

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 milliamperere-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

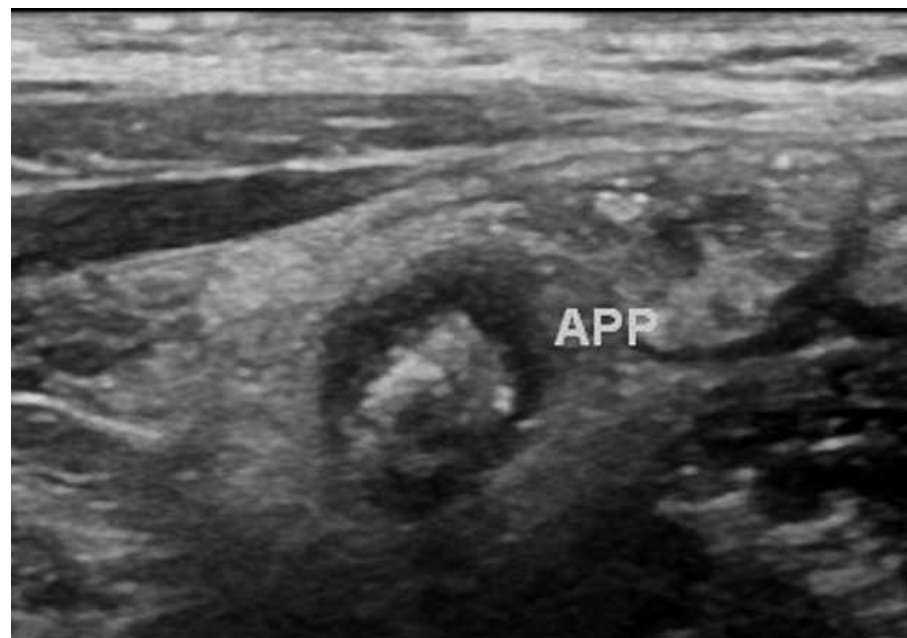
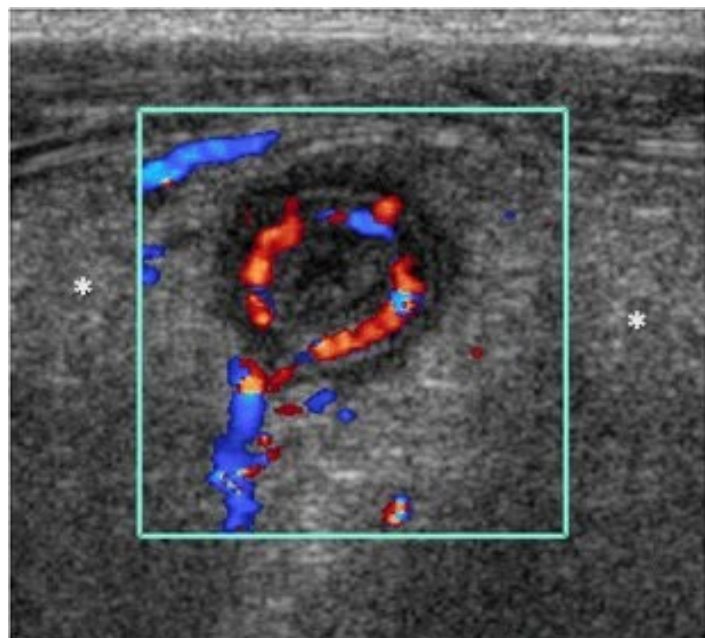
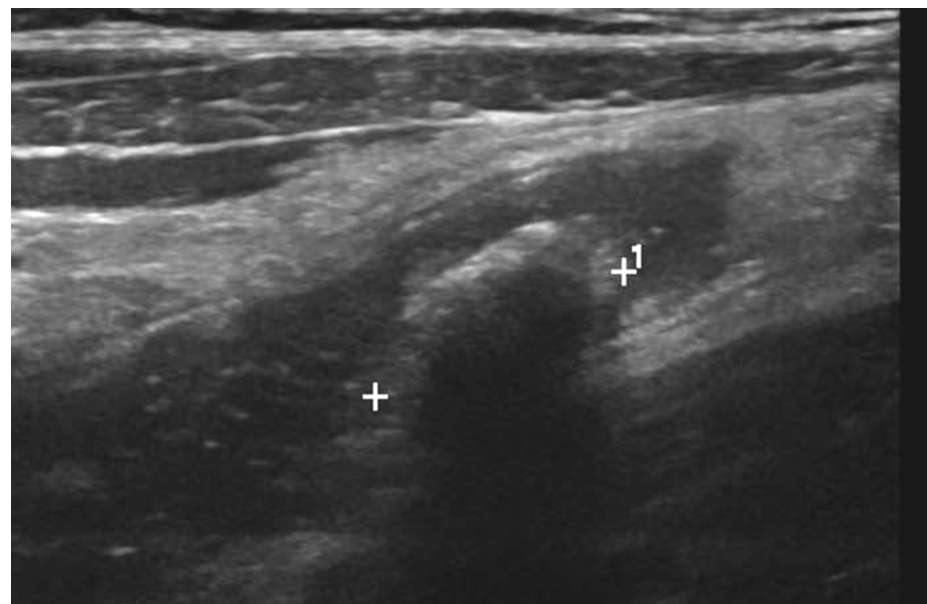
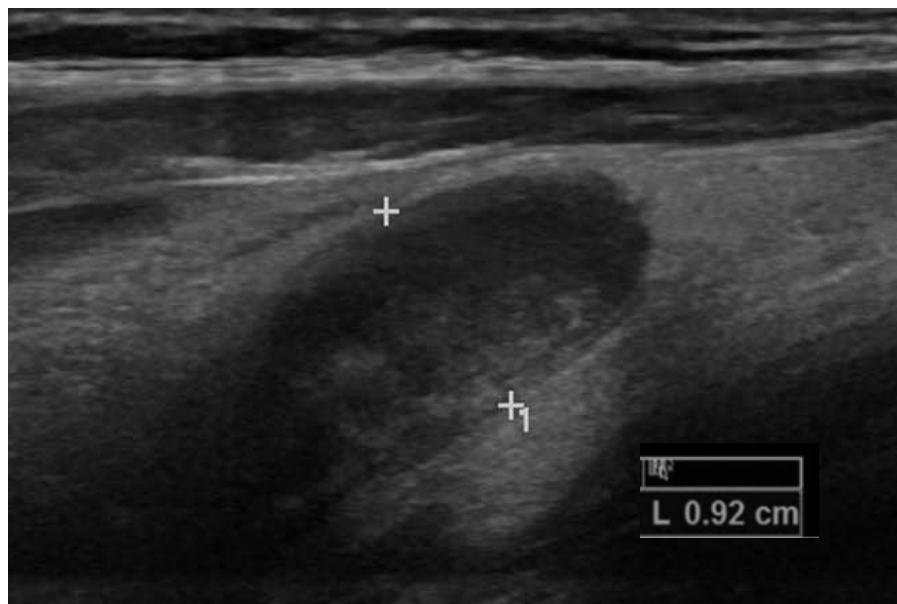
6- Pathological Considerations

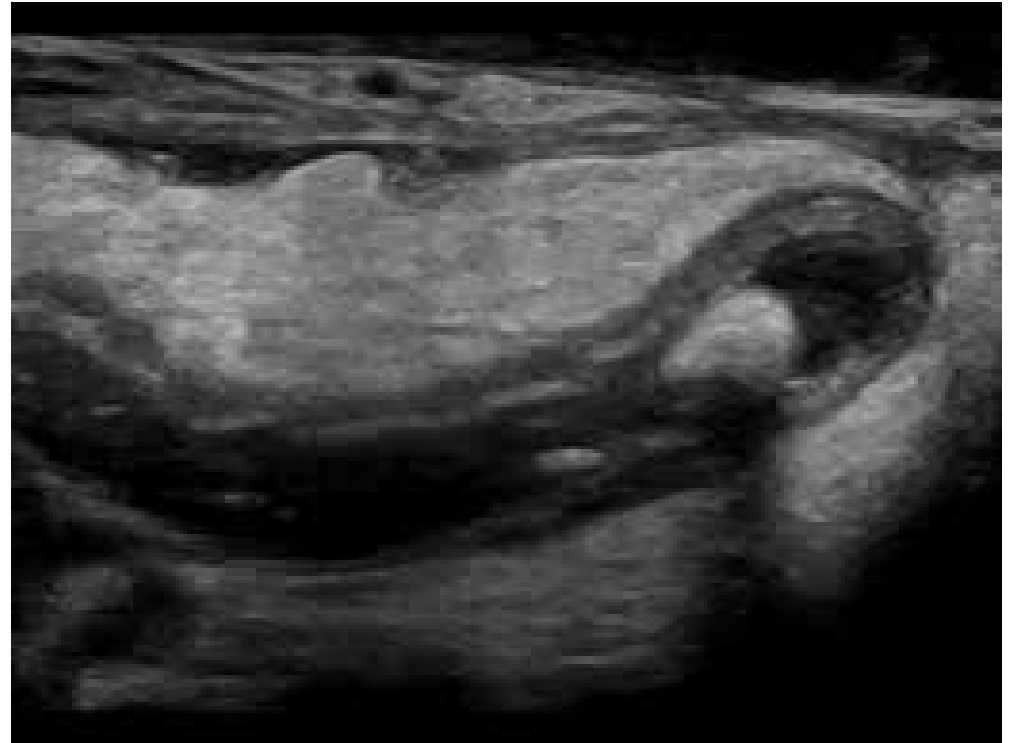
- congenital

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?
- - What do you request imaging-wise?







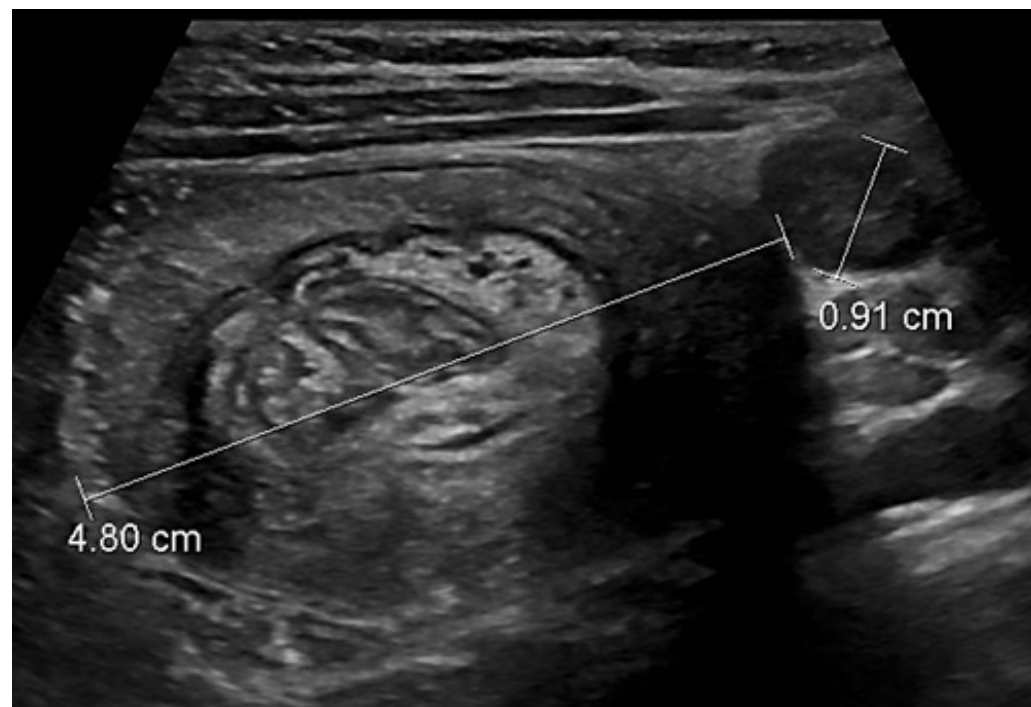
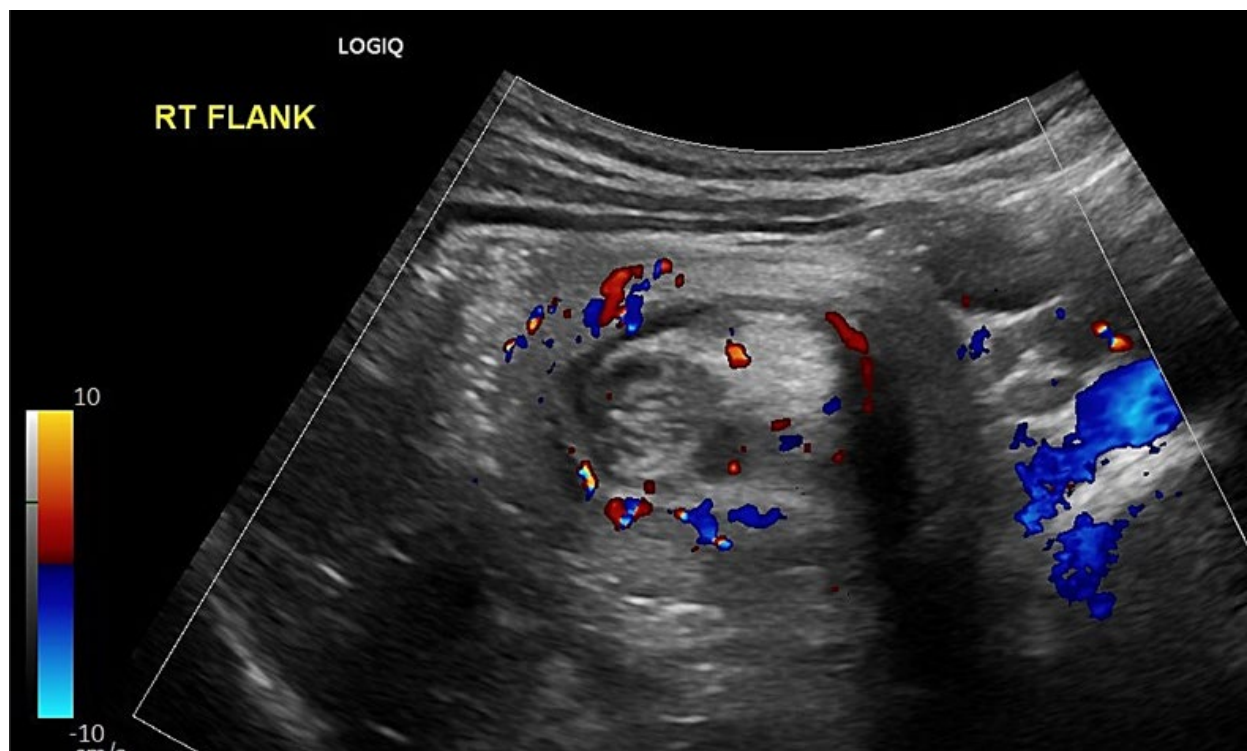
Torted Ovary

