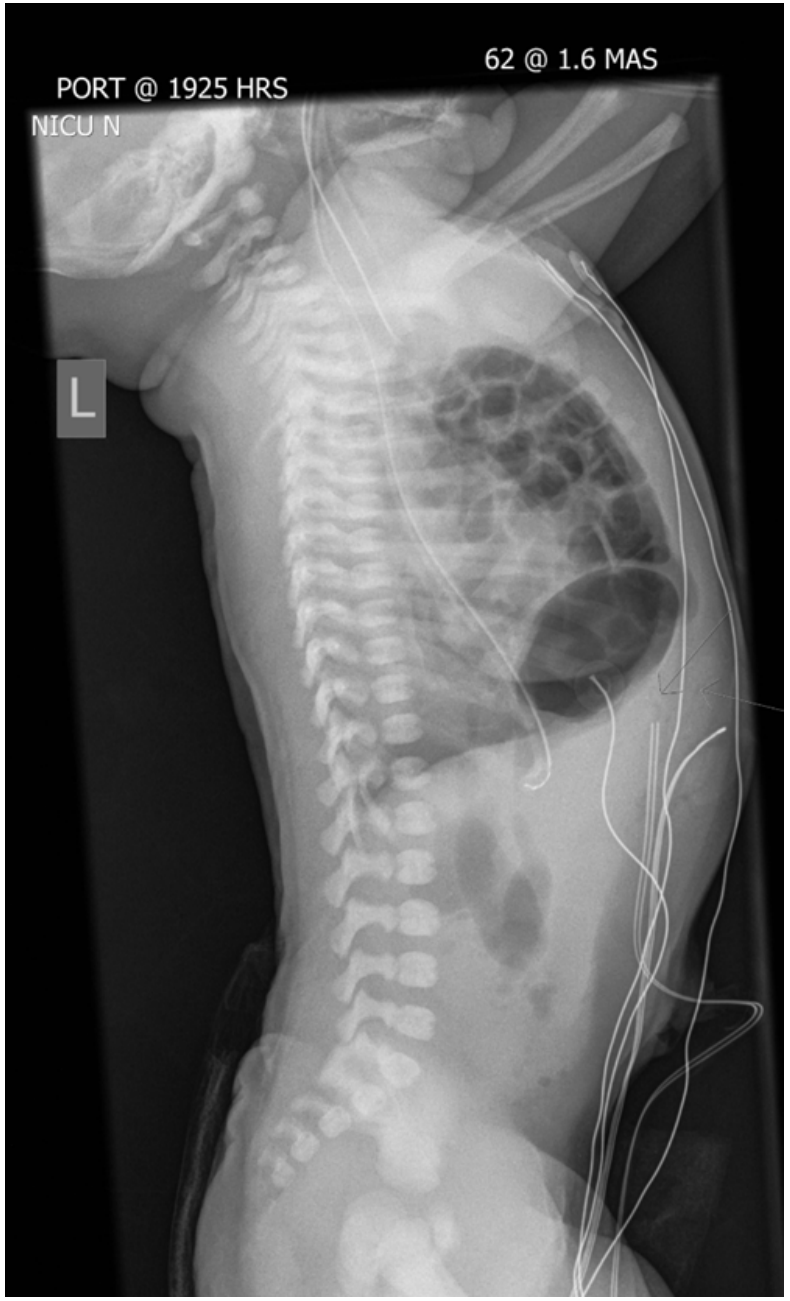


Upward direction of
the D2

normal





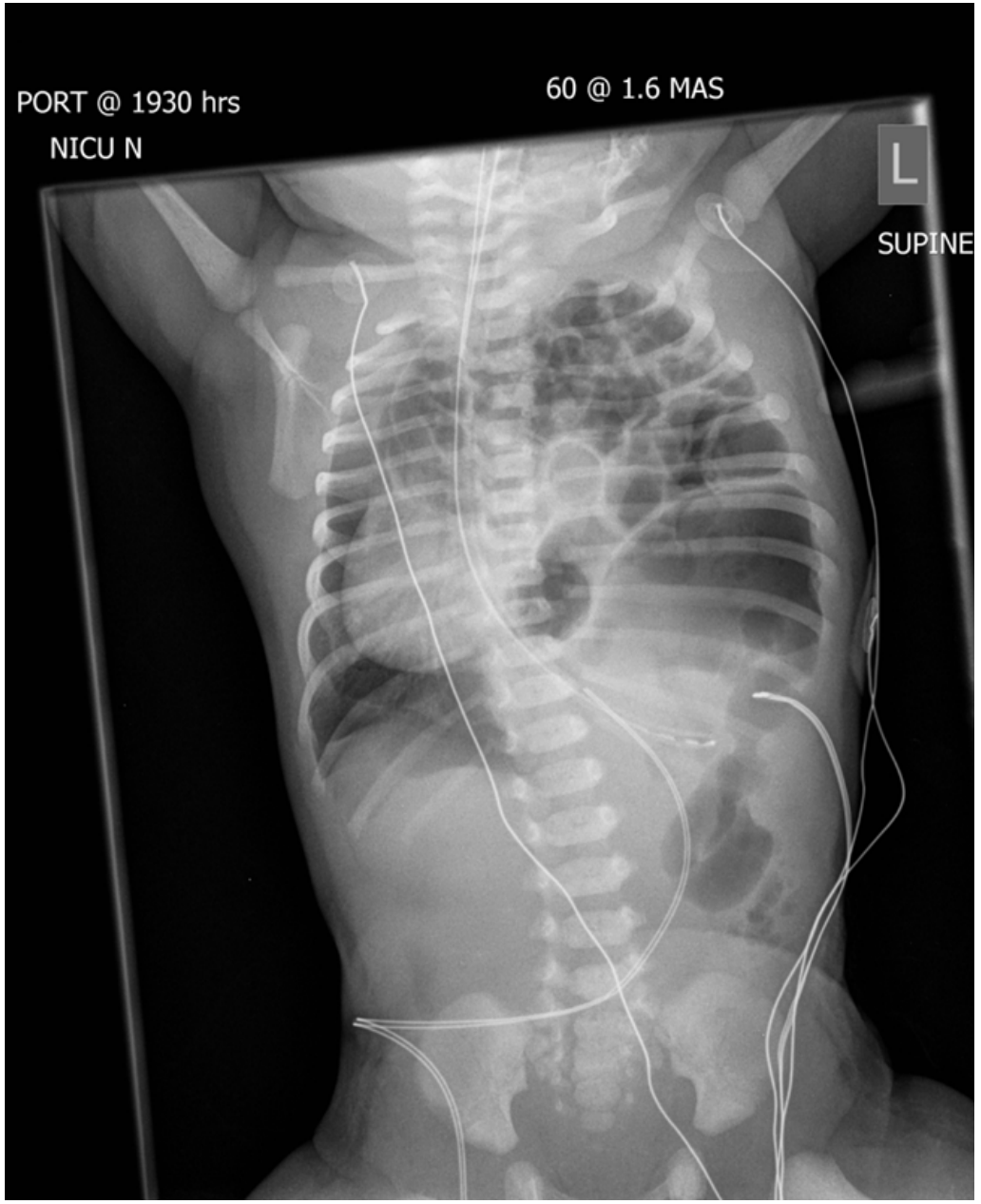


Q8

A 0- day old – Difficulty breathing

Diaphragmatic hernia

→ X-ray

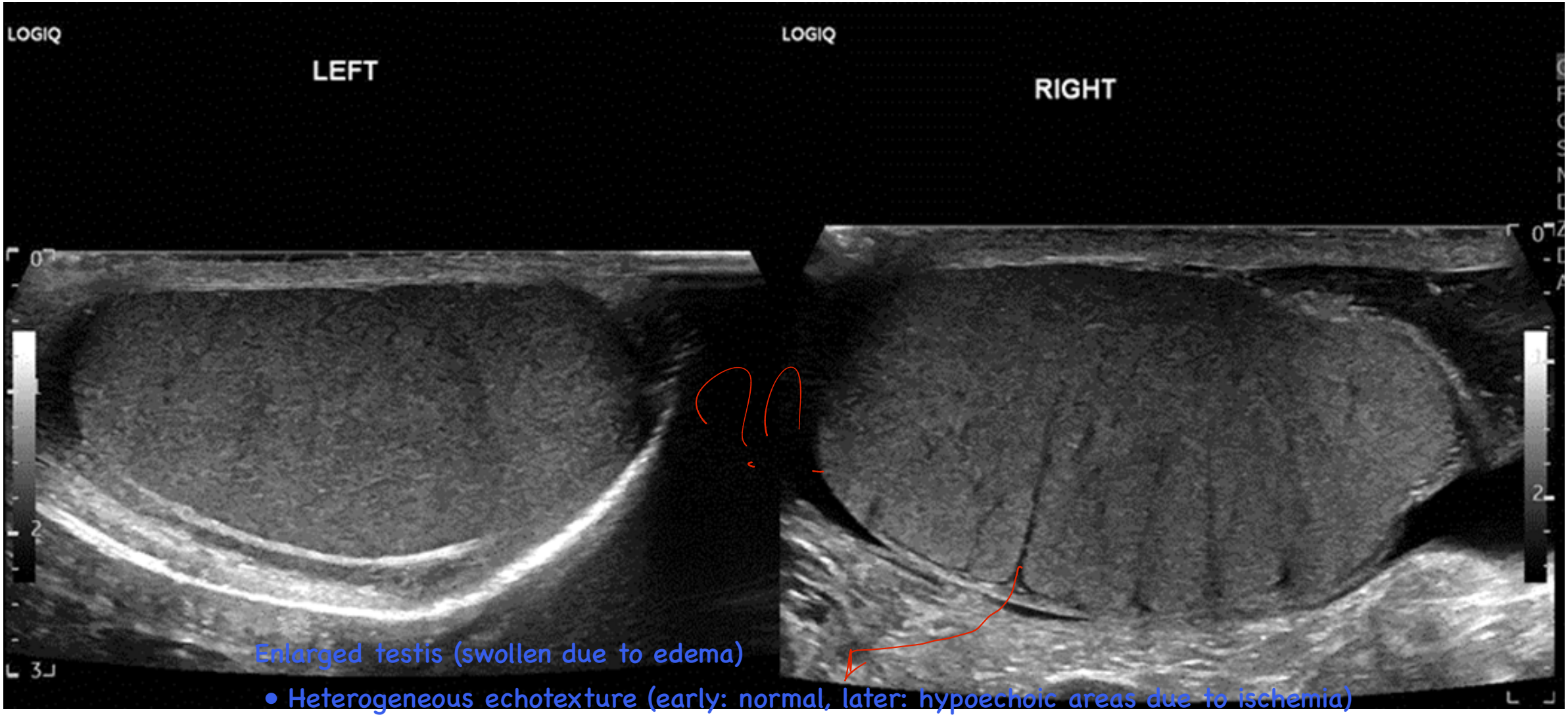


Q9

- A 13-year-old boy, scrotal pain

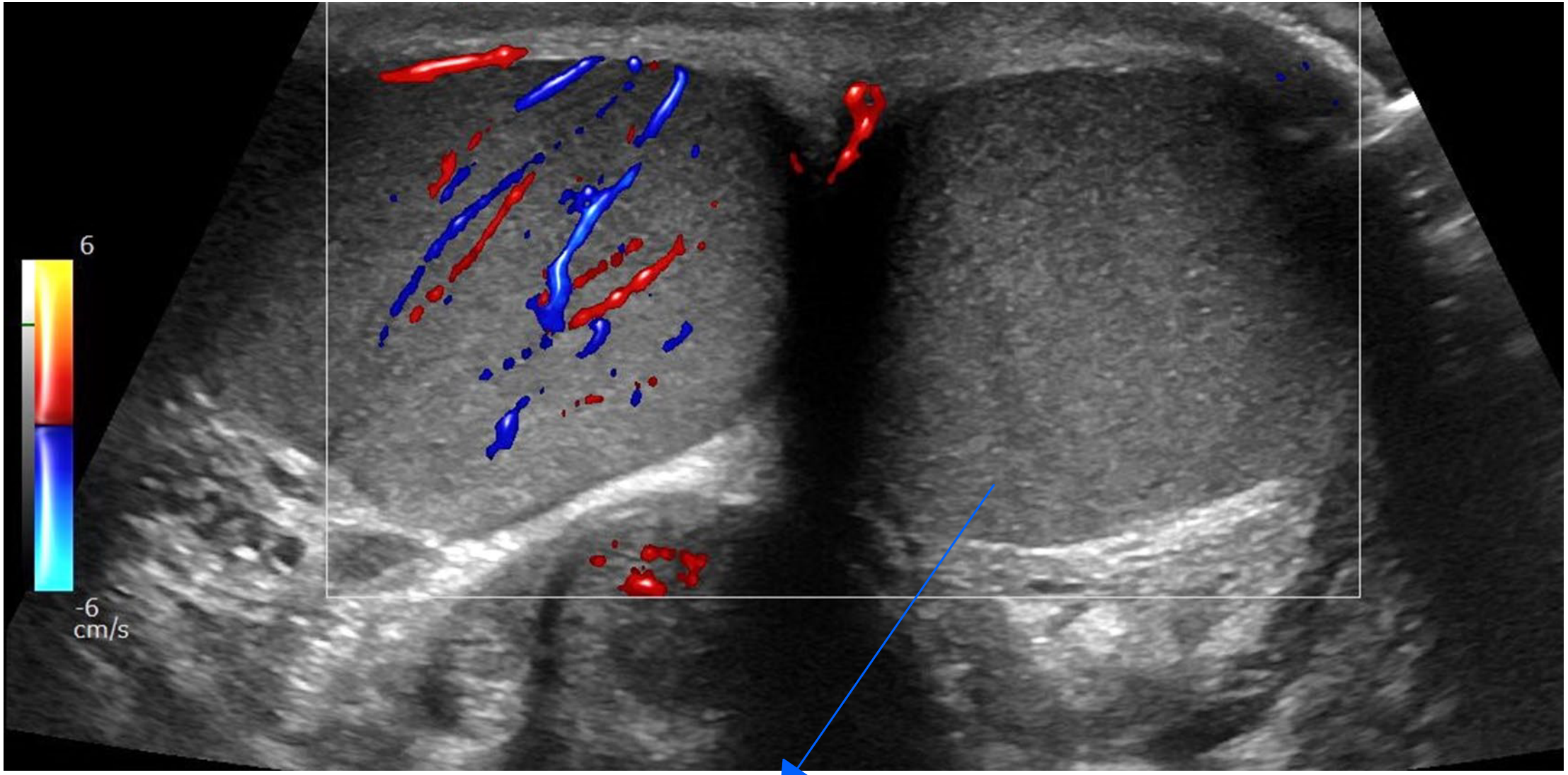
Dx: Testicular torsion

→ US



Enlarged testis (swollen due to edema)

- Heterogeneous echotexture (early: normal, later: hypoechoic areas due to ischemia)
