

# Staying Out of Trouble in Pediatric Orthopaedics

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UT Health  
San Antonio

I have no disclosures.



Who Am I?





Who Am I?

**UT Southwestern**  
Medical Center





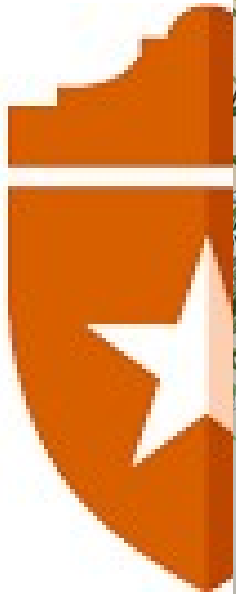
# Who Am I?







# Who Am I?



# Outline

Elbow Fractures

Physeal Fractures

Femur Fractures

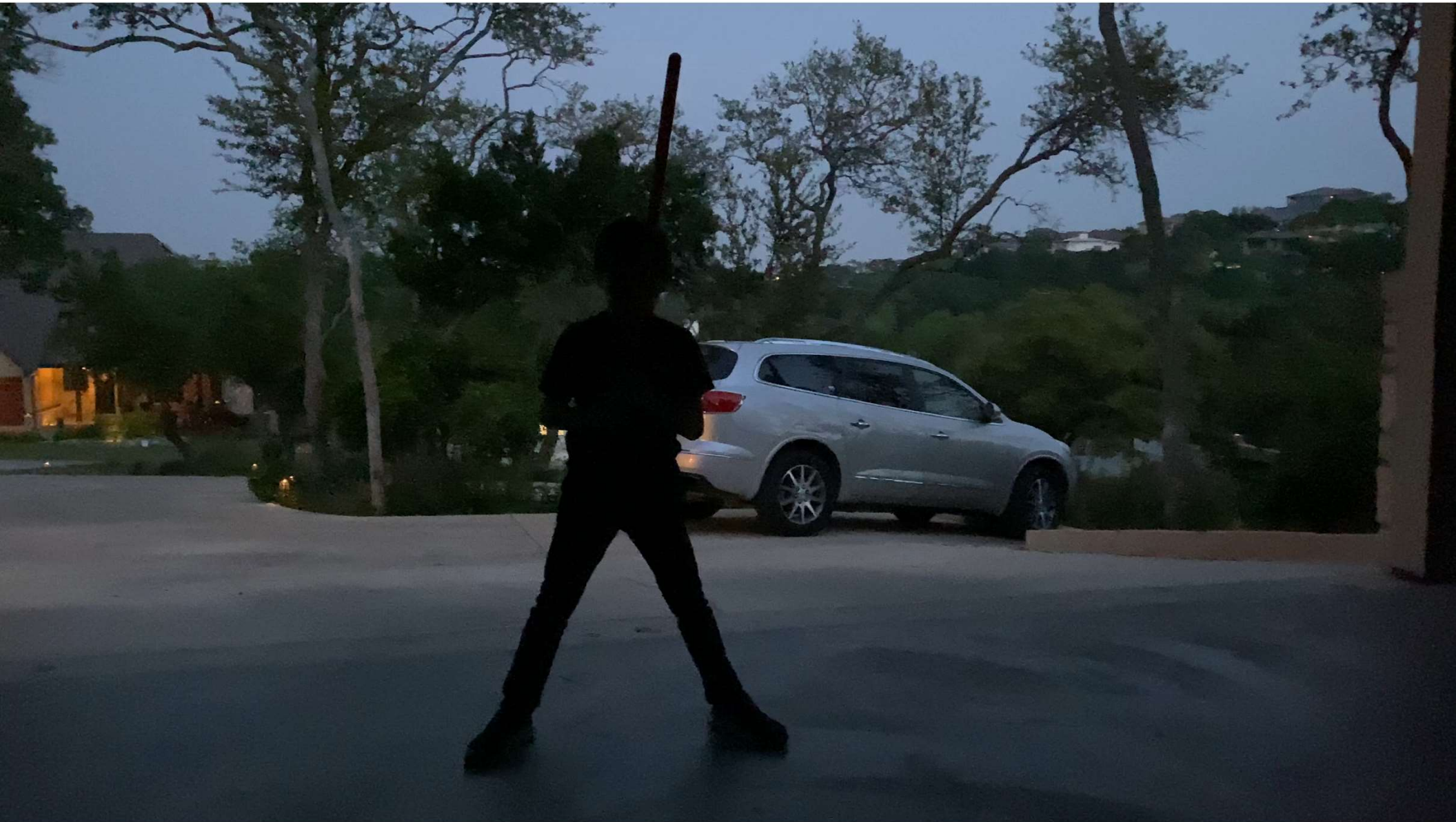
Non-accidental Trauma

SCFE

Tarsal Coalitions

DDH

Are you ready?