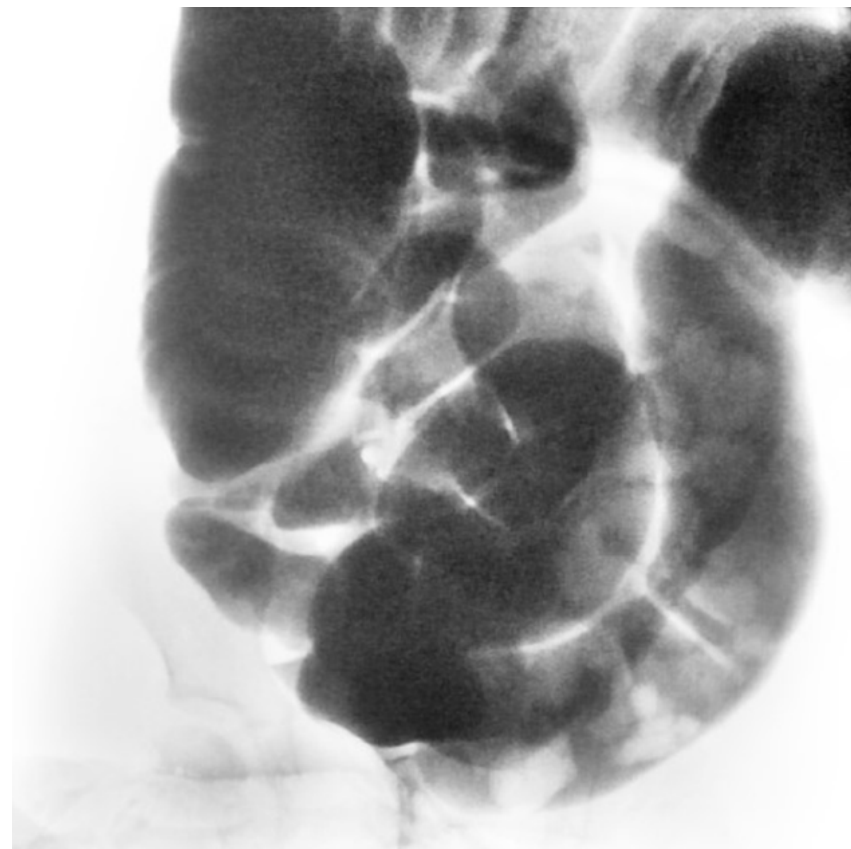
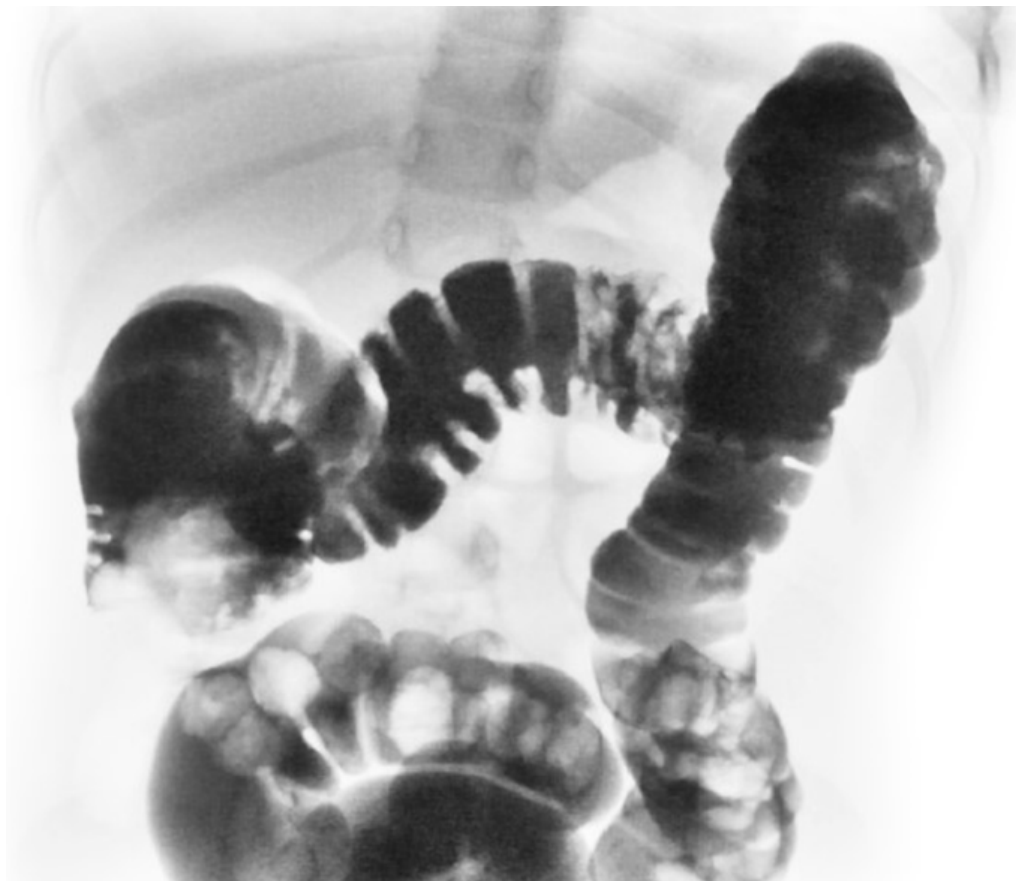


Normal Ovary

Q2

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

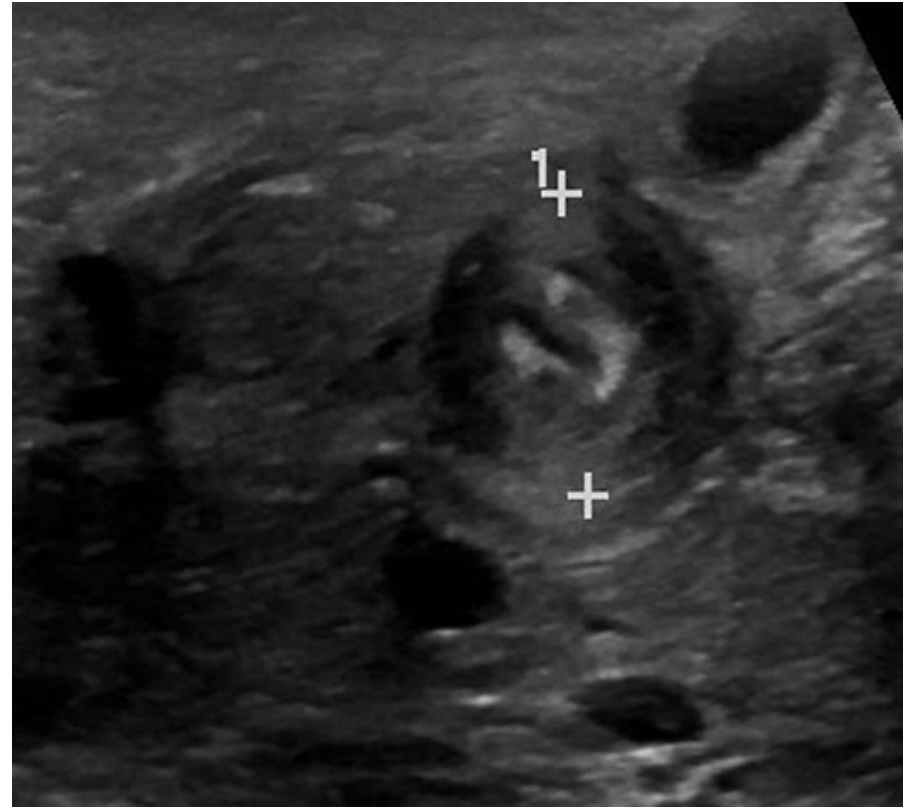
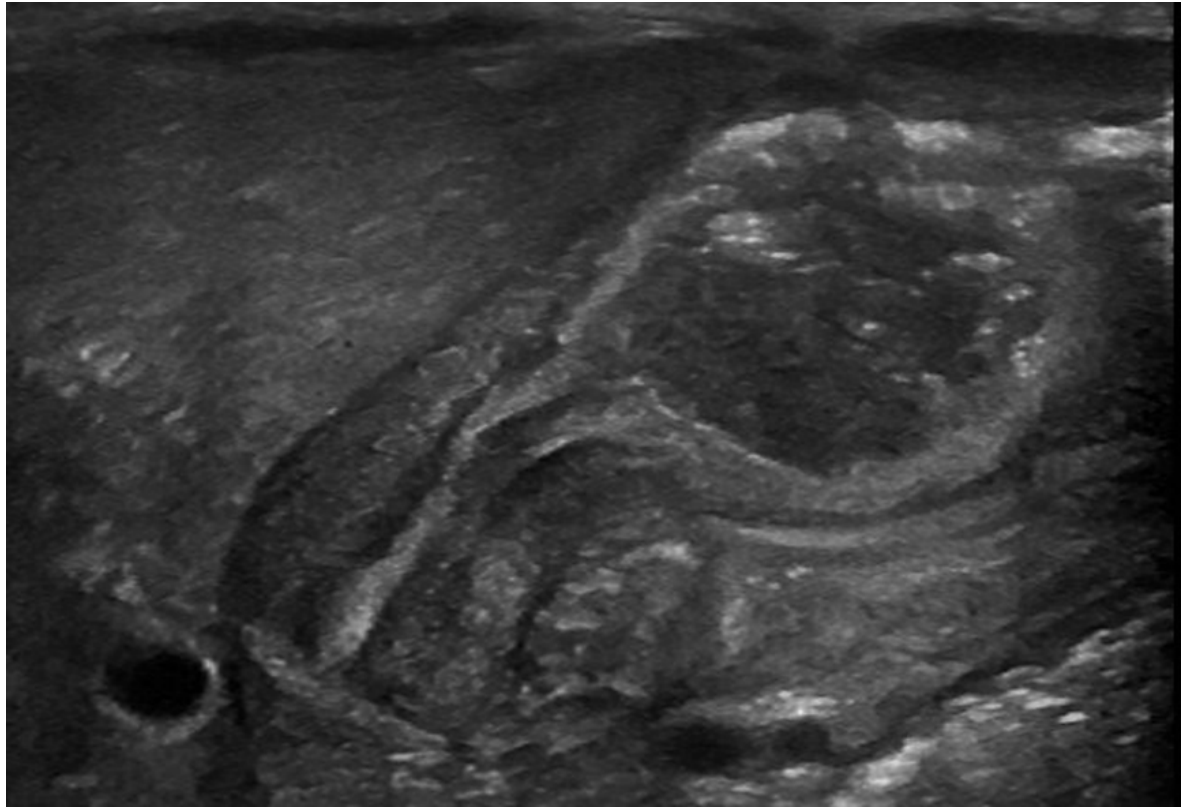


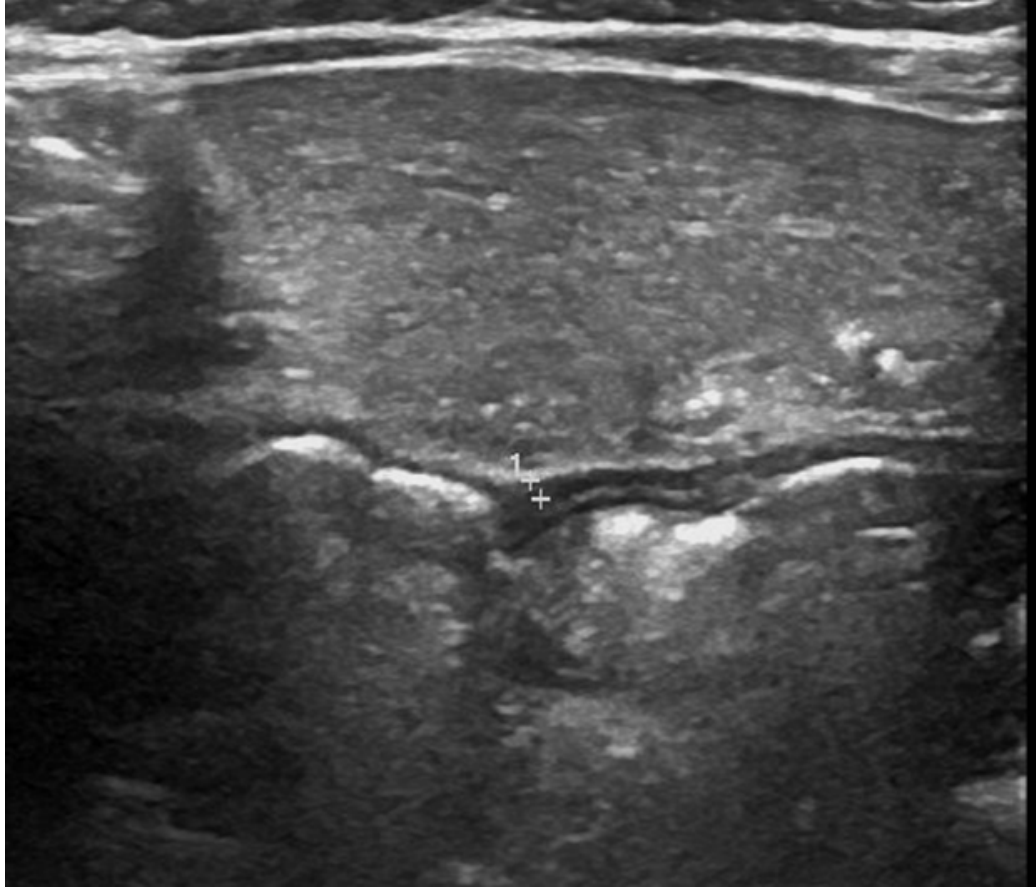




Q3

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





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

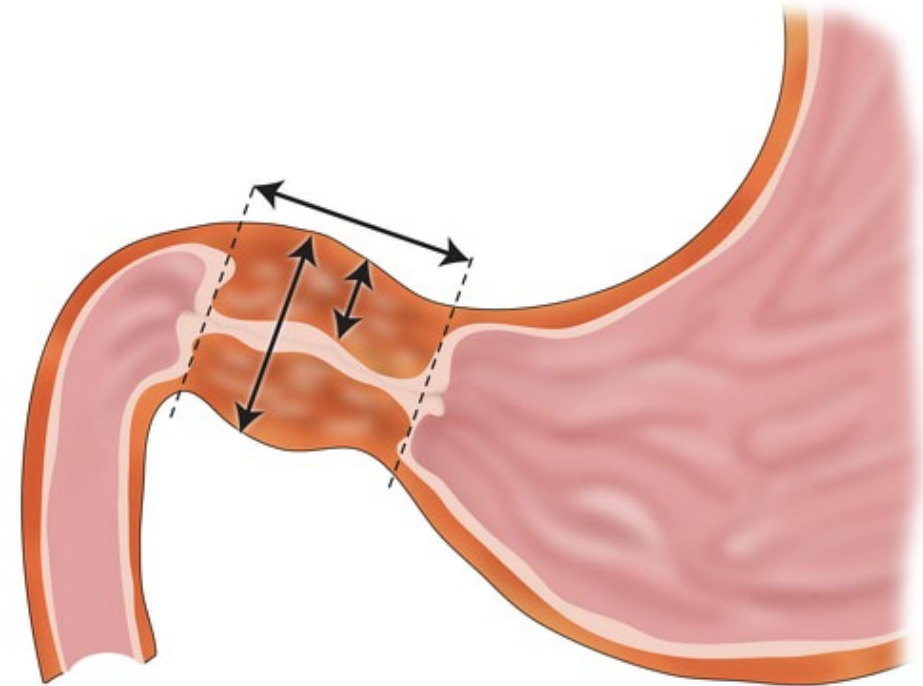
male predilection (M:F ~4:1).