- Reactive hydrocele (fluid around the testis)
- Thickened scrotal wall



Doppler ultrasound → absent blood flow in torsion.

Q10

- A 3-month-old baby, cough and irritability

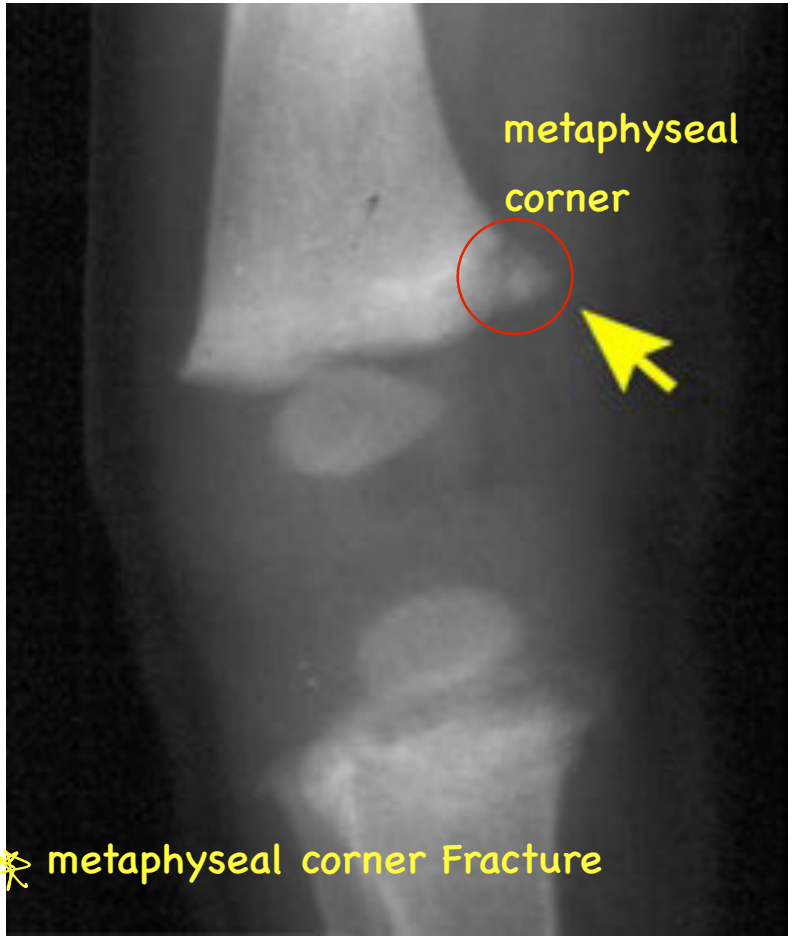
  Request X-ray

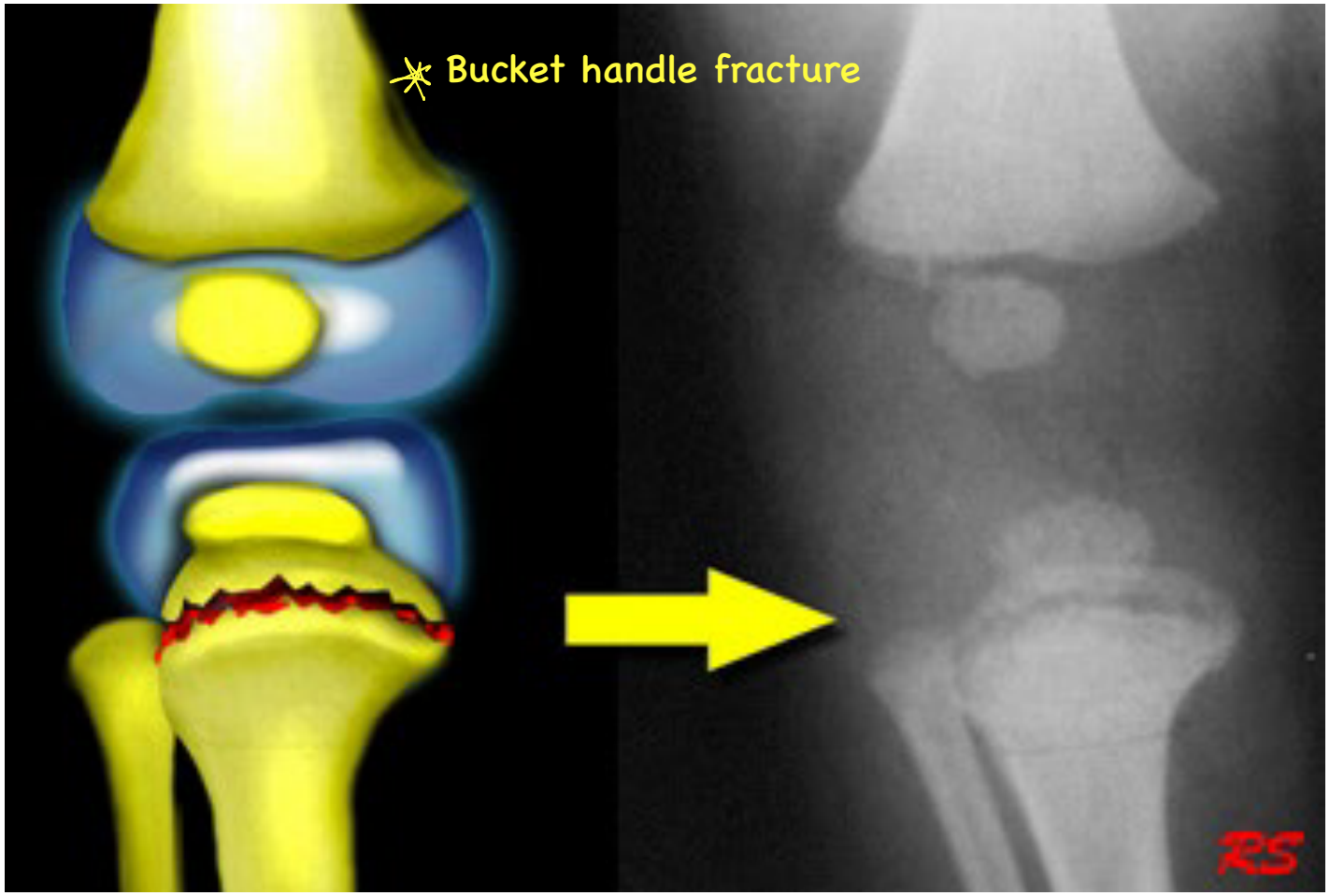
Rt premothorax
lung collapsed

- The classical **metaphyseal corner or bucket handle fracture** is virtually pathognomonic for abuse, although a differential diagnosis does exist.