***The year is 2024. The Death Star and their evil***

# Outline

## Elbow Fractures

Physeal Fractures

Femur Fractures

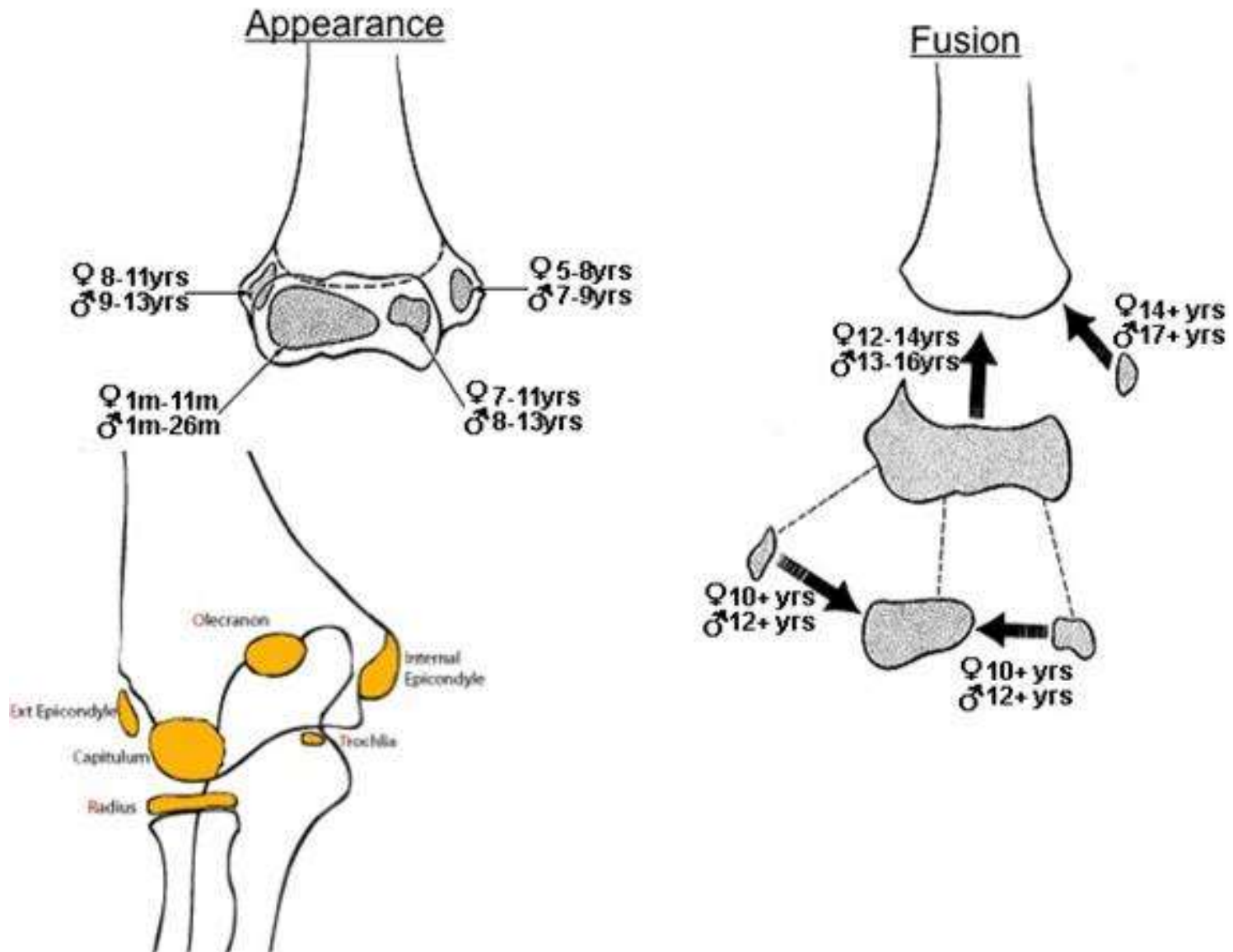
Non-accidental Trauma

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# The Elbow