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

Risk factors

- **First born**
- **maternal history of pyloric stenosis**

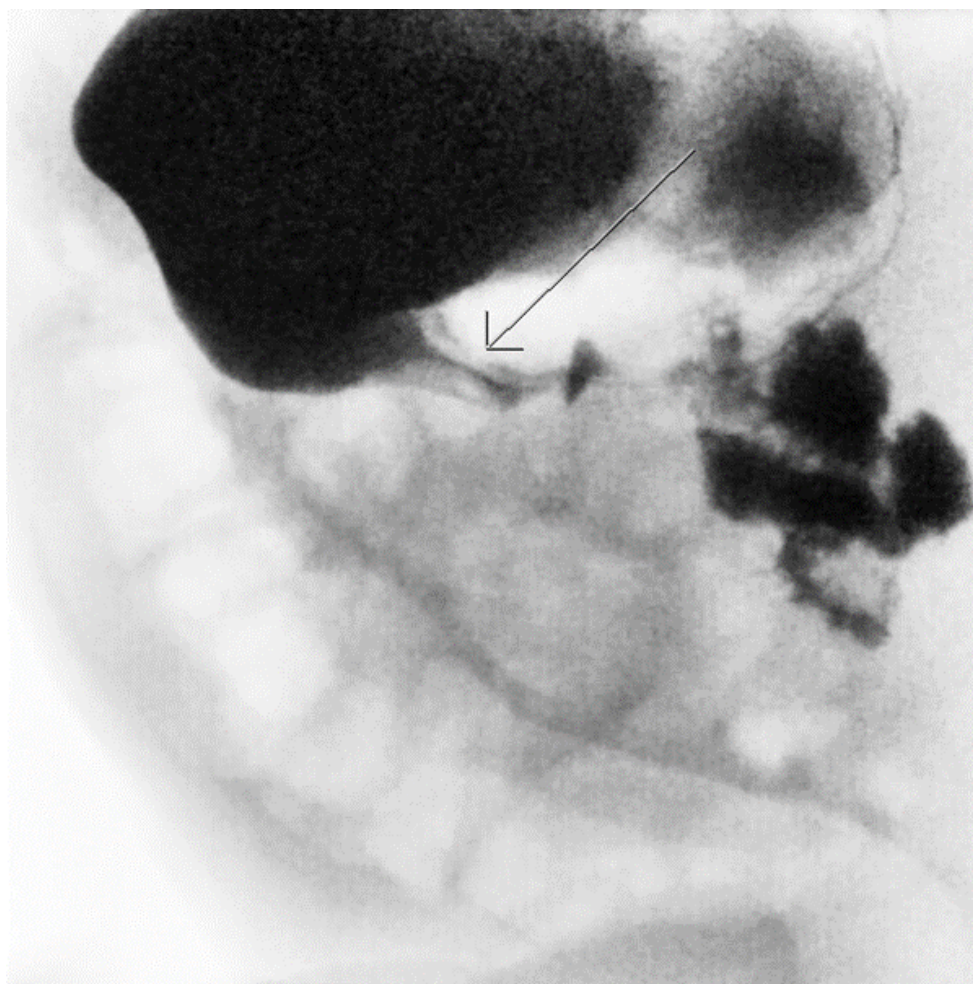
Pyloric stenosis



Normal values *

Length: <15mm
Single muscle thickness: <3mm
Pyloric width: <7mm

* values vary somewhat from publication to publication



Q4

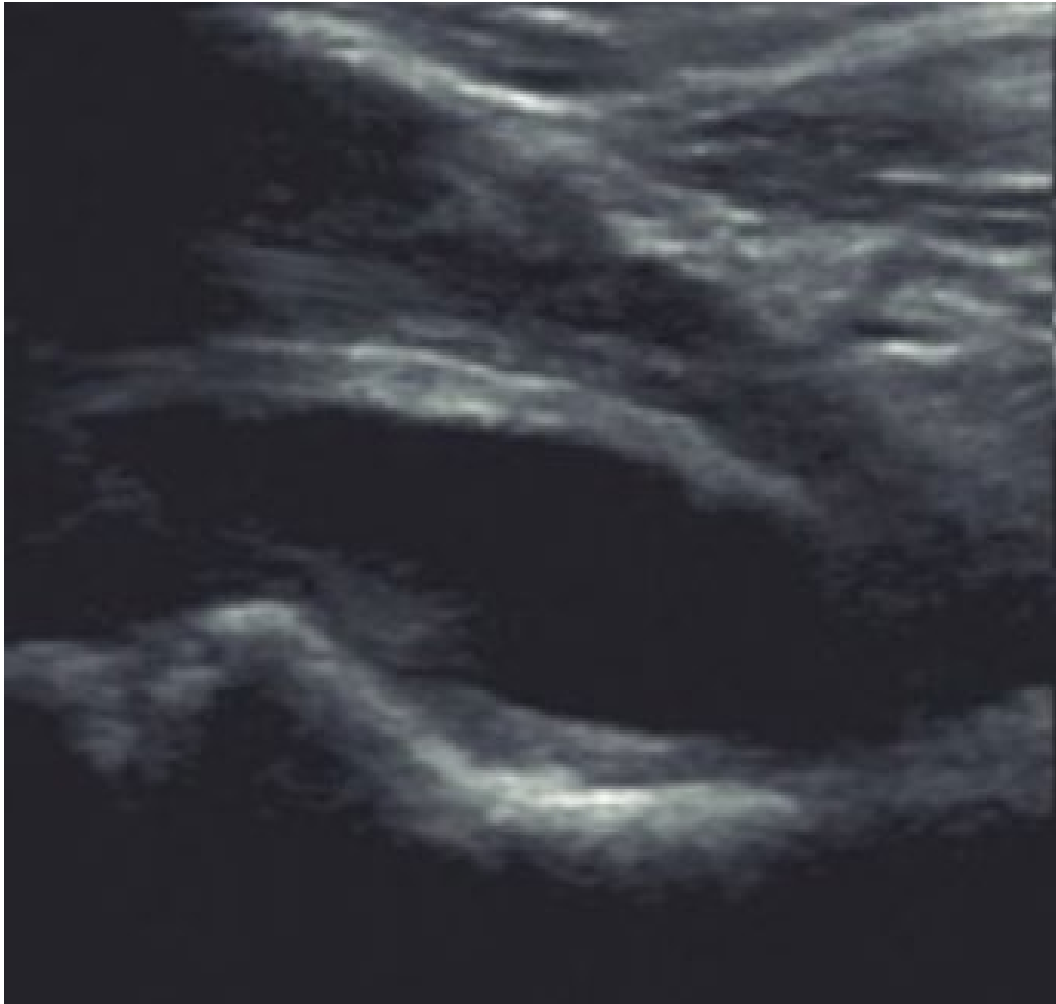
- A 5-year-old boy, non-weight bearing on the right side for the last 24 hours, low-grade fever



right



left



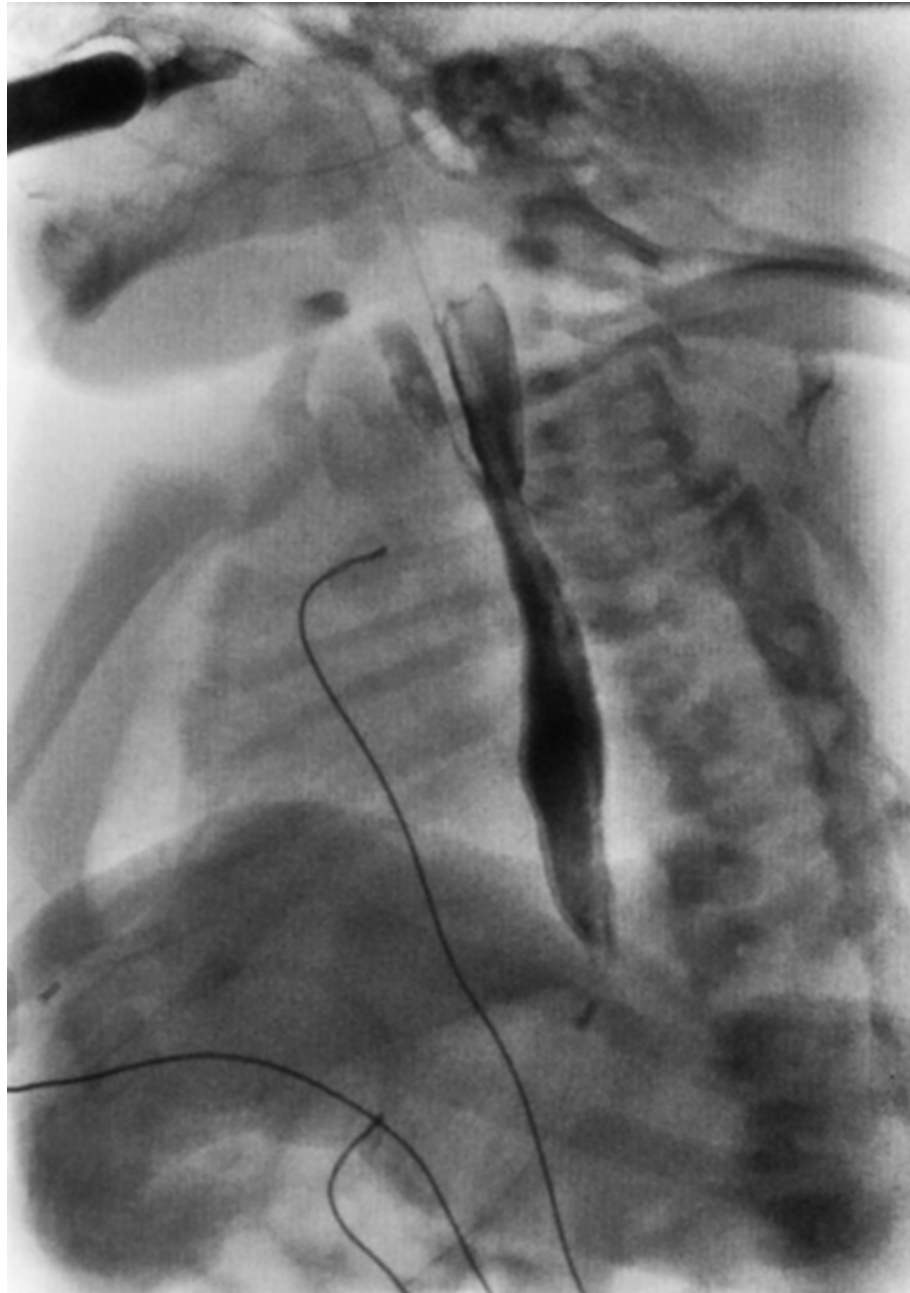
right



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?
 - - Imaging investigations?



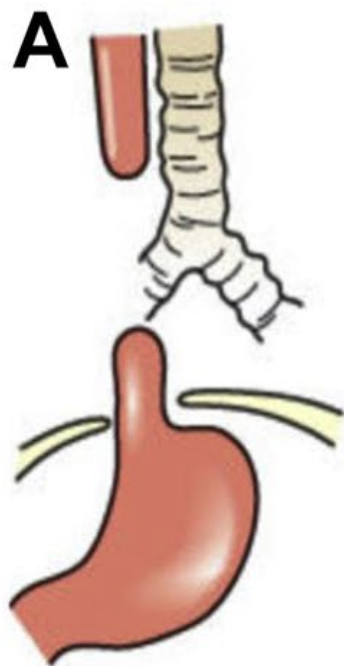
Tracheoesophageal fistula



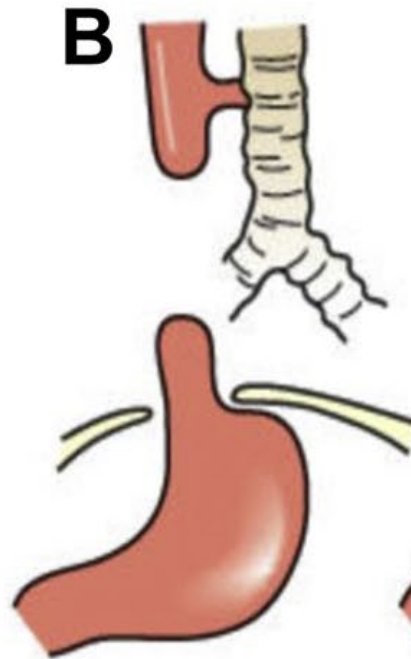
Isolated fistula
H-type

~4%

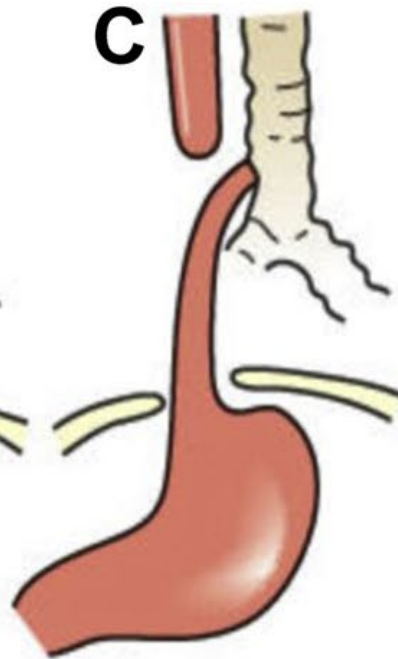




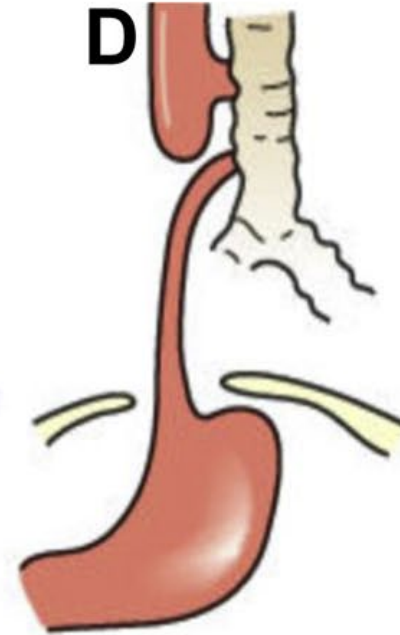
- 8%
- Atresia alone, no fistula
- Small stomach, gasless abdomen
- Usually has a long gap between the esophageal ends
- Gross type A



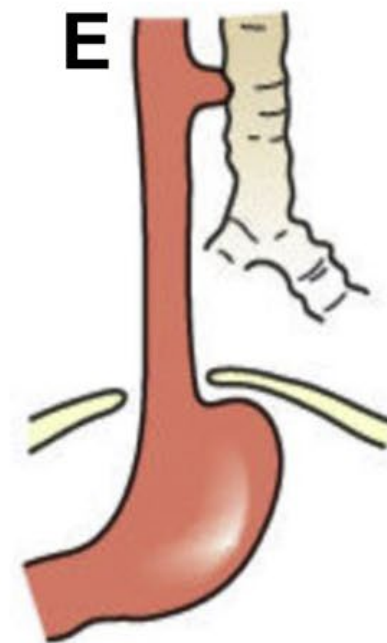
- 1%
- Proximal tracheoesophageal fistula
- No distal fistula
- Small stomach, gasless abdomen
- Often has a long gap between esophageal ends
- Gross type B