- **Rib fractures** are prevalent and highly specific for abuse in young children less than 2 years.

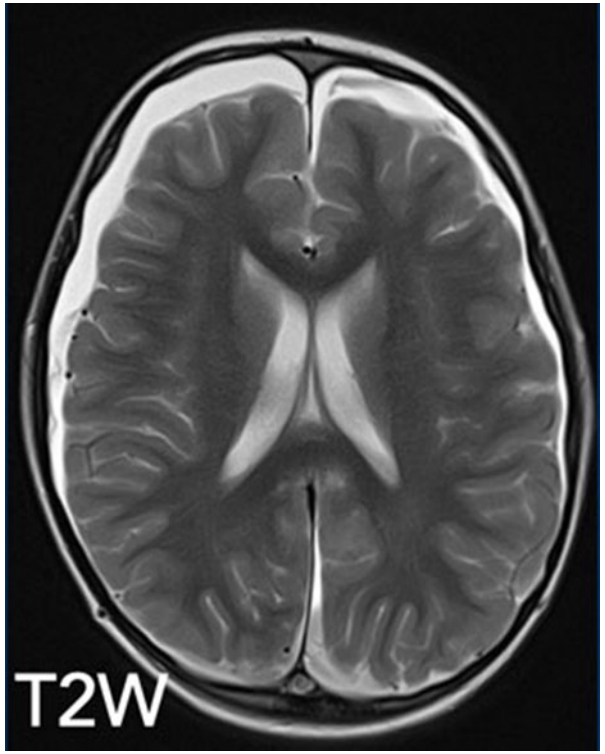
- Fractures of **the acromion, sternum** and **spinous processes** are so rare in accidental conditions, giving them a high specificity for abuse.

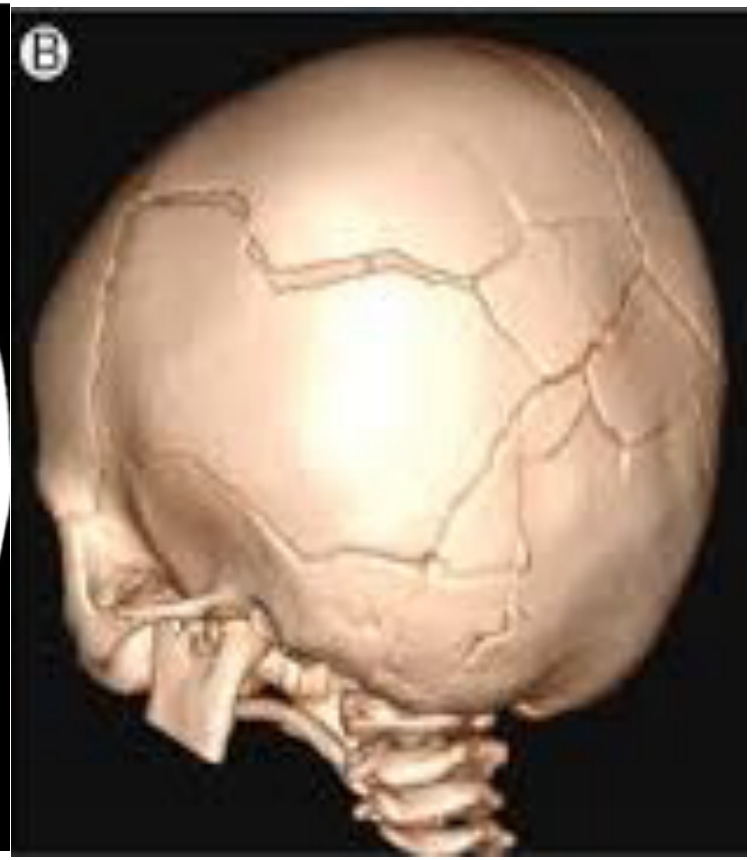




These 2 type indicates child abuse

The metaphyseal lesion in abused infants: a radiologic-histopathologic studyPK Kleinman, SC Marks, and B Blackbourne, Am. J. Roentgenol., 146: 895 - 905.





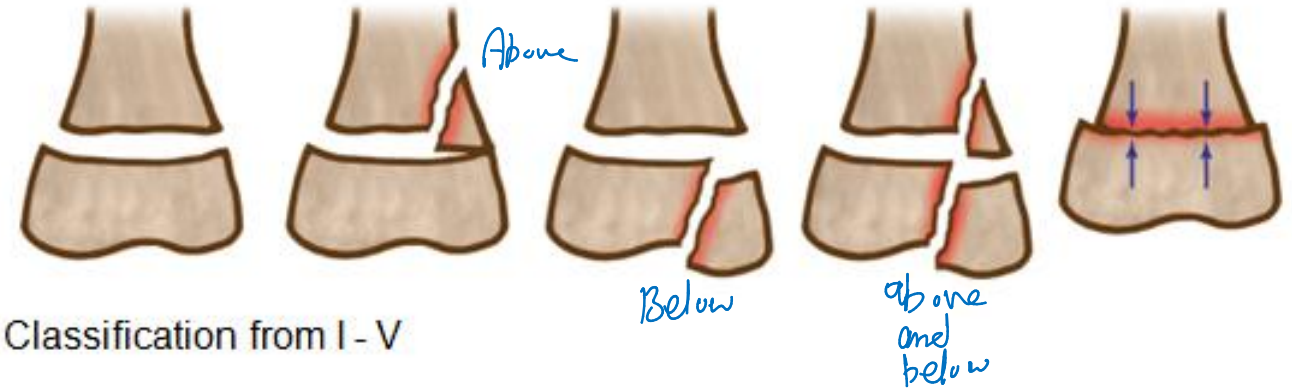
Bilateral subdural hematoma

Shaken baby syndrome

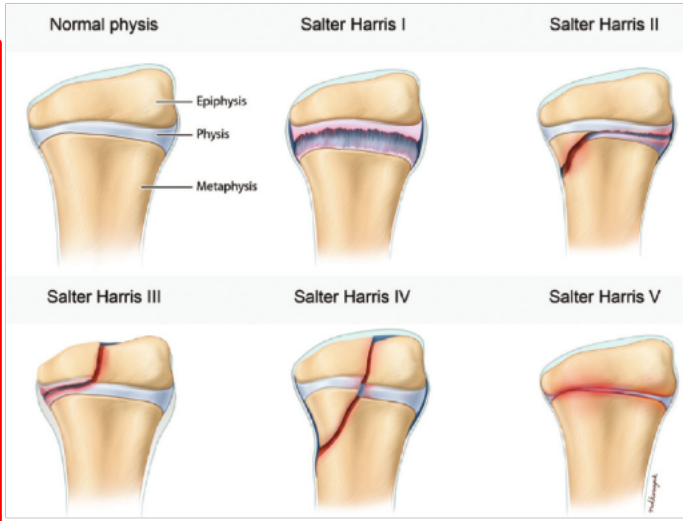
Peds. MSK

SALTER Harris Physeal Injury Classifications

Type	Characteristics
I	Separation through the physis, usually through areas of hypertrophic and degenerating cartilage cell columns.
II	Fracture through a portion of the physis that extends through the metaphyses.
III	Fracture through a portion of the physis that extends through the epiphysis and into the joint.
IV	Fracture across the metaphysis, physis and epiphysis.
V	Crush injury to the physis.