# The Elbow

C - 2

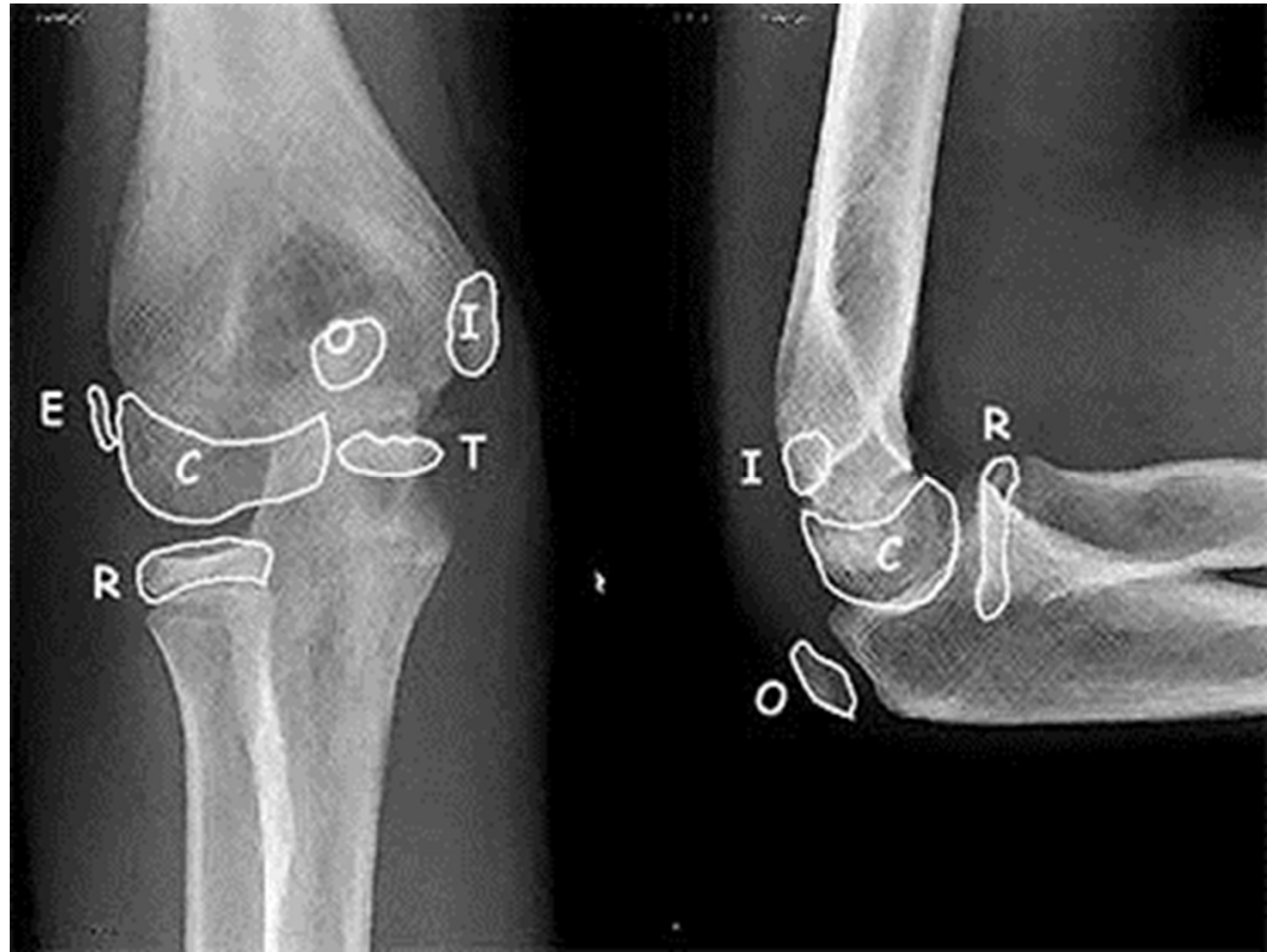
R - 4

M - 6

T - 8

O - 10

L - 12





# The Elbow

C – 2