- 86%
- Most common abnormality
- Gross type C



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



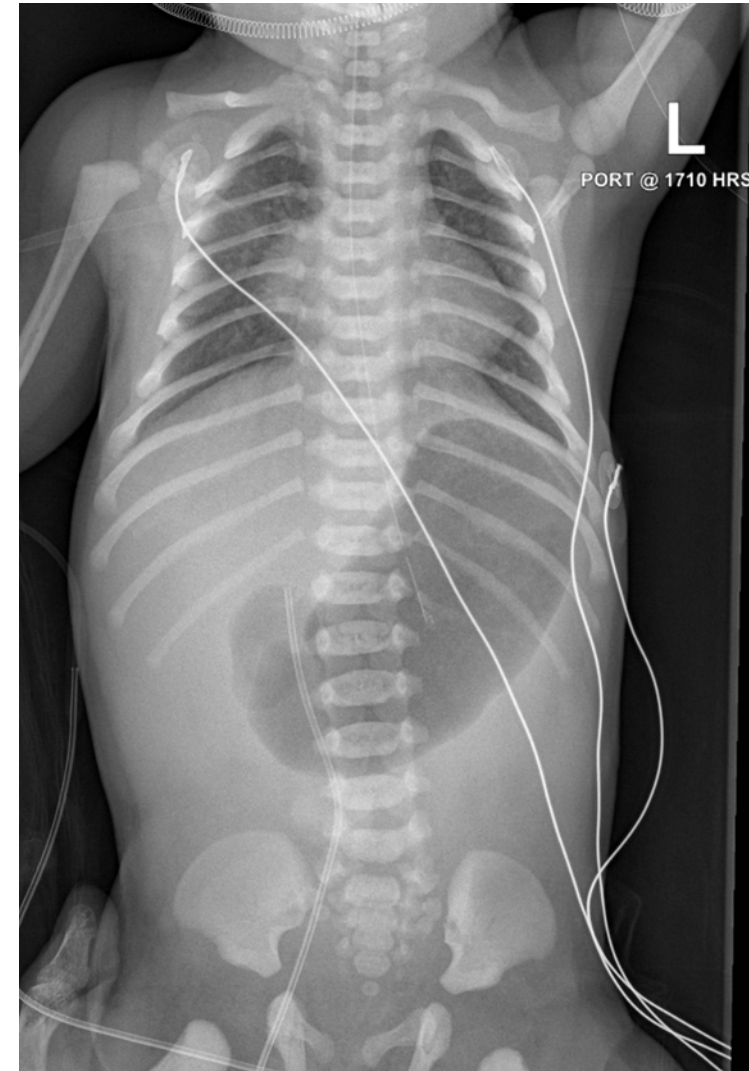
- 4%
- No atresia of the esophagus
- Congenital tracheoesophageal fistula
- H or N fistula
- Gross type E

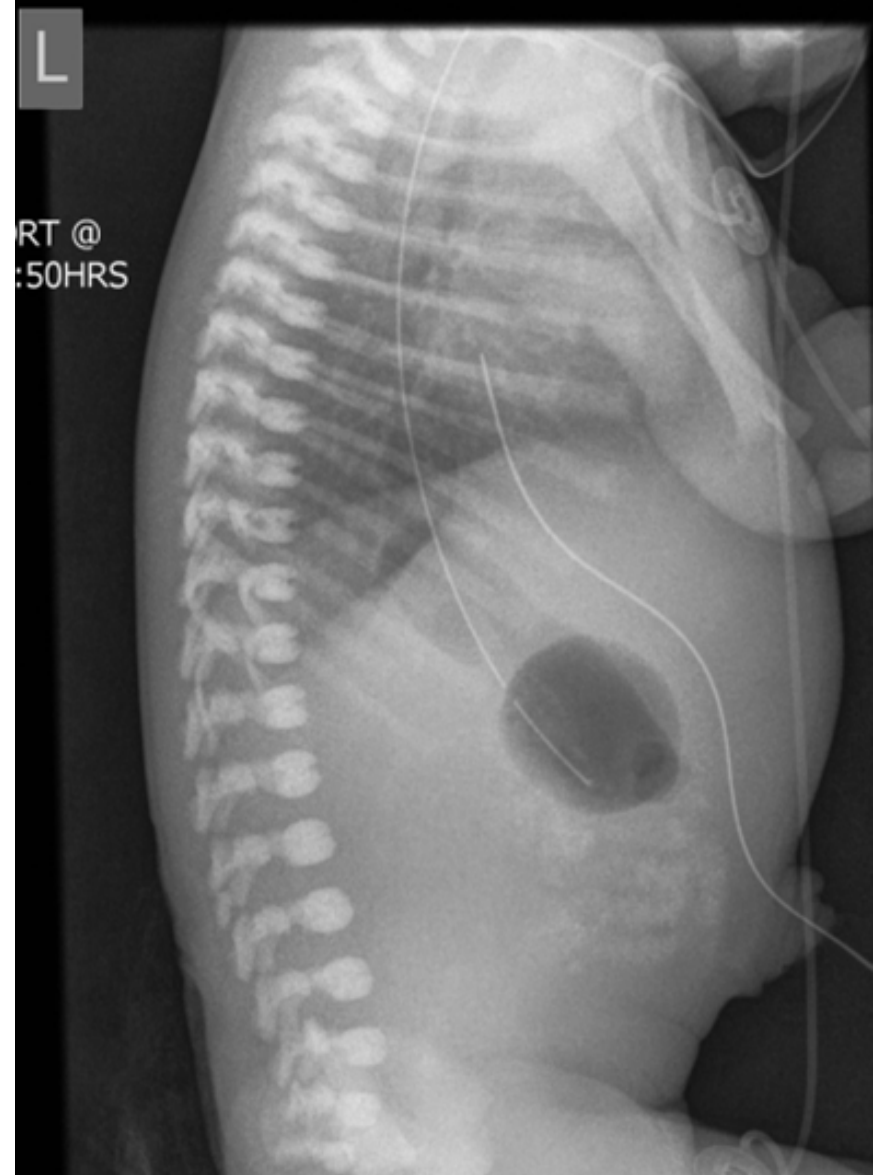
VACTREL Association

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

Q6

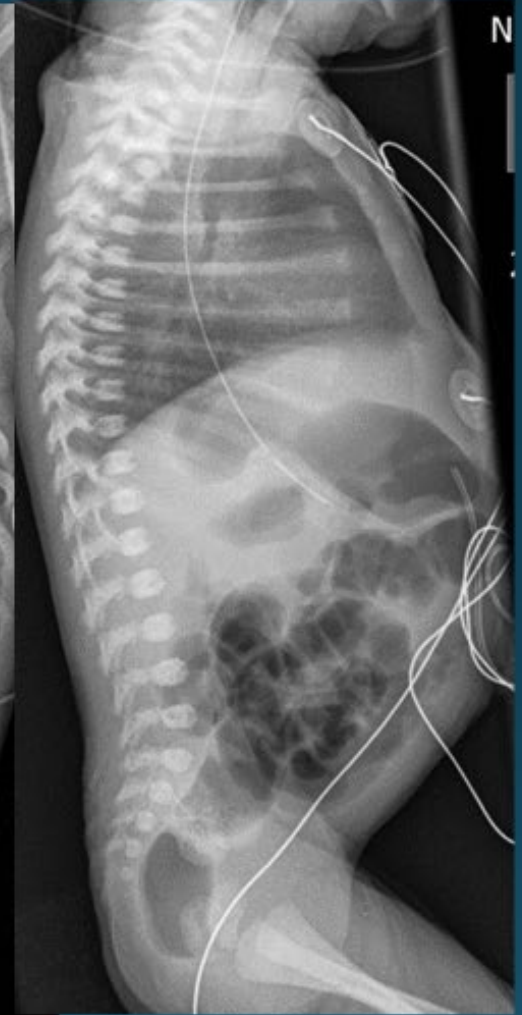
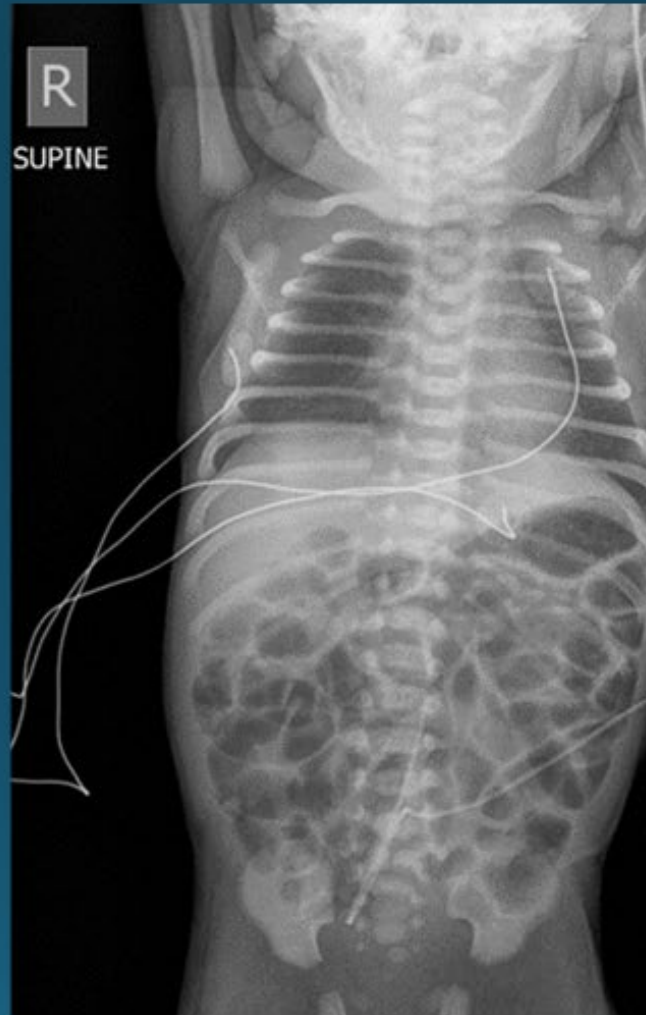
- A 12-hour old baby. Paucity of gas in the abdomen. Air is seen in the stomach and proximal duodenum
- - DDX?