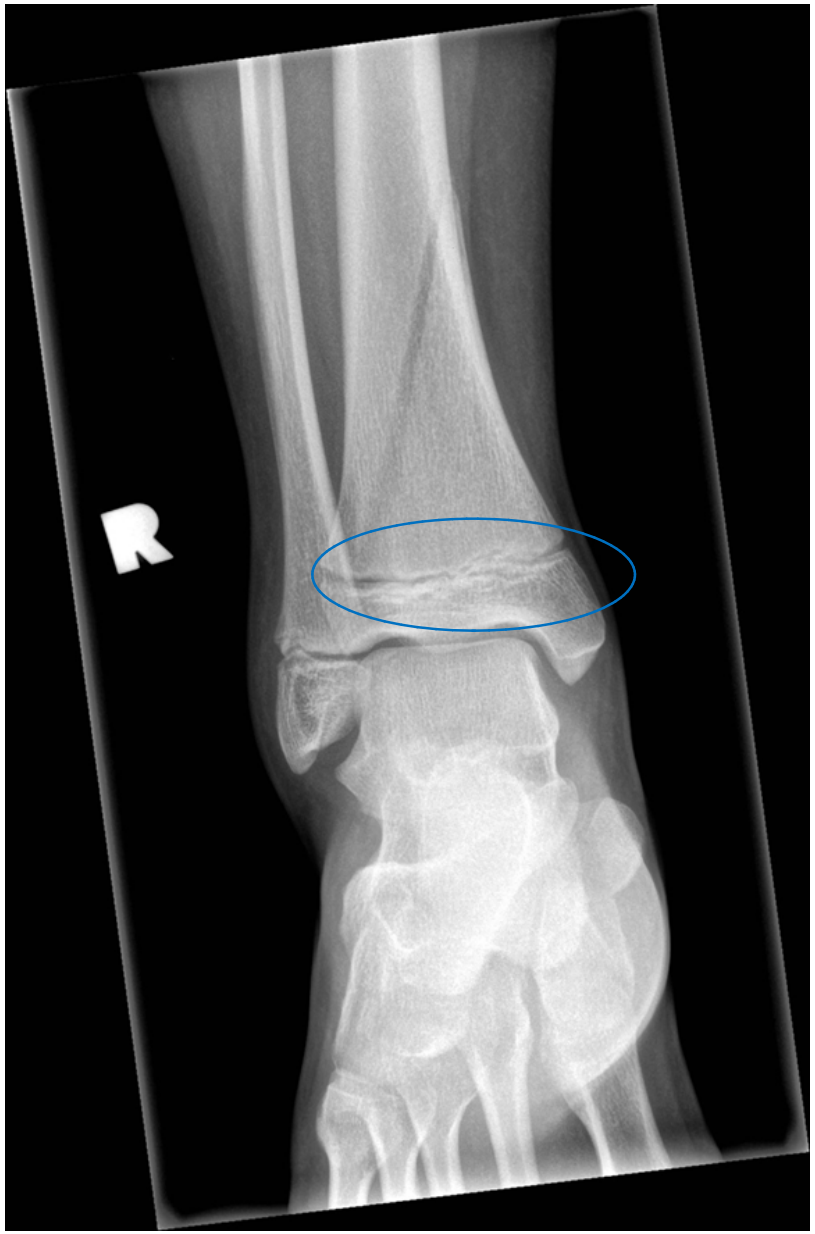


SH Classification from I - V



https://www.emnote.org/emnotes/salter-harris-fractures

Minimally displaced oblique Salter Harris II fracture of the distal
tibia



14-Year-old, ankle injury

14-year-old, ankle injury

Un-displaced **Tillaux fracture**

Tibial epiphysis = Salter III

Salter 4,
Above and below growth plate

ELBOW

The appearance of the ossification centers around the elbow
The order of appearance, but necessarily the same order of fusion