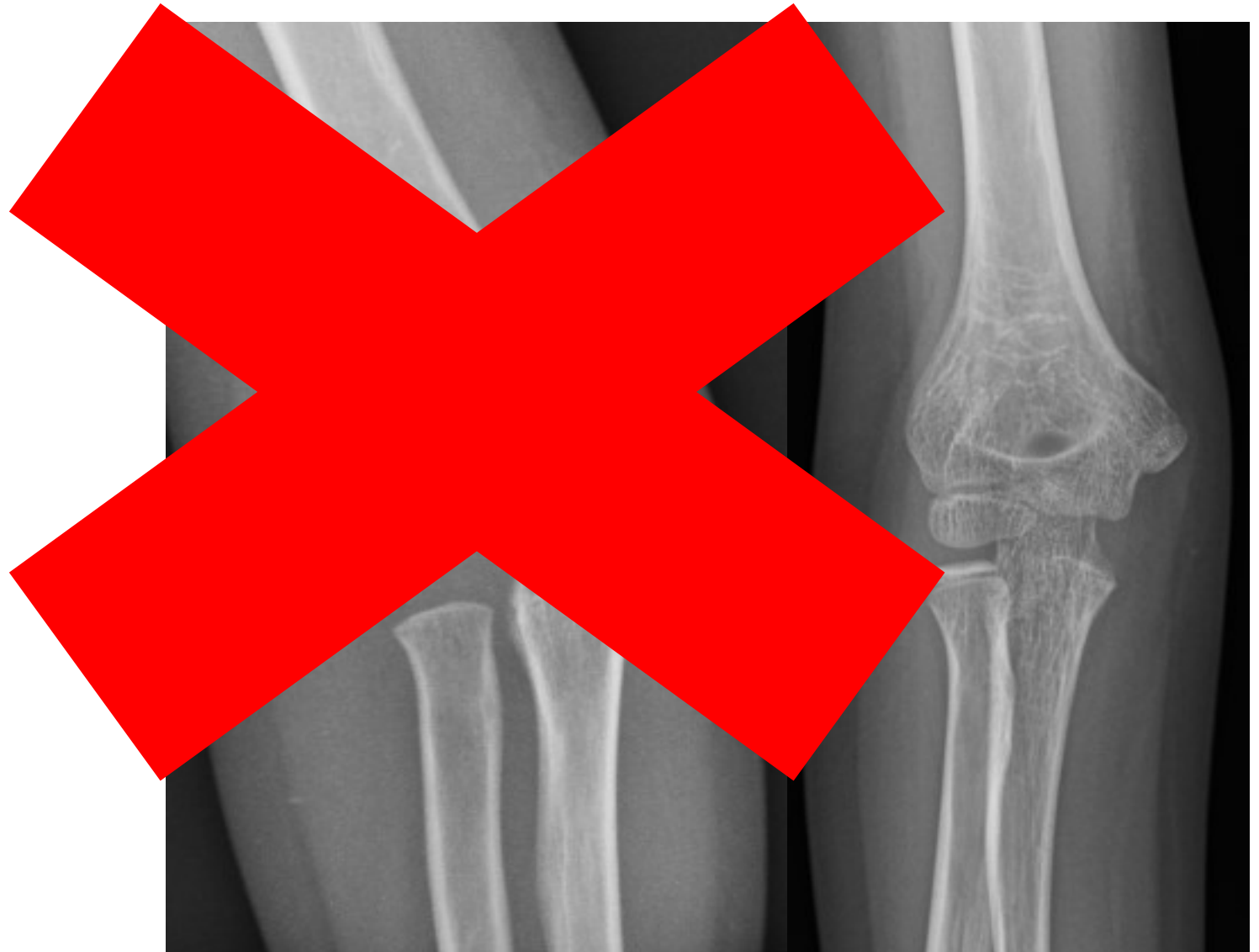
R – 4

M – 6

T – 8

O – 10

L – 12



# Supracondylar Humerus Fx