Duodenal Atresia

- **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



2-hr

6-12-hr

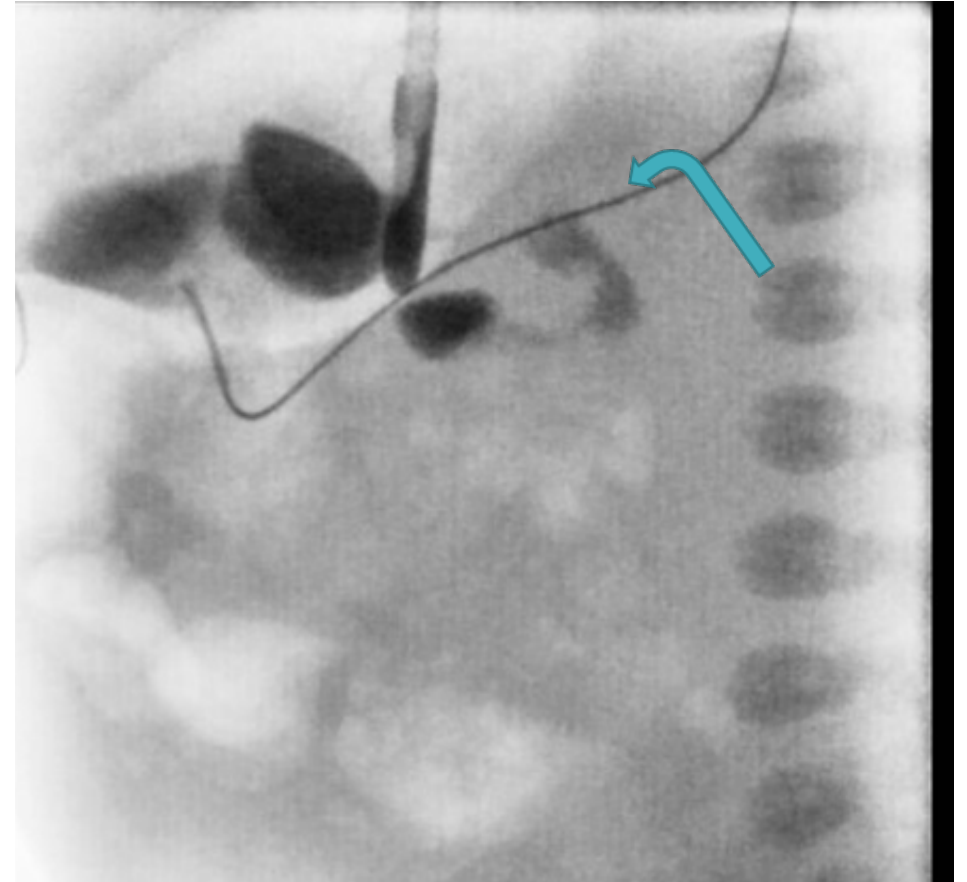
12-24-hr

12-24-hr

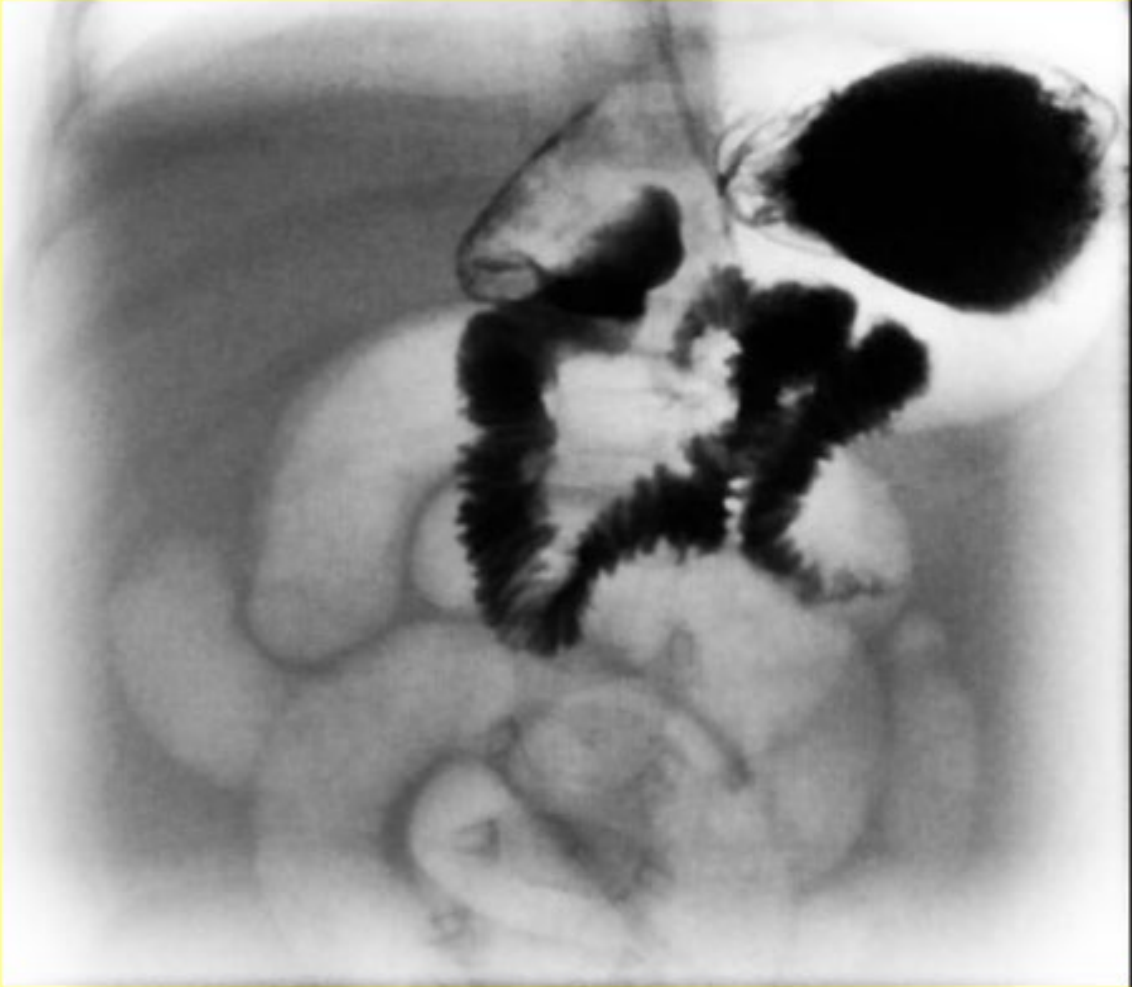
Q7

- 39 weeks, 0-day, bilious vomiting

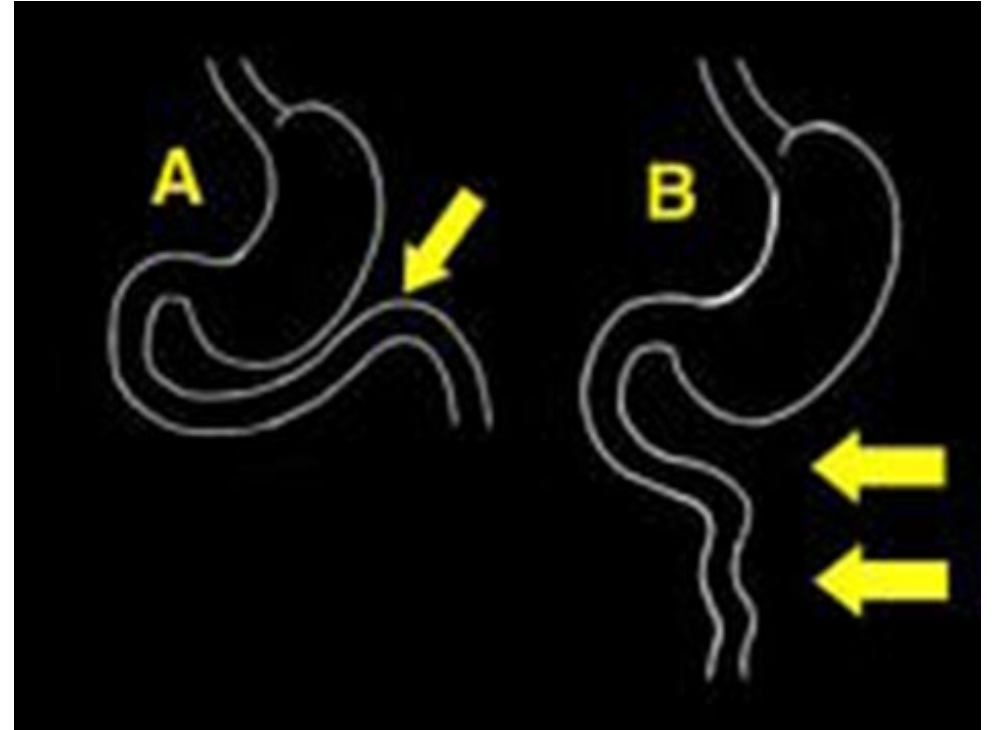


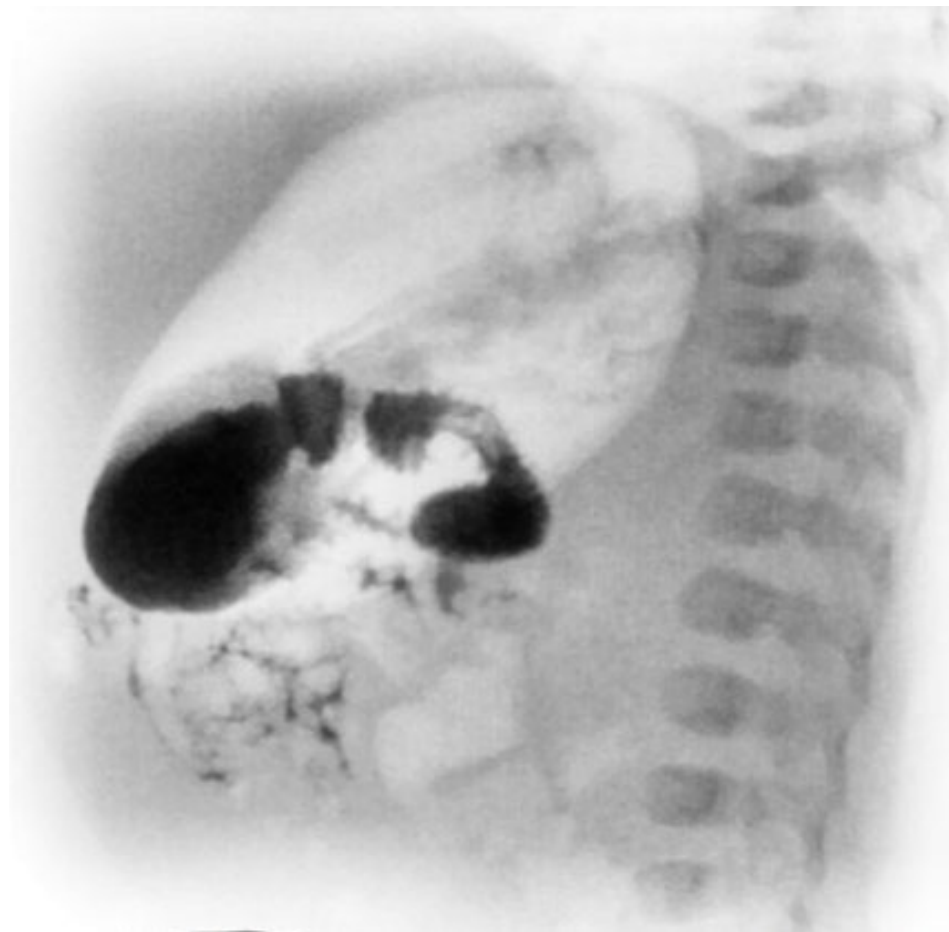


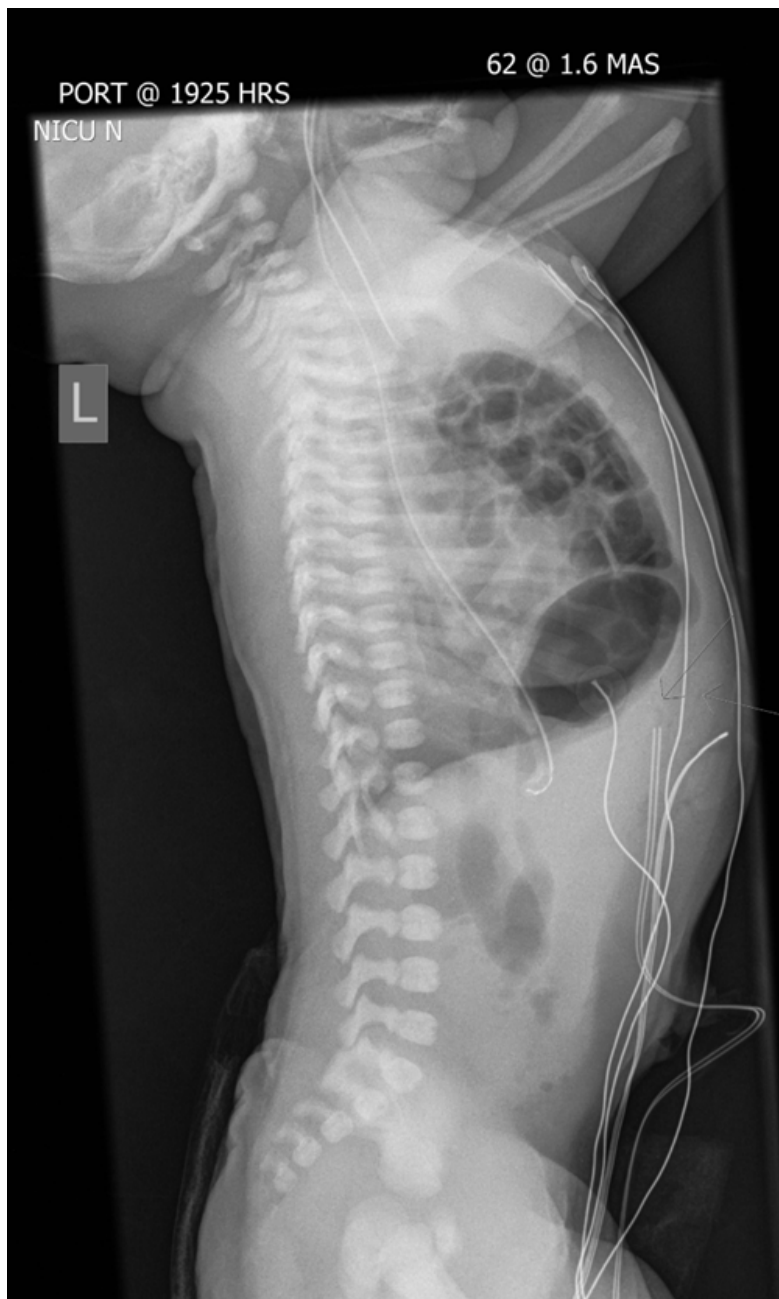
Upward direction of
the D2



normal

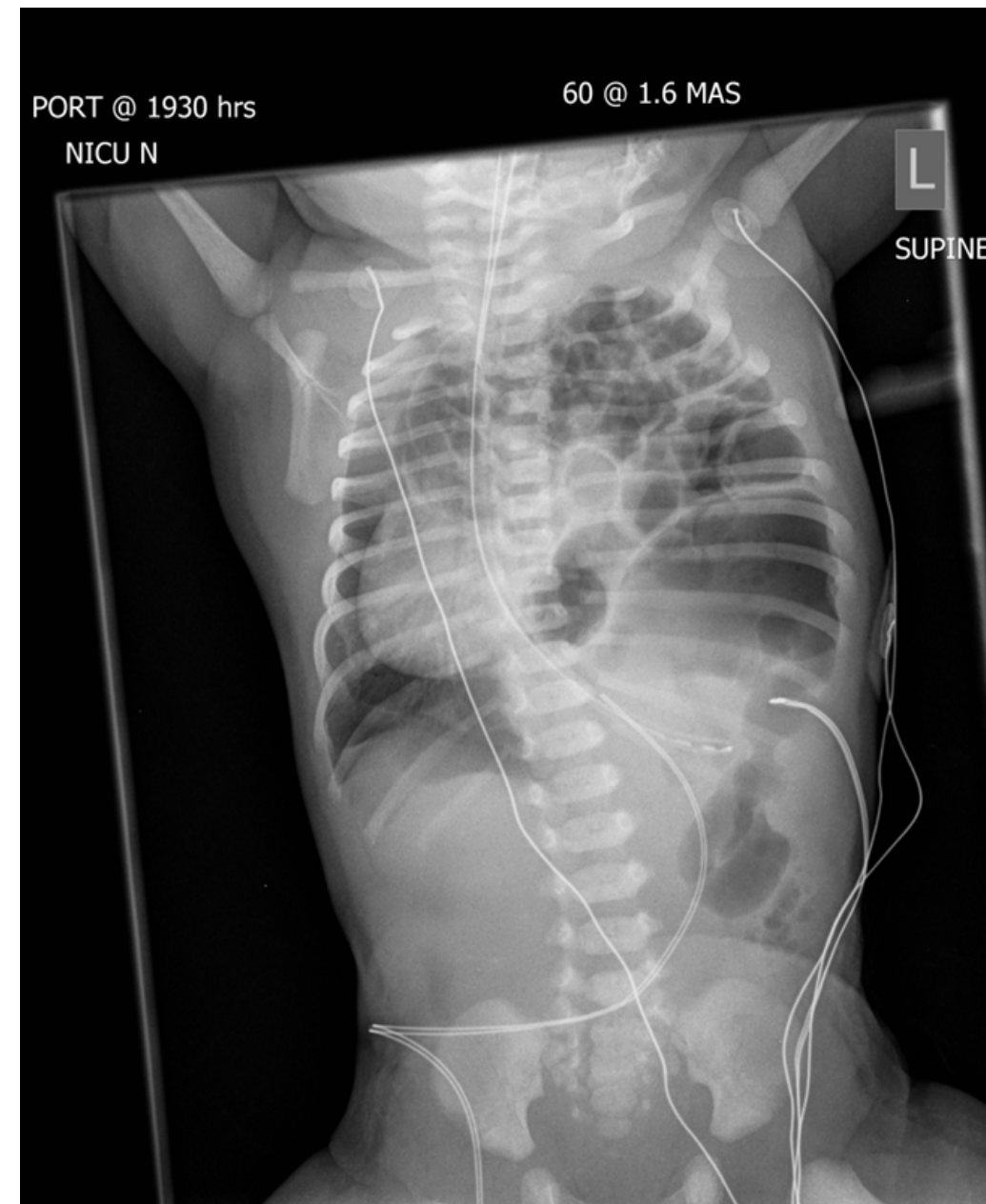






Q8

A 0- day old –