Capitellum: **1** Y

Radial head: **3** Y

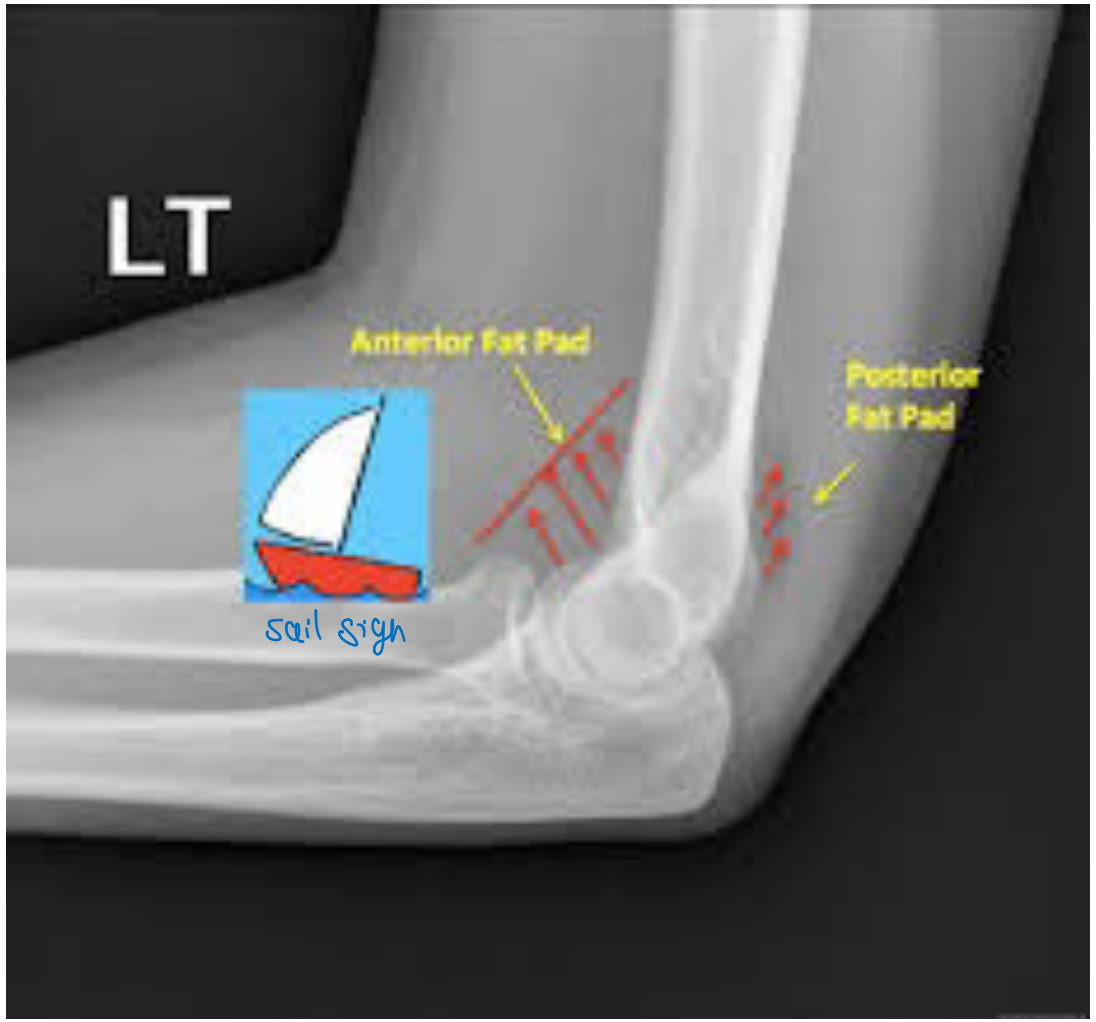
Int. epicondyle: **5** Y

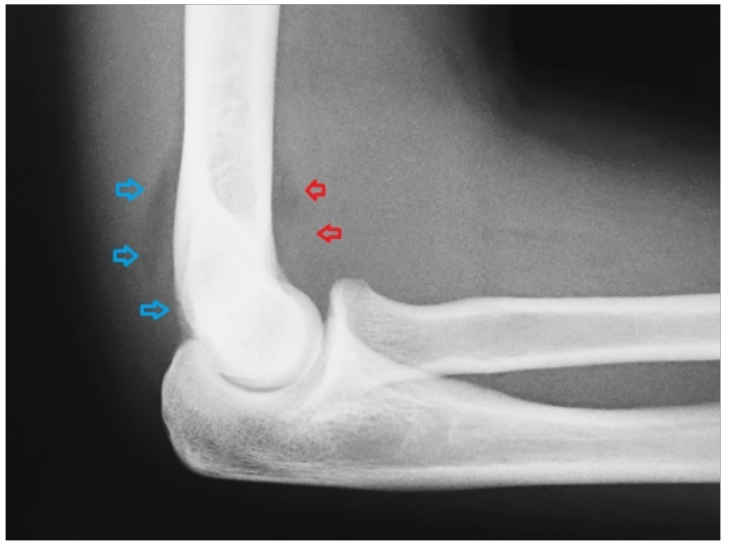
Trochea: **7** Y

Olecranon: **9** Y

Ext. epicondyle: **11** Y

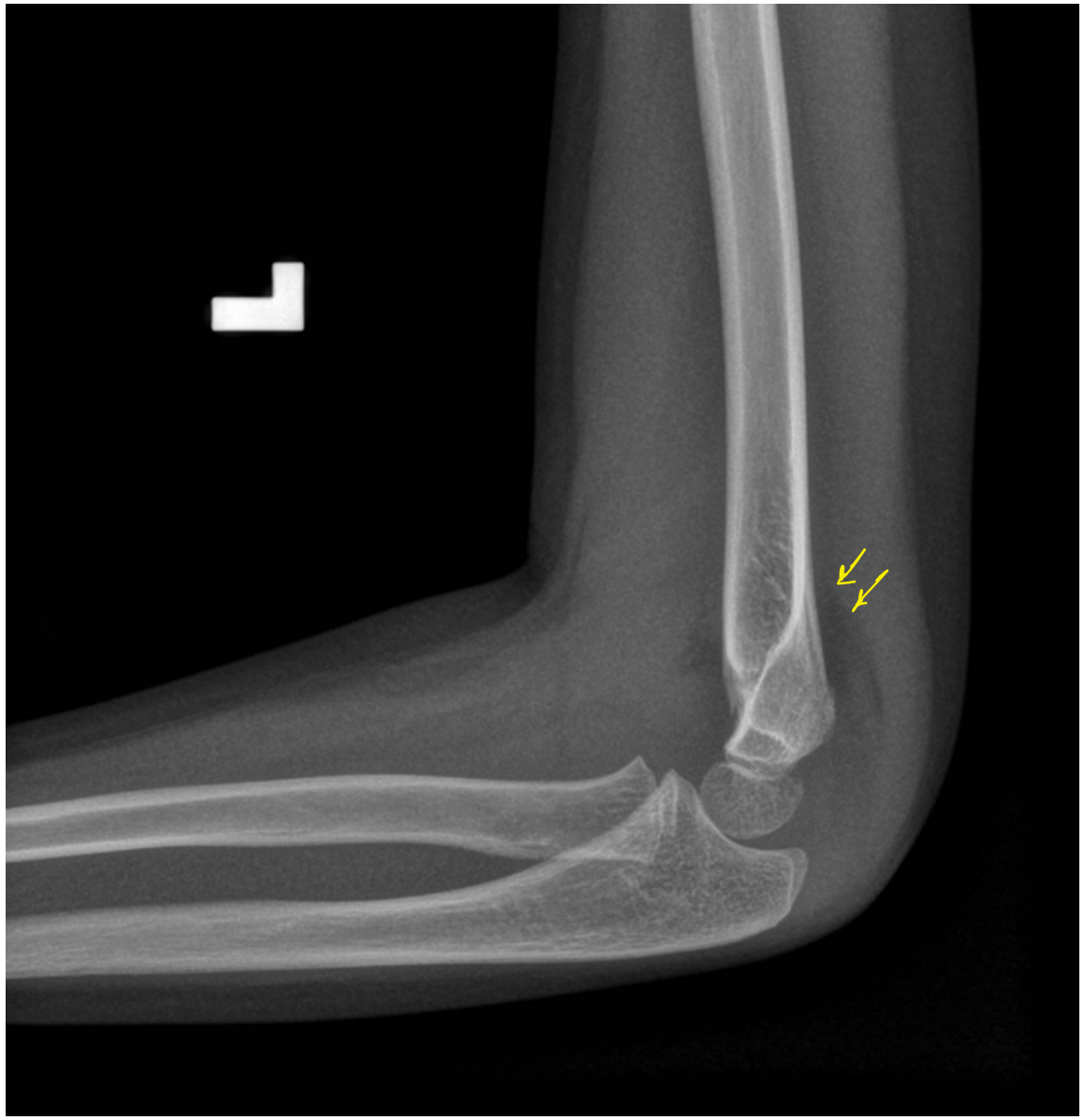
Elbow fractures- Joint effusion





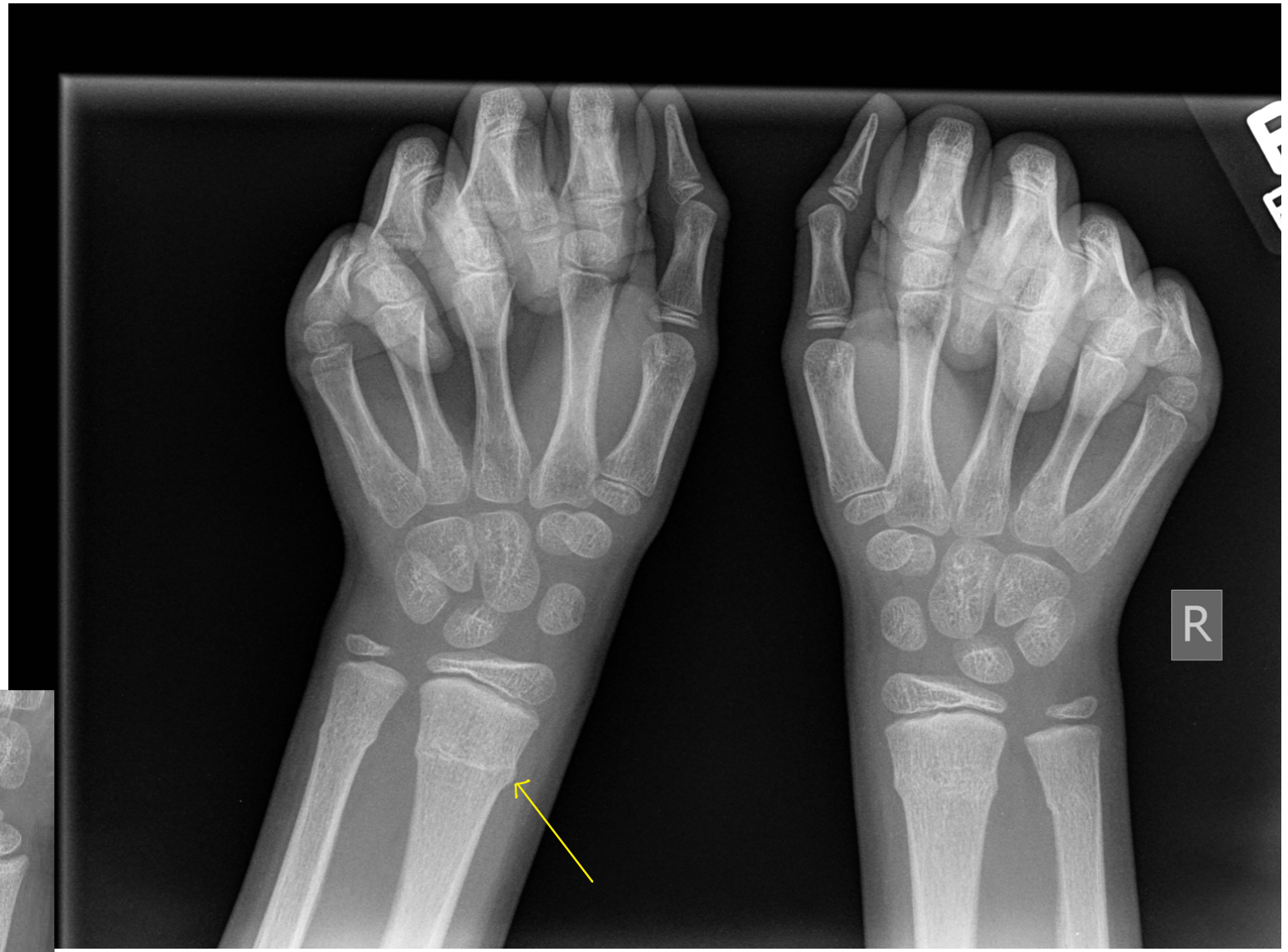
- Anterior fat pad → normally may be seen, but in effusion it looks elevated → "Sail sign
- Posterior fat pad → normally not visible; if seen, it's always abnormal → suggests intra-articular fracture and effusion.

https://coreem.net/core/radial-head-fracture/



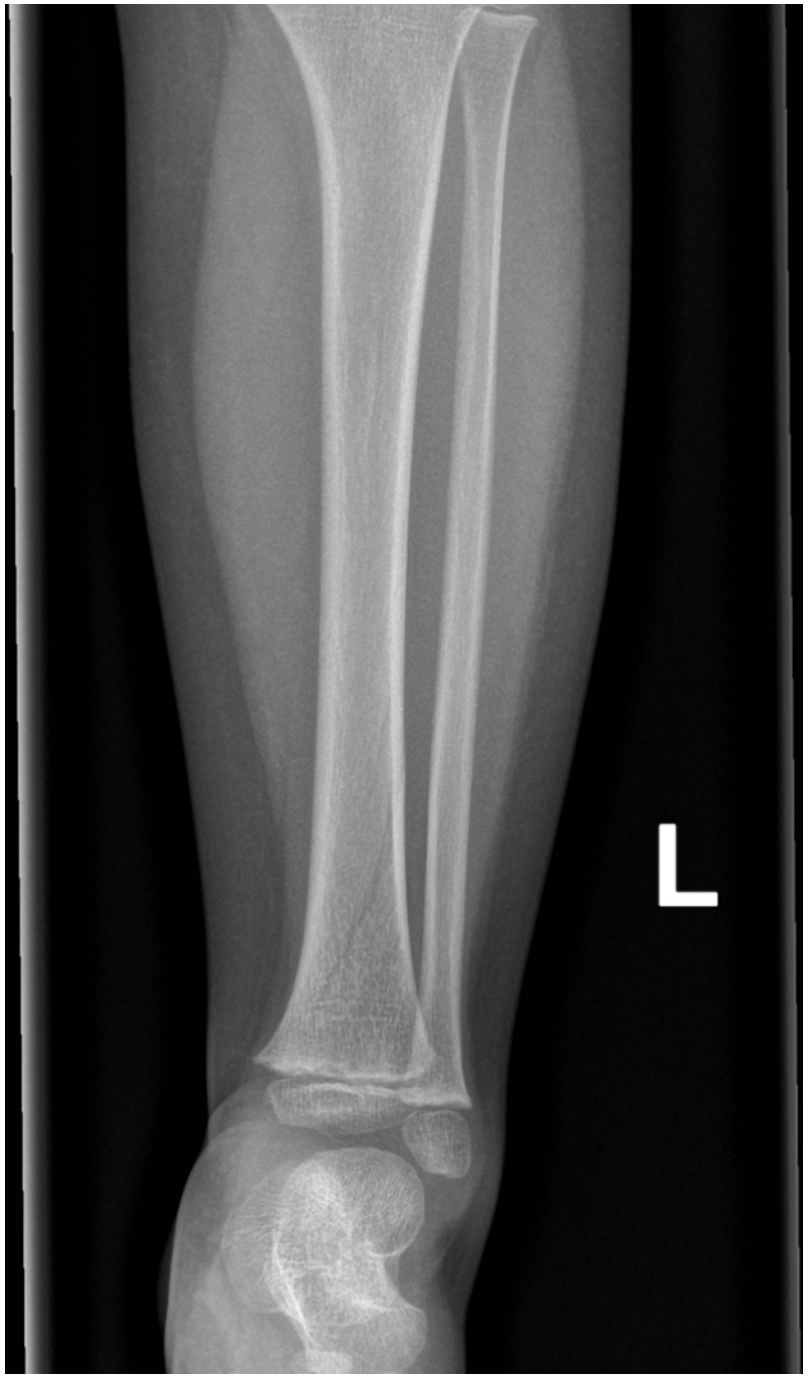
Nondisplaced supracondylar humeral fracture