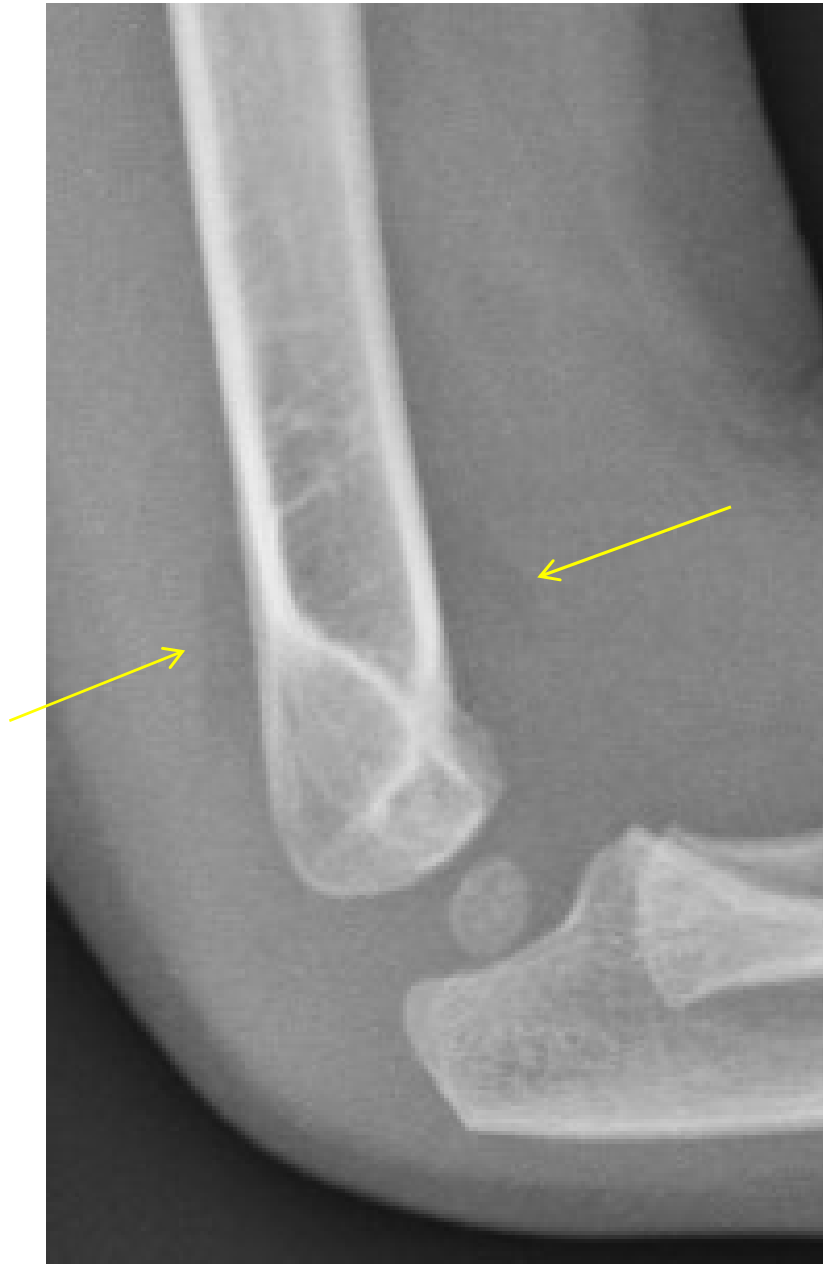
Common injury

Often needs surgery

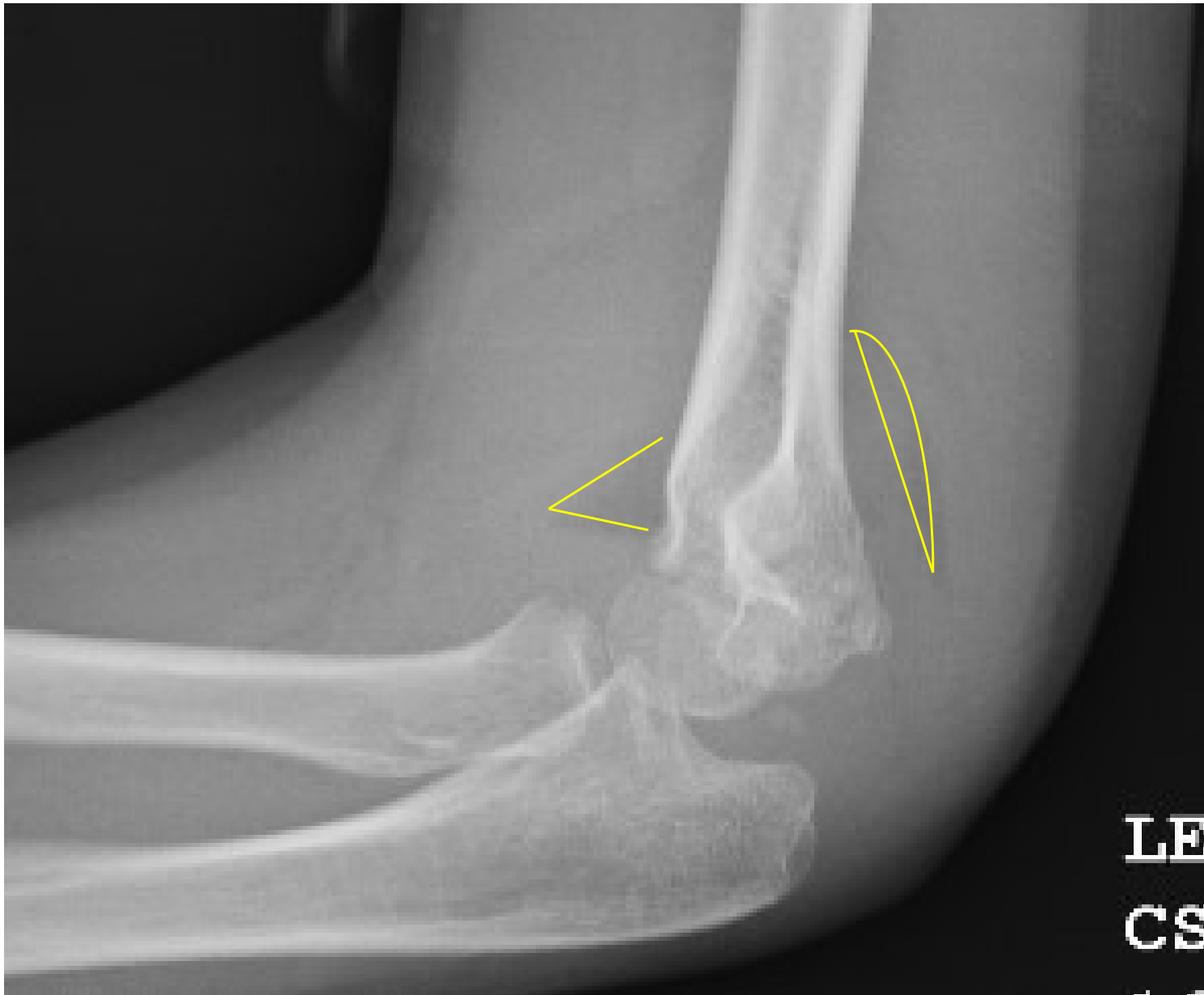
AIN palsy