Difficulty
breathing

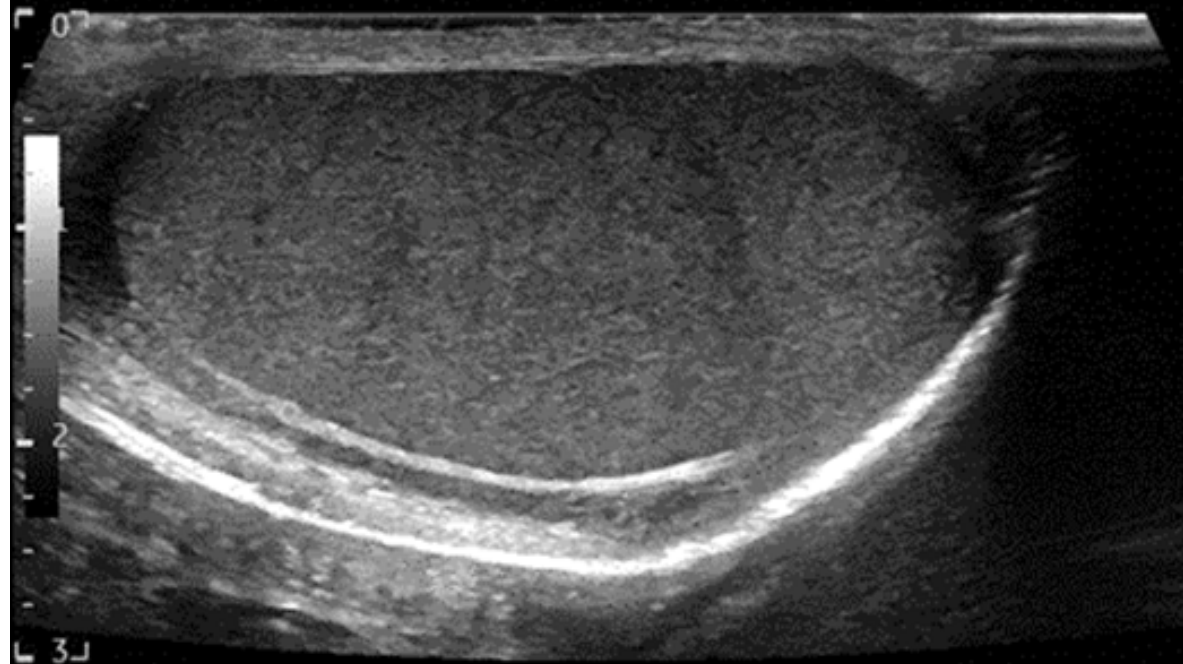


Q9

- A 13-year-old boy, scrotal pain

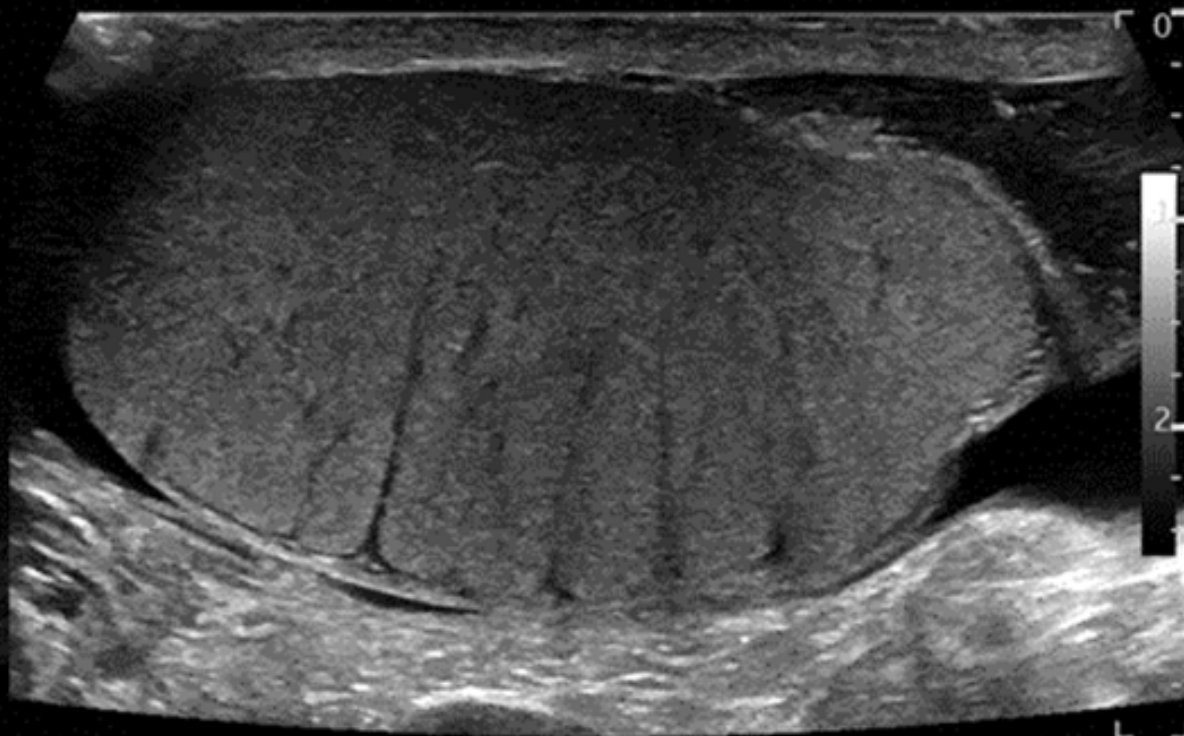
LOGIQ

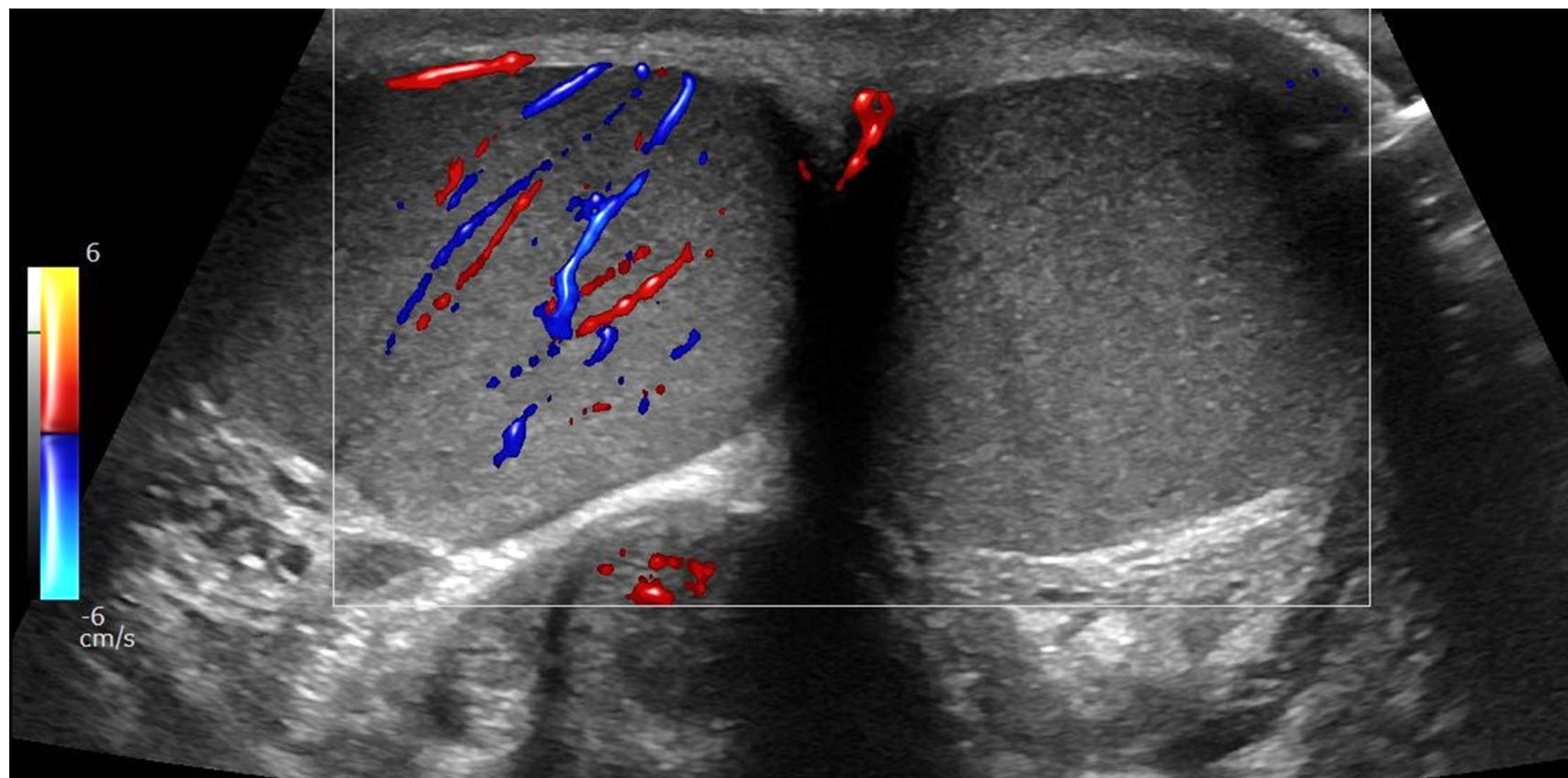
LEFT



LOGIQ

RIGHT



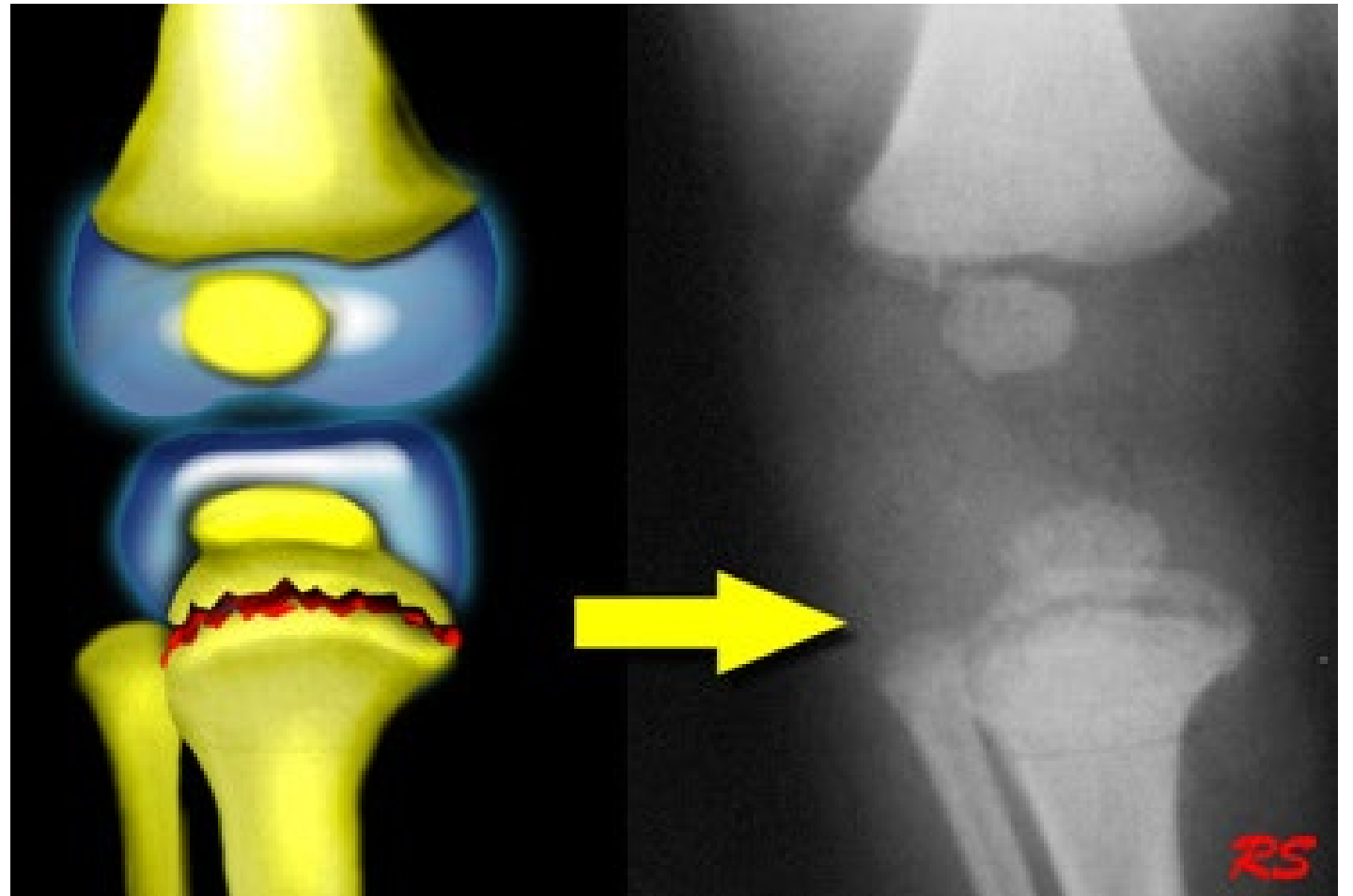


Q10

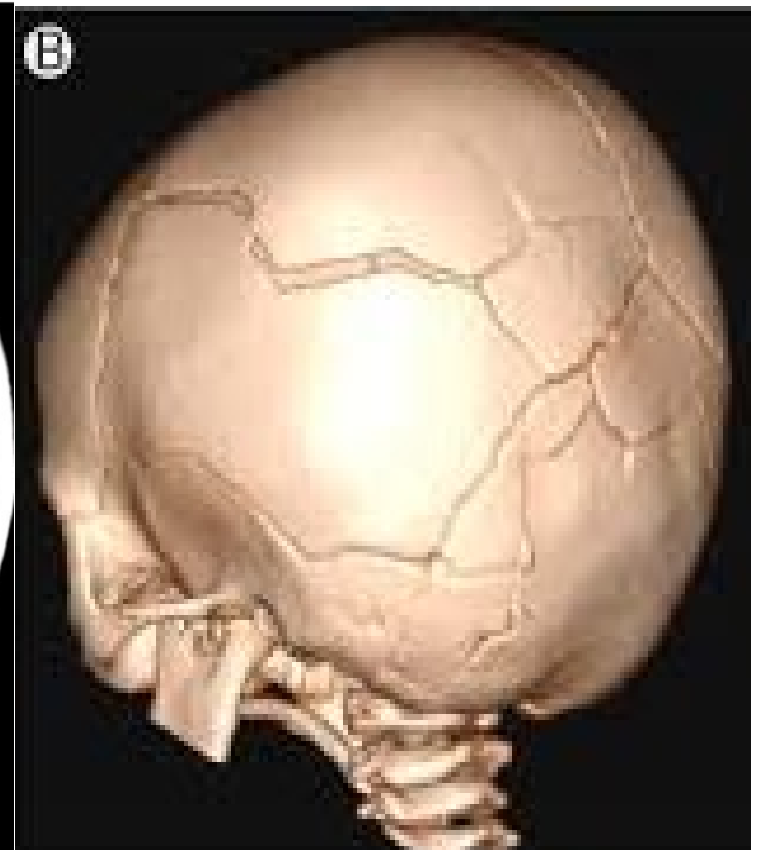
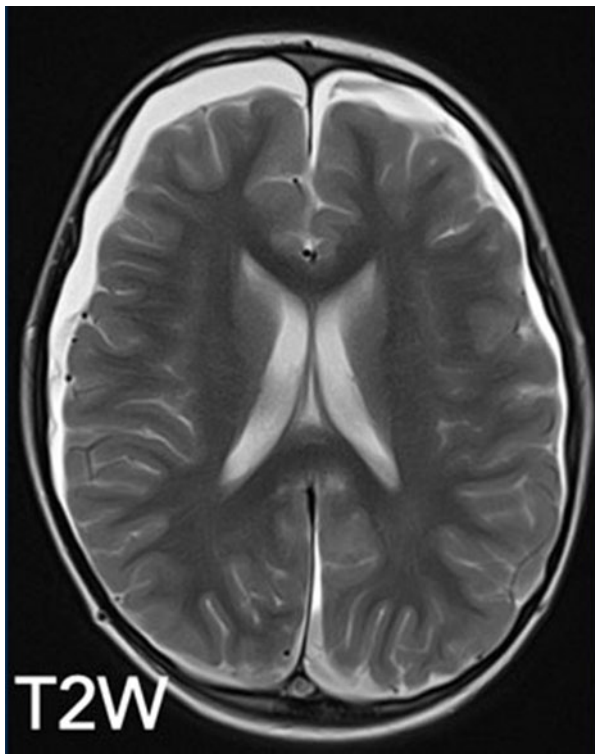
- A 3-month-old baby, cough and irritability



- 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.