R



Buckle fracture of distal radial metaphysis

Buckle Fracture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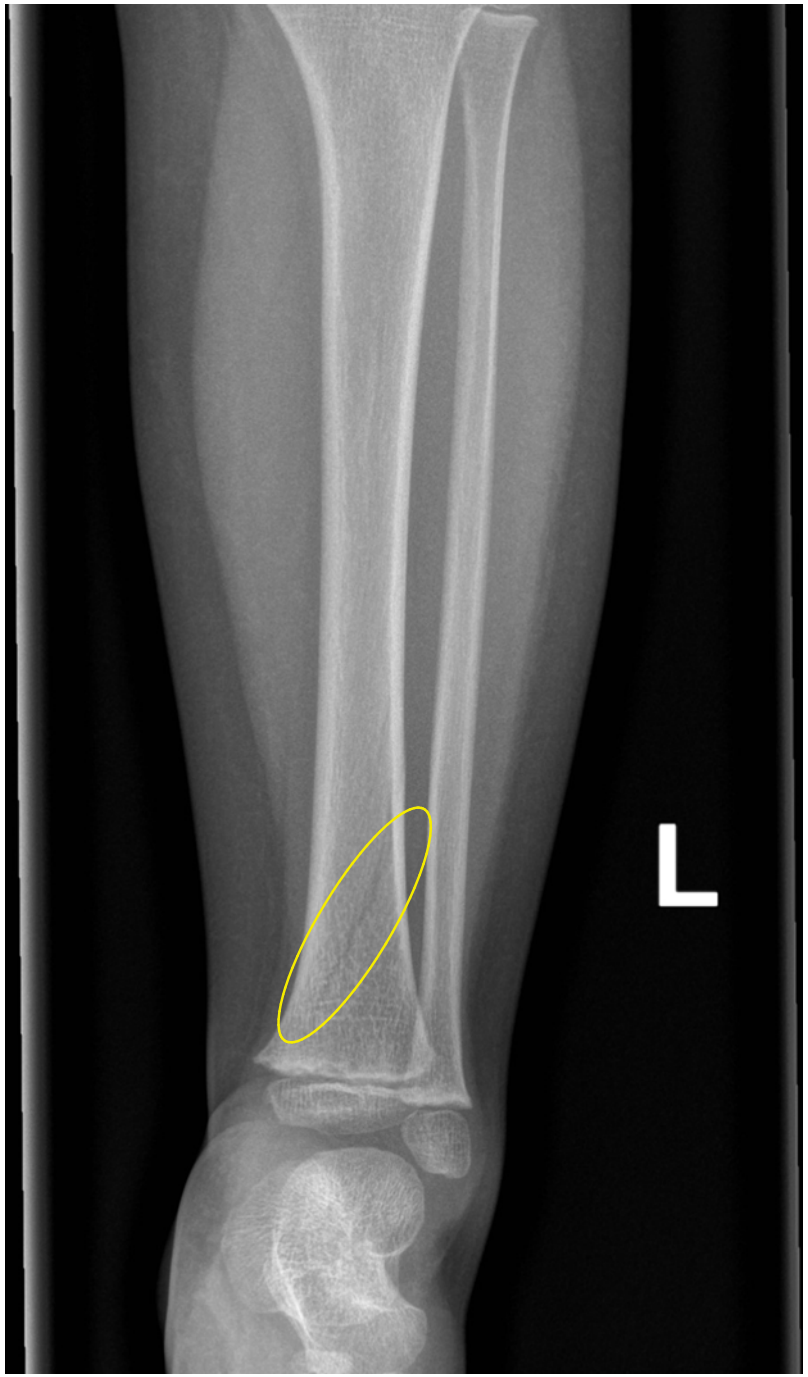
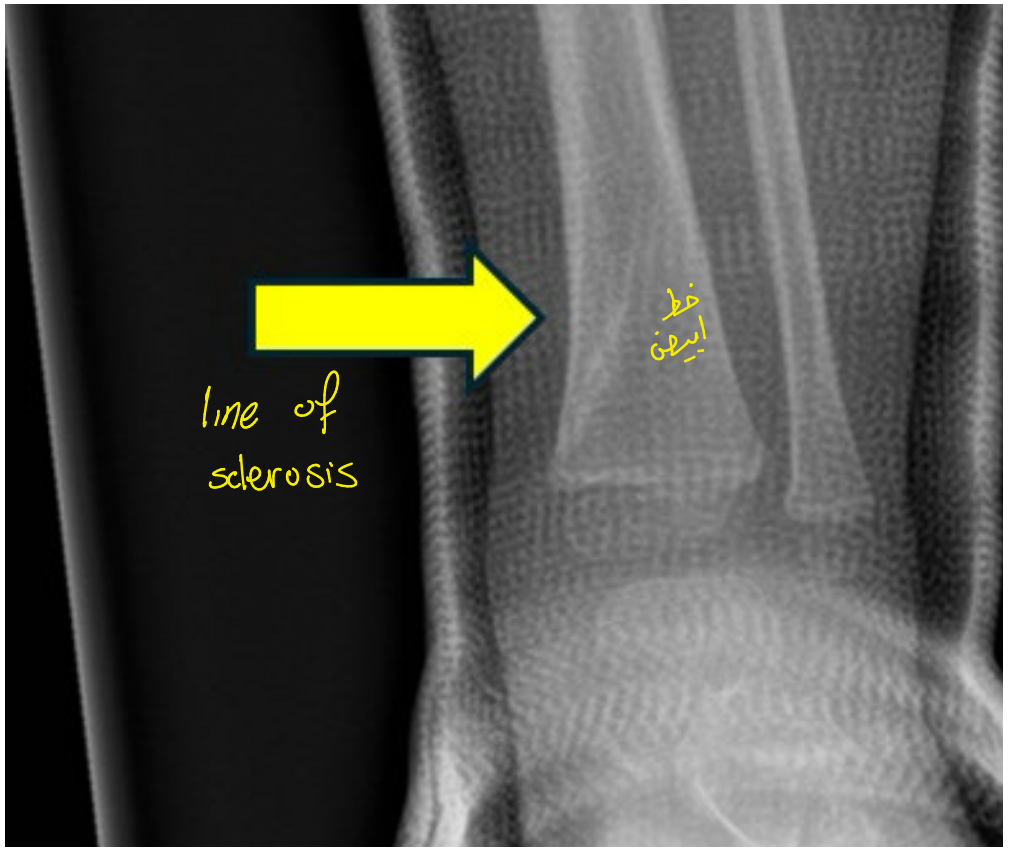
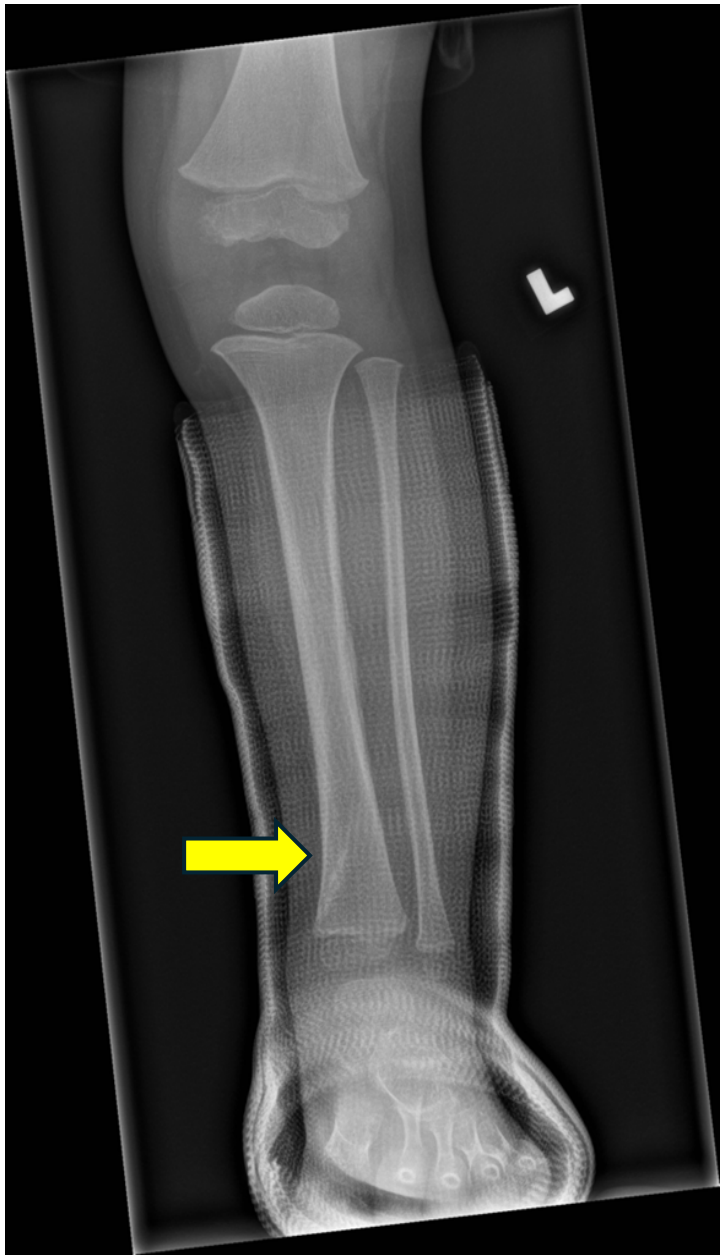