# Fat Pad Sign



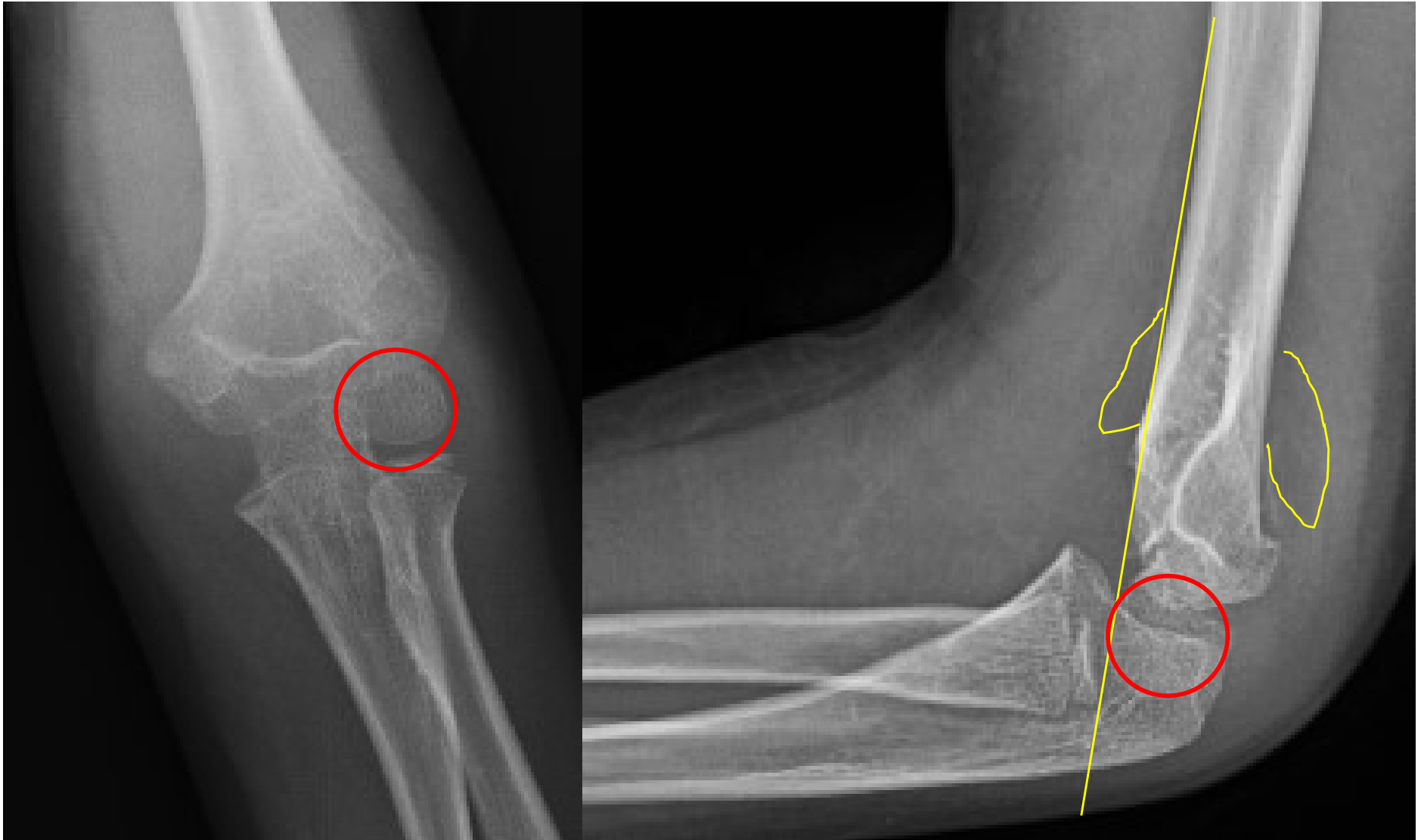
# Fat Pad Sign



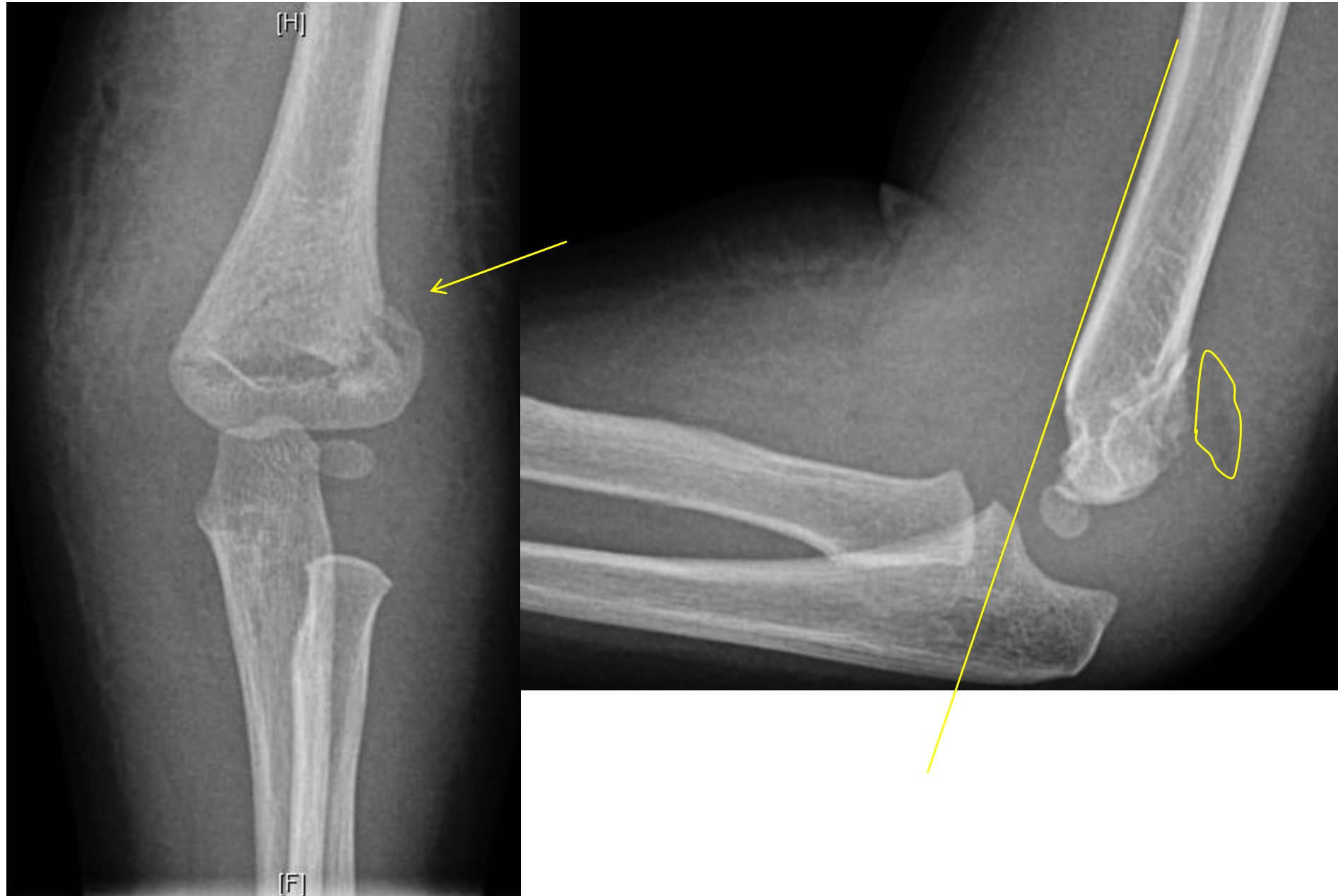