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



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

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

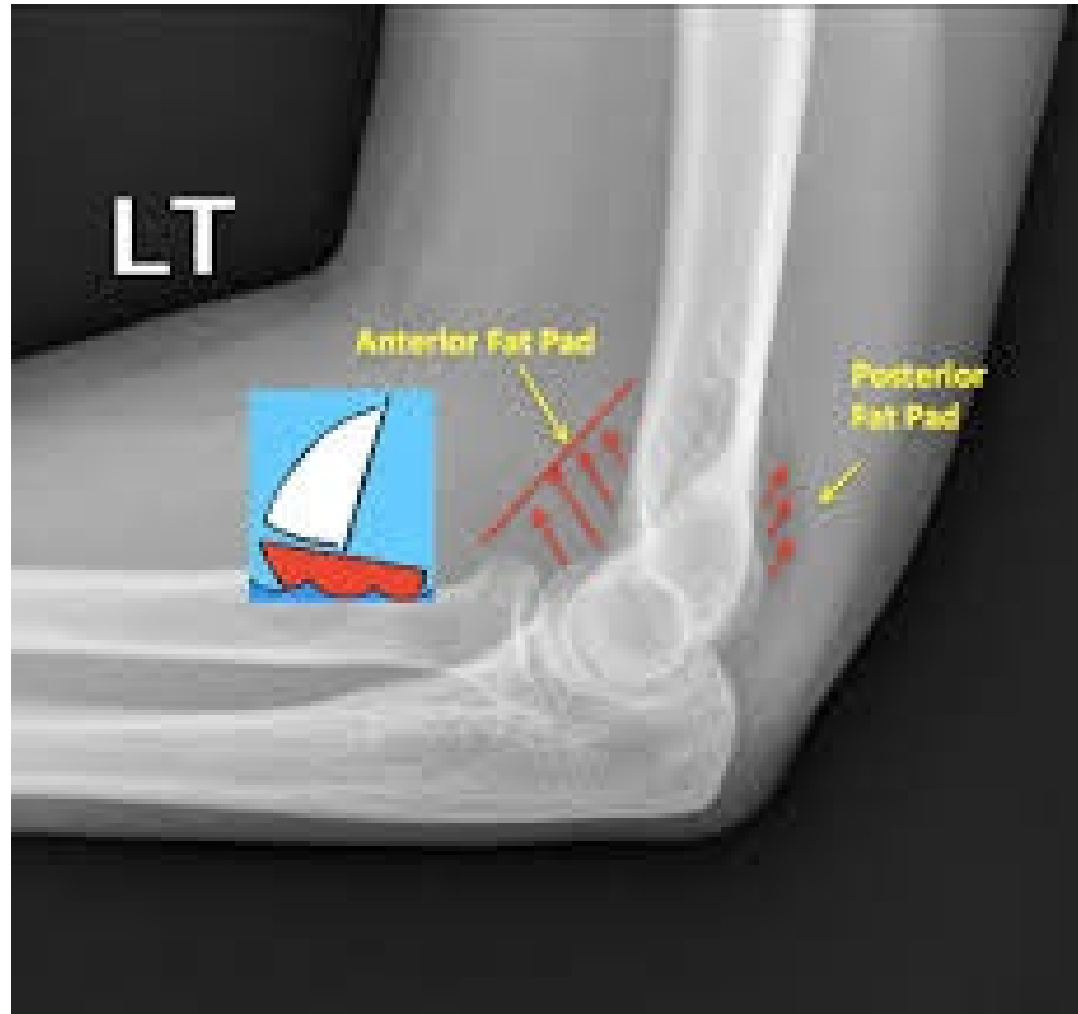
Trochea: **7** Y

Olecranon: **9** Y

Ext. epicondyle: **11** Y



Elbow fractures- Joint effusion





Nondisplaced
supracondylar
humeral fracture

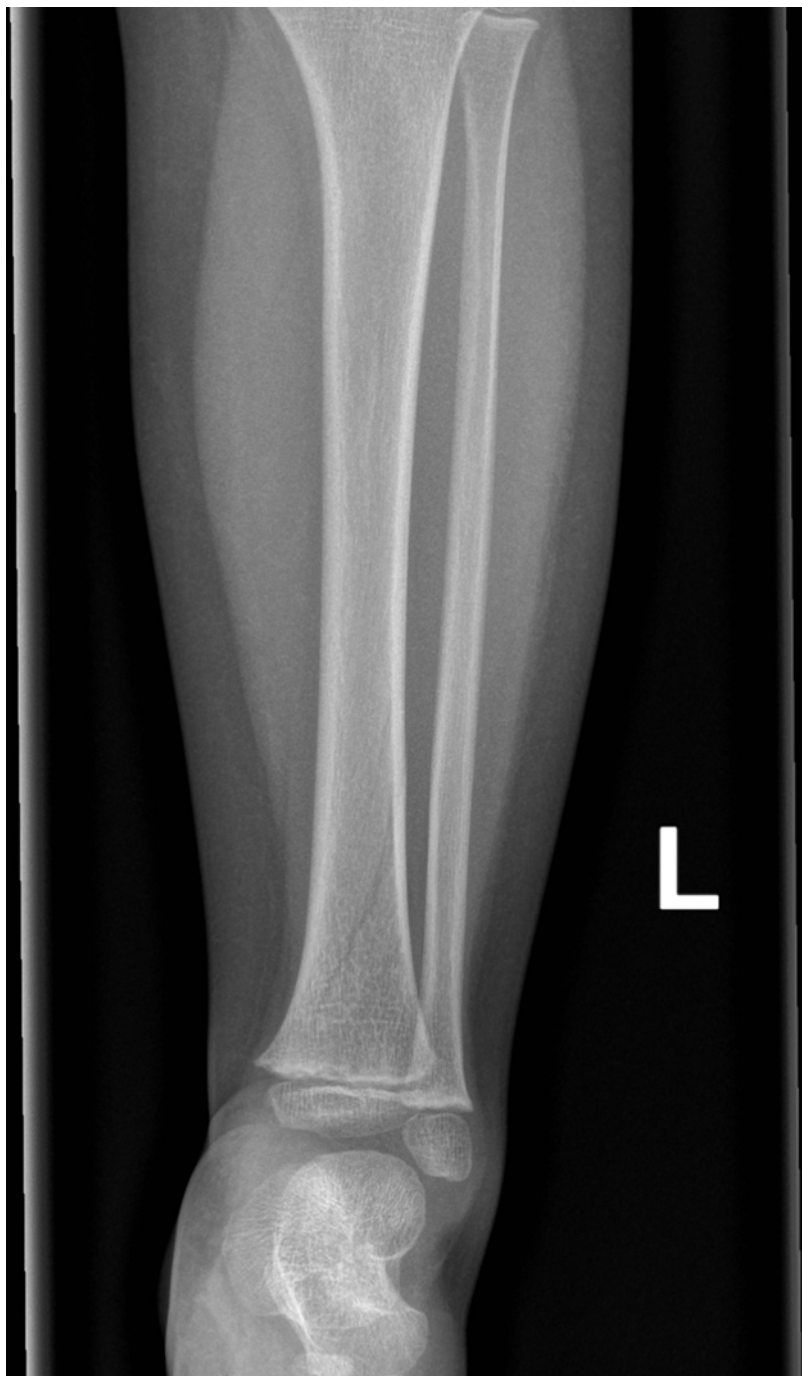


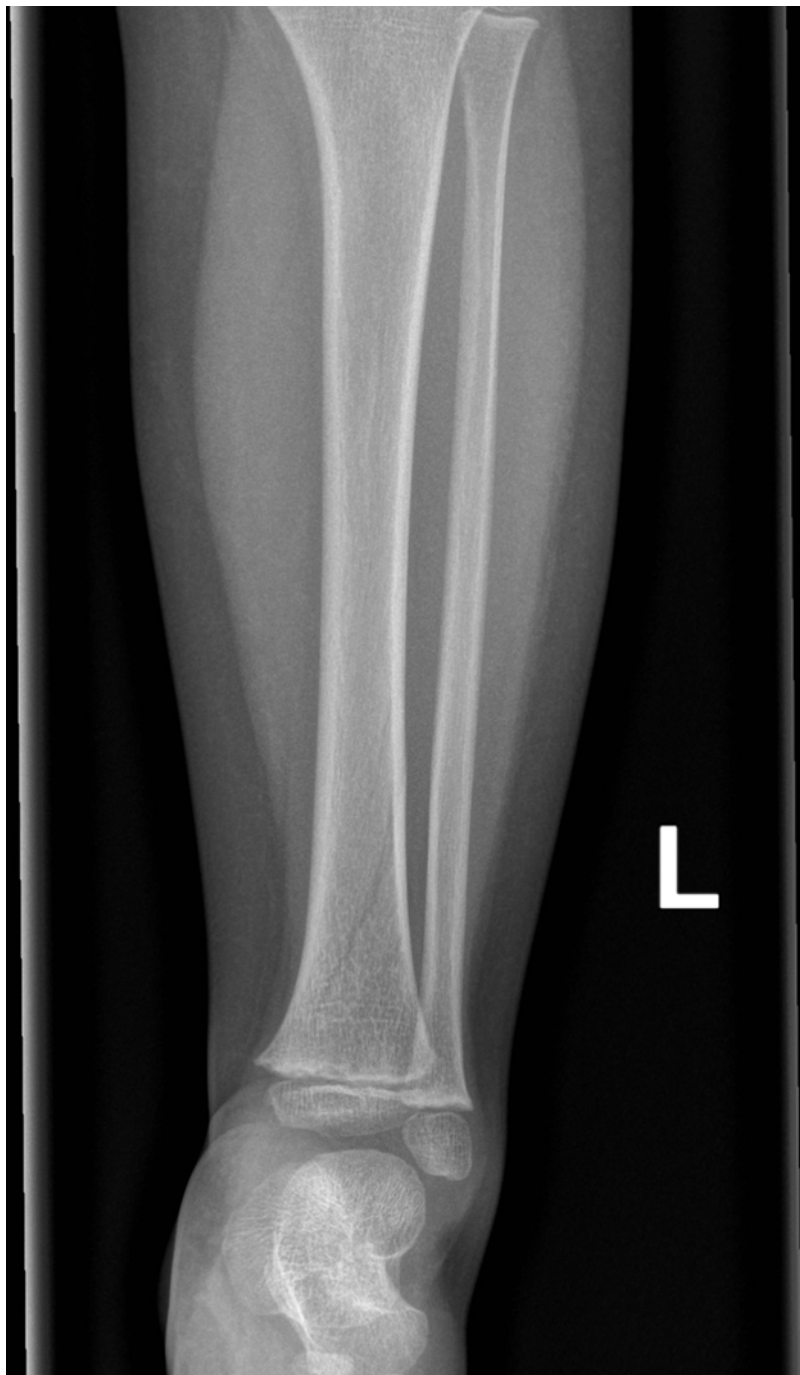






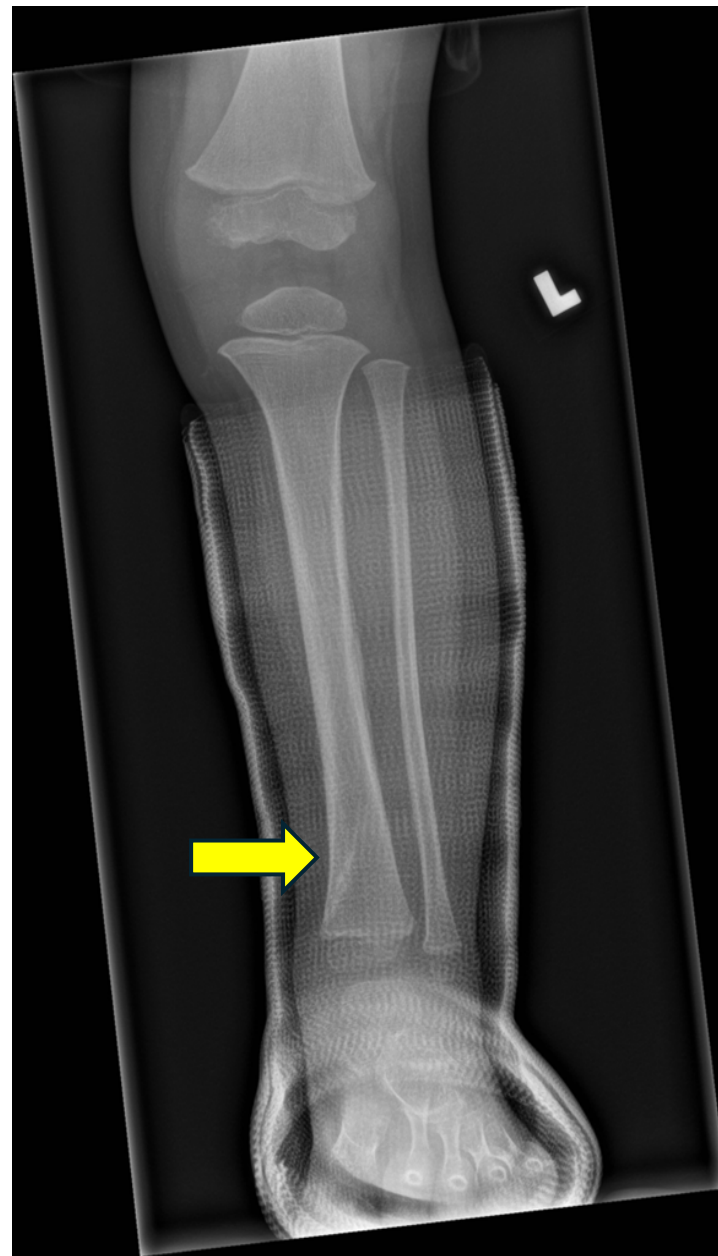
Buckle fracture
of distal radial
metaphysis