Toddler’s fracture of the distal tibial metaphysis

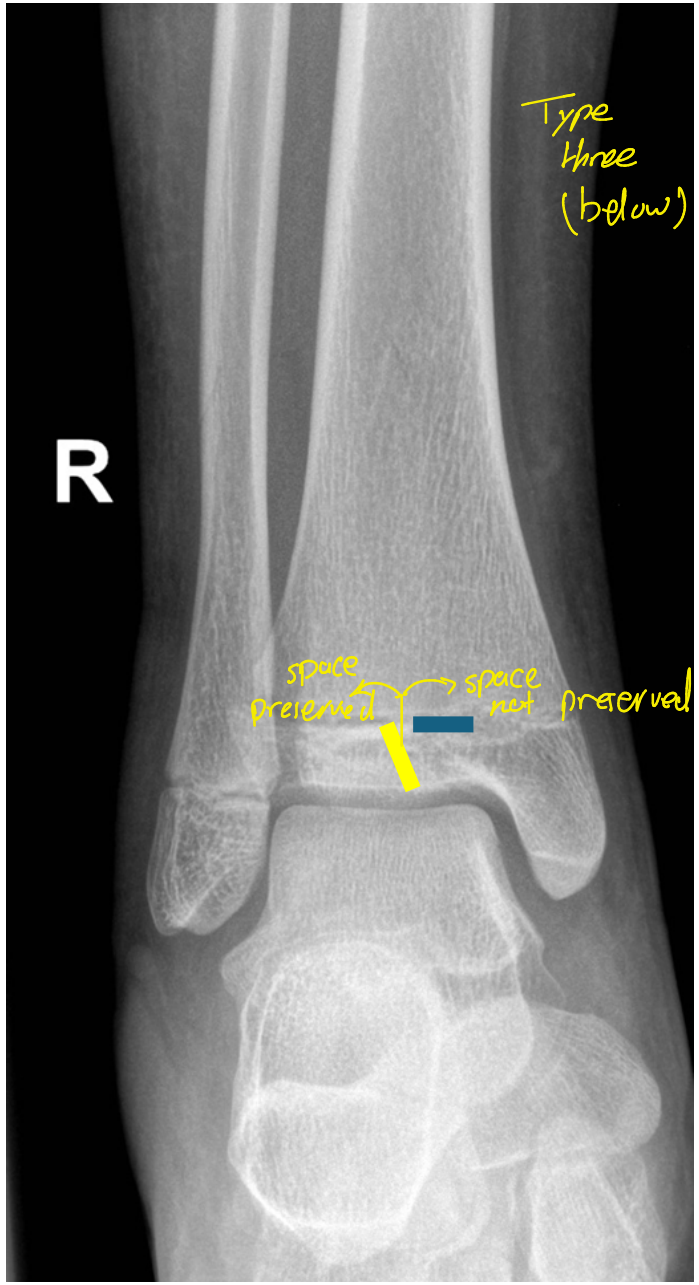
Follow-up x-ray ➔:
Ongoing healing

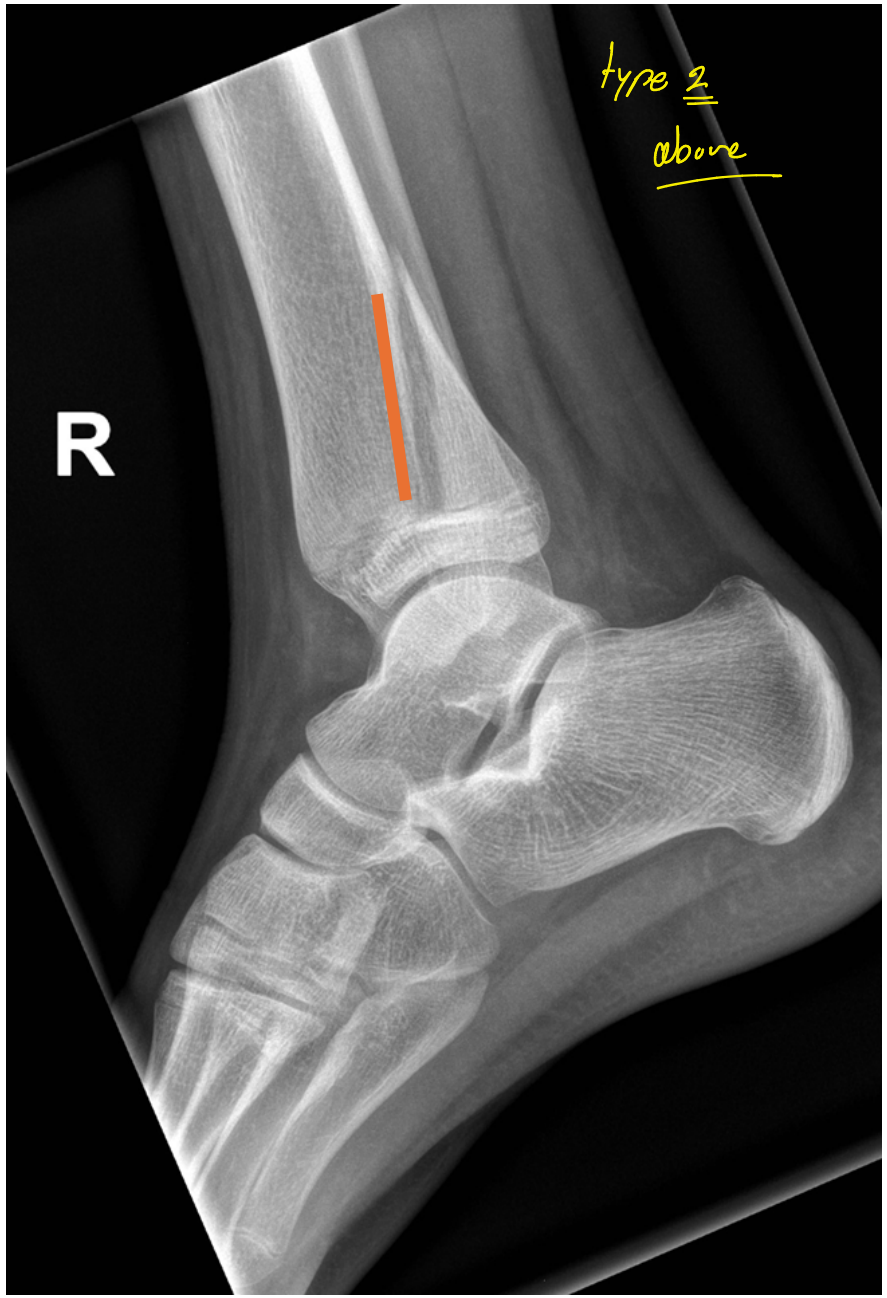





R


R





Triplane fracture

Triplane (triplanar) fracture

- Only occurring in **adolescents➔** As the physiological closure of the physeal plate begins **medially,** the lateral (open) physis is prone to this type of fracture.

- Usually considered as a **type 4 Salter-Harris** fracture.
    - Salter-Harris 3 fracture on AP
    - Salter-Harris 2 fracture on lateral

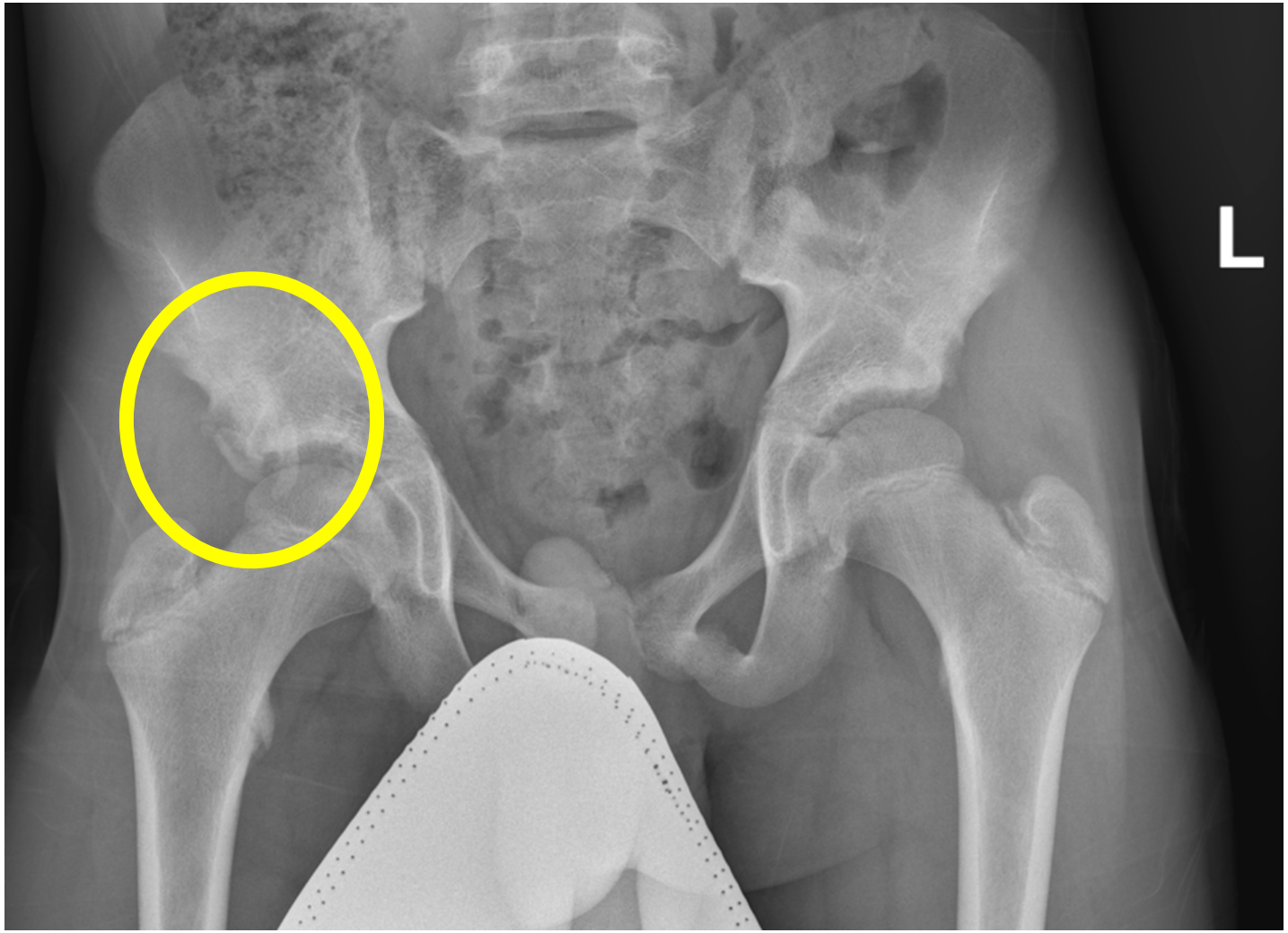
- It comprises 3 components:
    - a vertical (**sagittal**) fracture through the **epiphysis**
    - a horizontal (**axial**) fracture through the **physis**
    - an oblique (**coronal)** fracture through the **metaphysis**

Salter-Harris type 2 fracture

A 13-year-old male with 1 month of right hip pain, decreased internal rotation of the right hip.

Abnormal calcific densities in the region of the **superior right hip joint** ➔

in keeping with a **subacute avulsion injury of the rectus femoris** muscle.