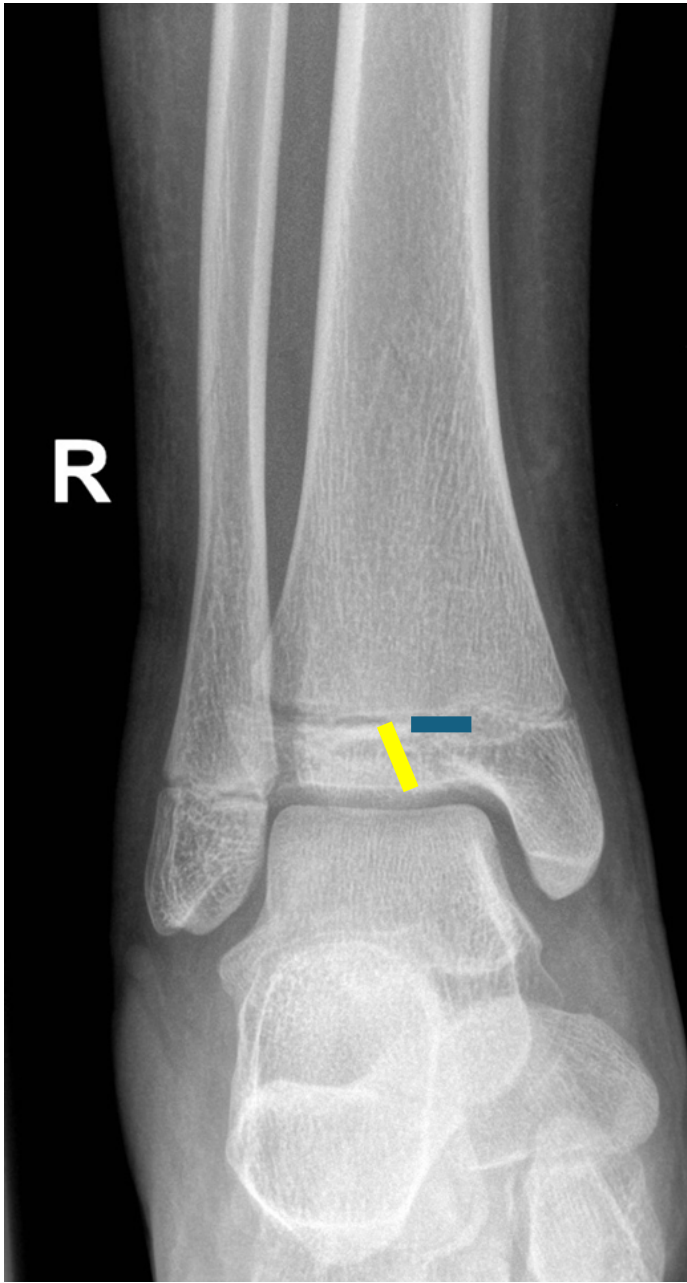


Toddler's fracture
of the distal tibial
metaphysis

Follow-up x-ray ➡:
Ongoing healing







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

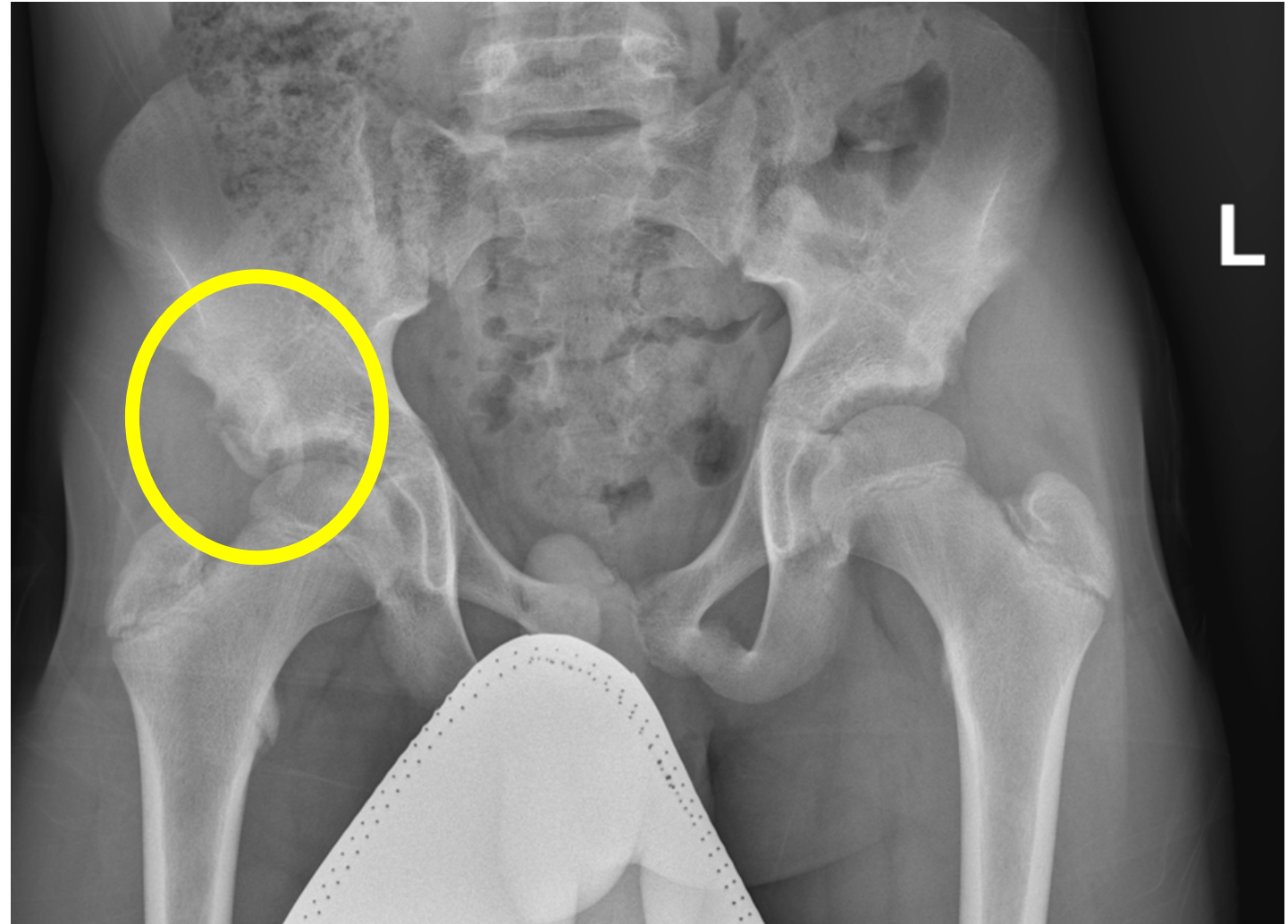


A 13-year-old male
with 1 month of
right hip
pain, decreased
internal rotation of
the right hip.



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





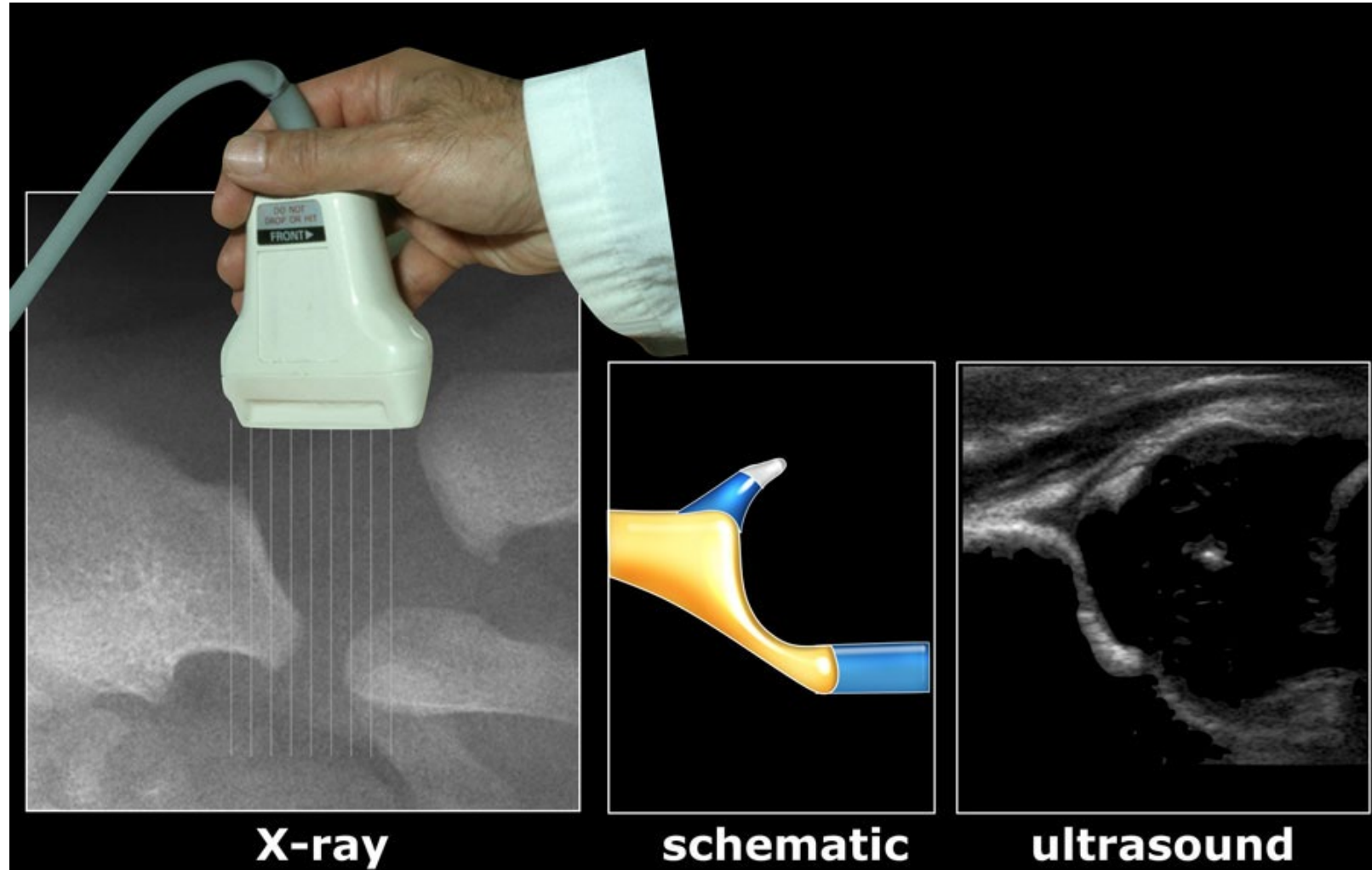
DDH

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.

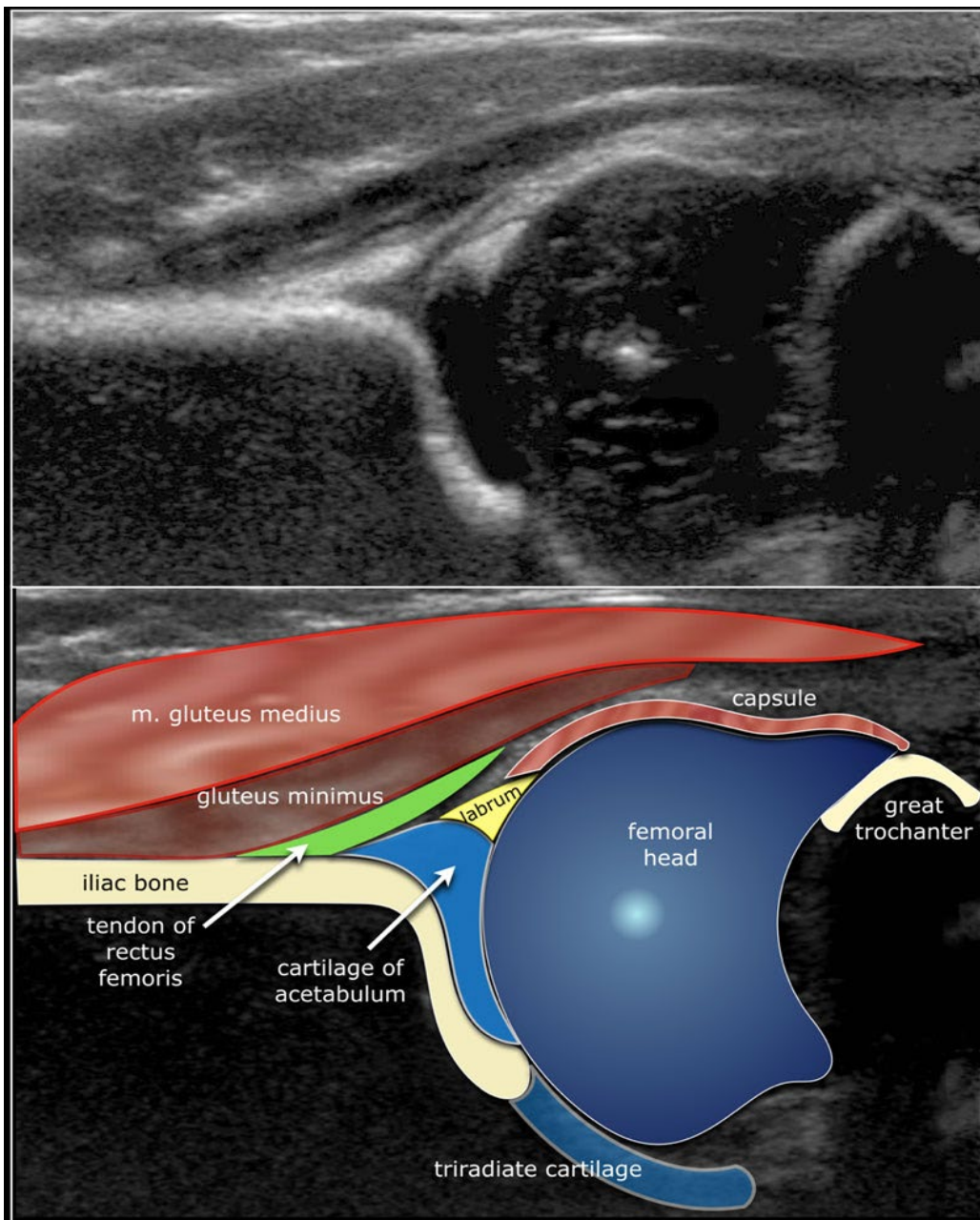
Risk factors include

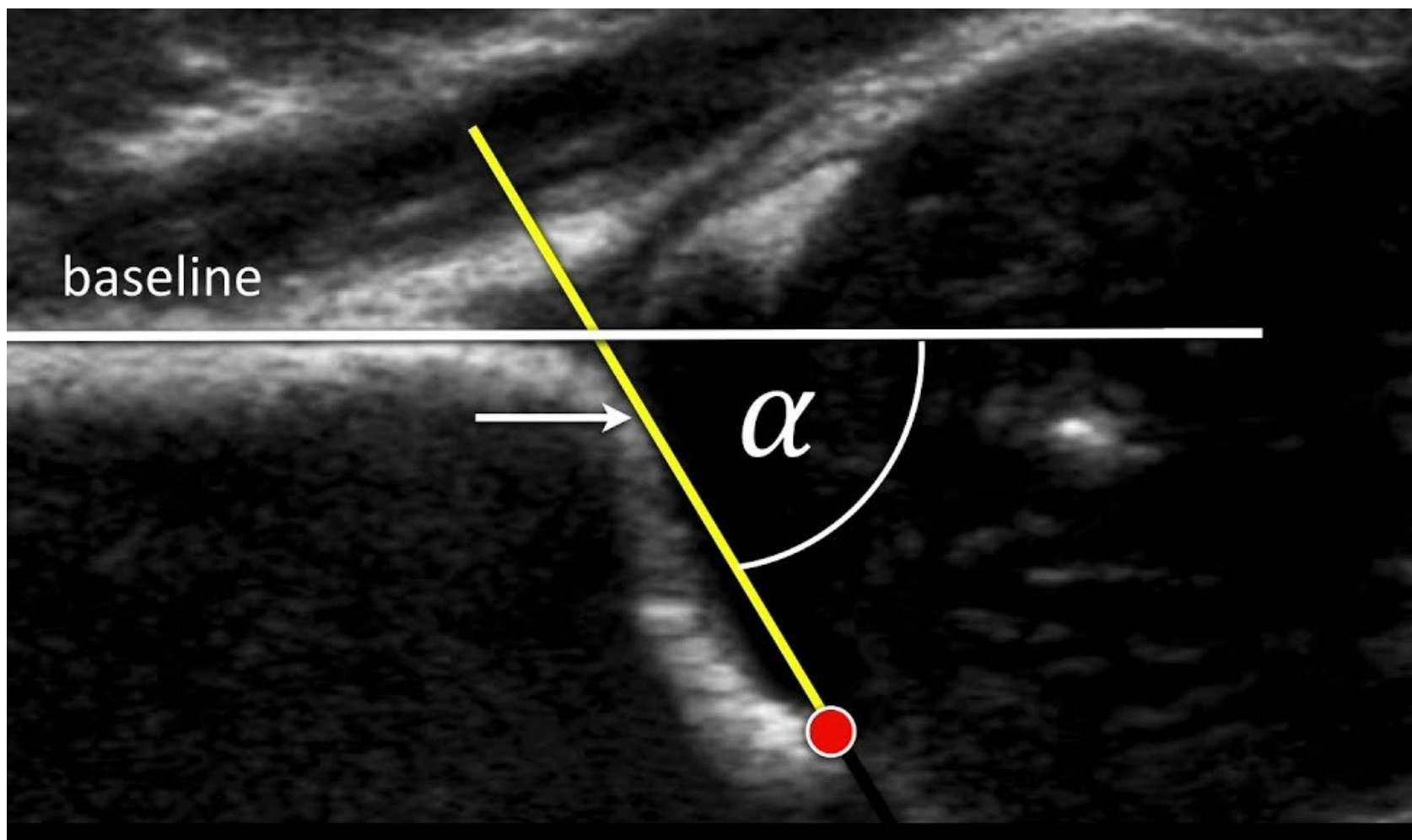
- Female gender (M:F ~1:8)
- Firstborn baby
- Family history
- Breech presentation
- Oligohydramnios

DDH



ULTRASOUND









THANK
YOU