Minimally displaced oblique Salter Harris II fracture of the distal tibia

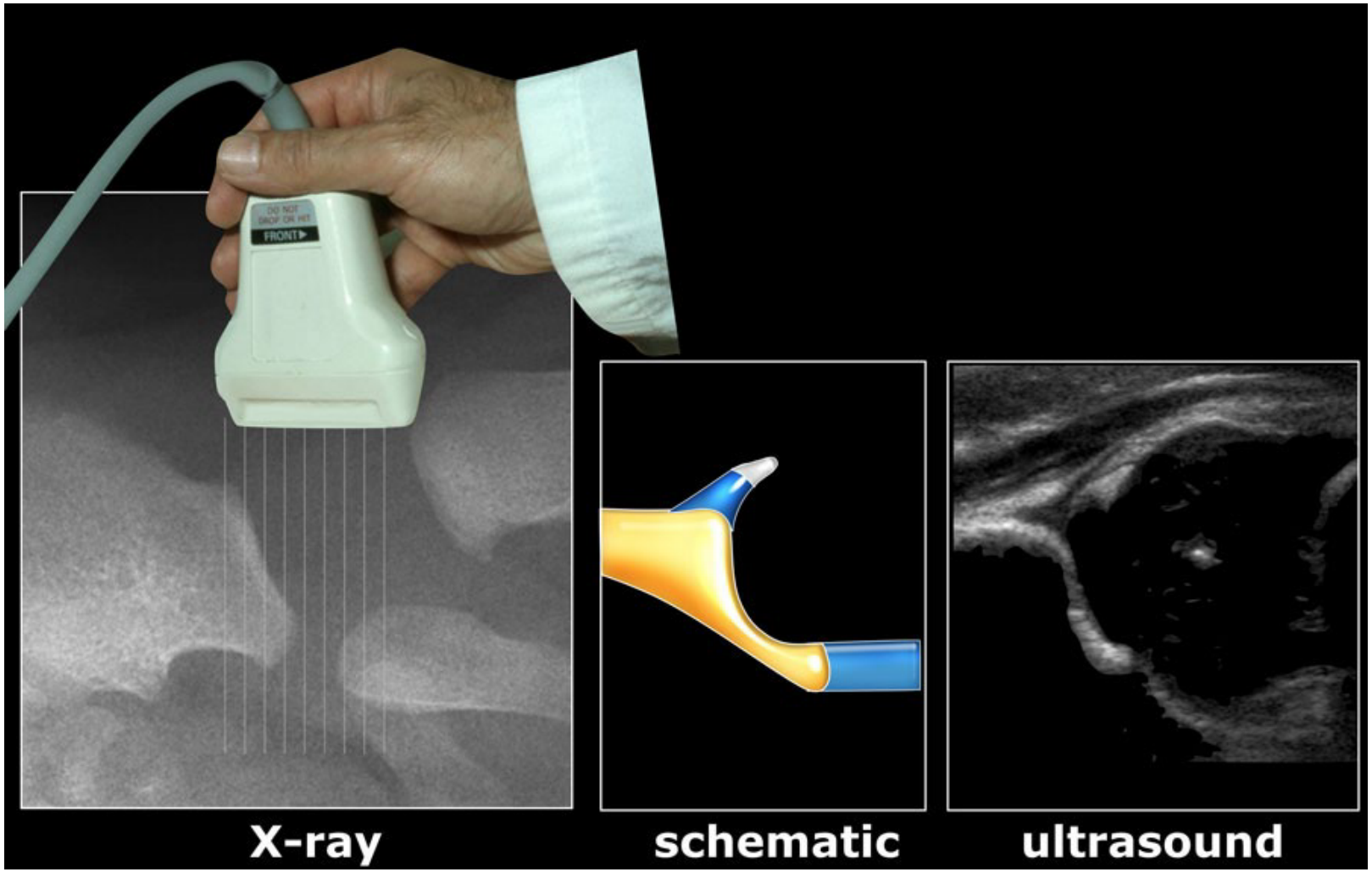
DDH

Developmental dysplasia of the hip (DDH) denotes aberrant development of the hip joint and results from an abnormal relationship of the femoral head to the acetabulum.

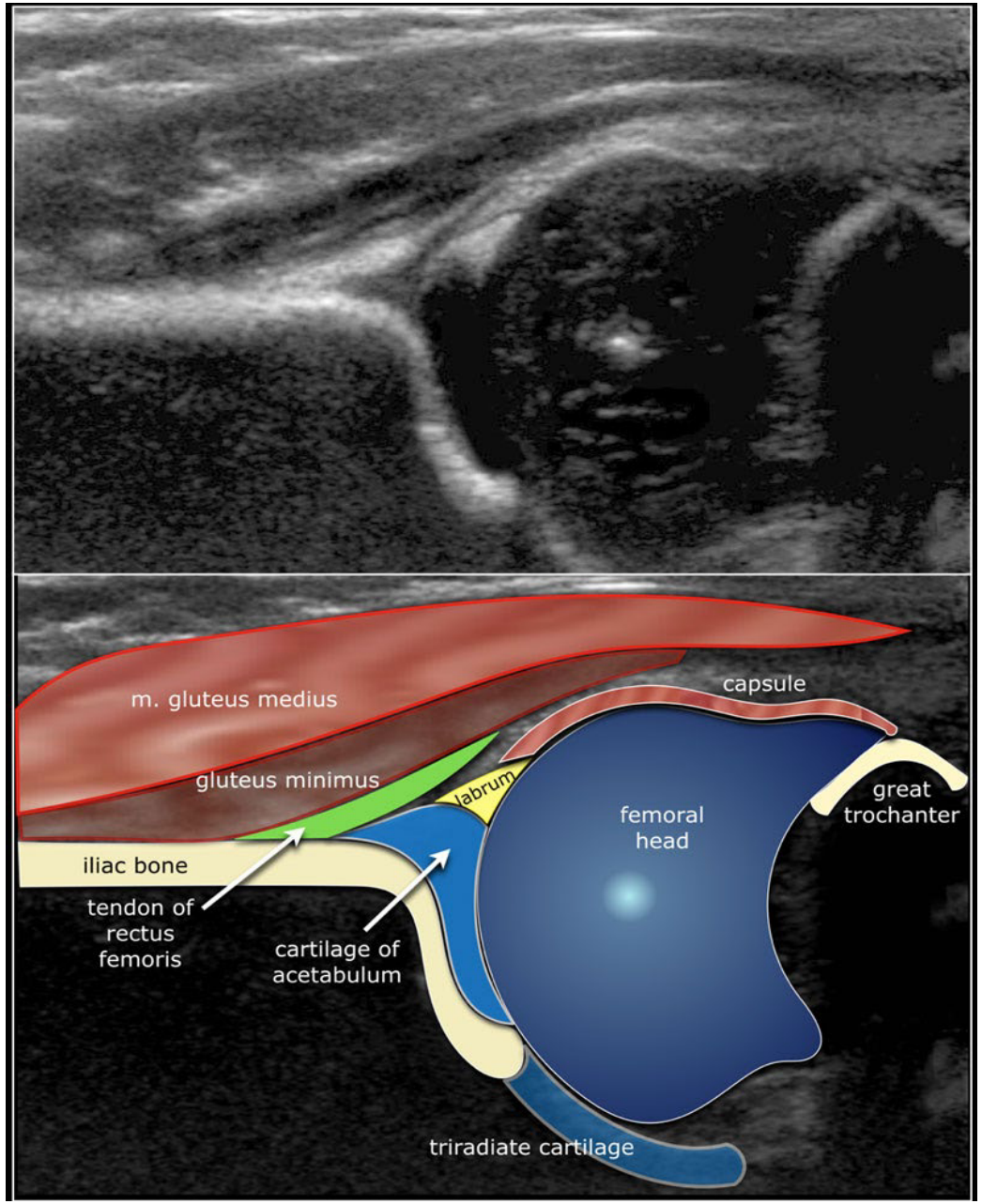
Risk factors include

- Female gender (M:F ~1:8)
- Firstborn baby
- Family history
- Breech presentation
- Oligohydramnios

DDH



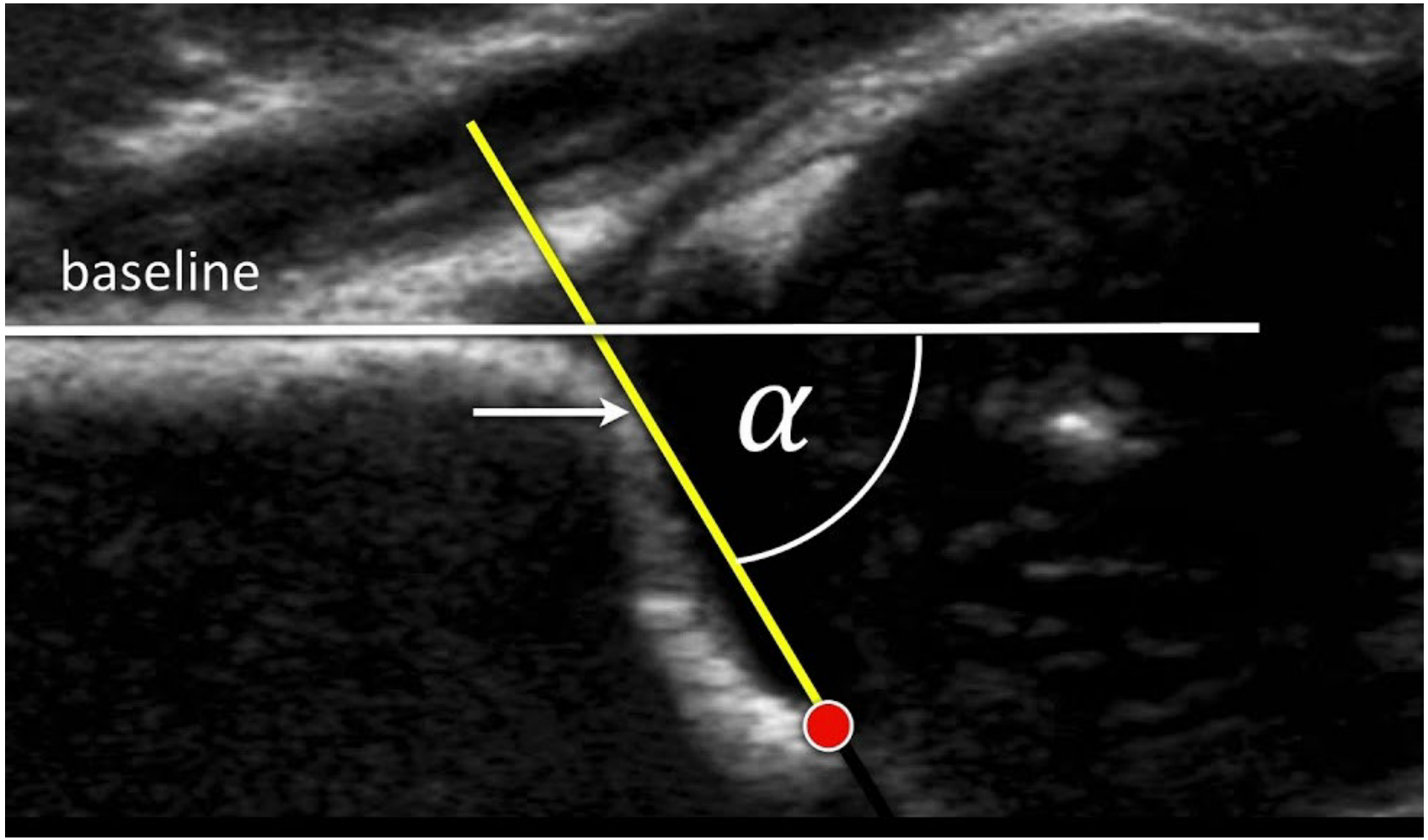
https://radiologyassistant.nl/pediatrics/hip/developmental-dysplasia-of-the-hip-ultrasound



ULTRASOUND

Imaging Findings: femoral head partially or completely out of acetabulum.

https://radiologyassistant.nl/pediatrics/hip/developmental-dysplasia-of-the-hip-ultrasound


baseline
α

shallow acetabulum,
lateral displacement of
femoral head,
increased acetabular
angle


THANK
YOU