# Anterior Humeral Line



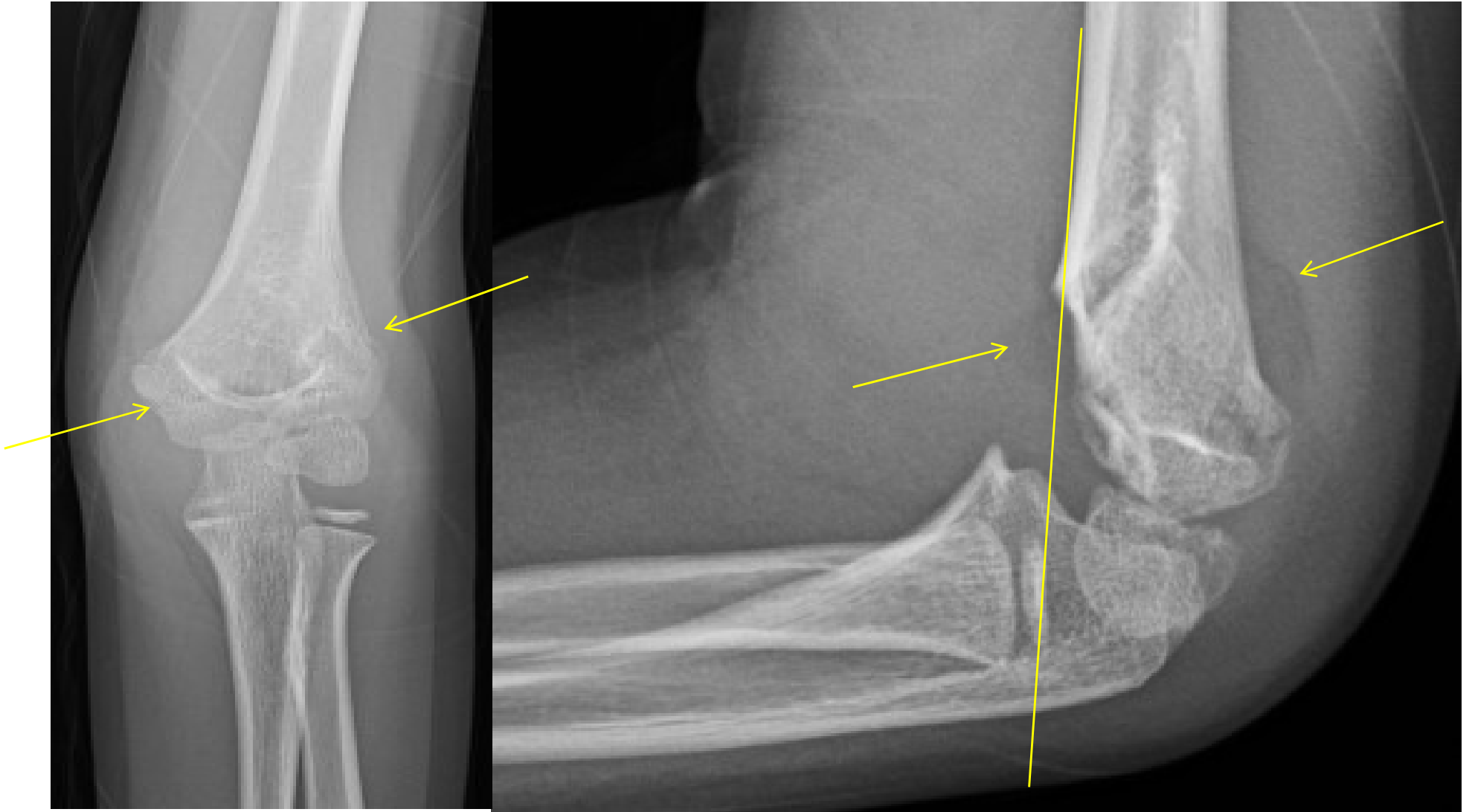
# Anterior Humeral Line



# Supracondylar Humerus Fx

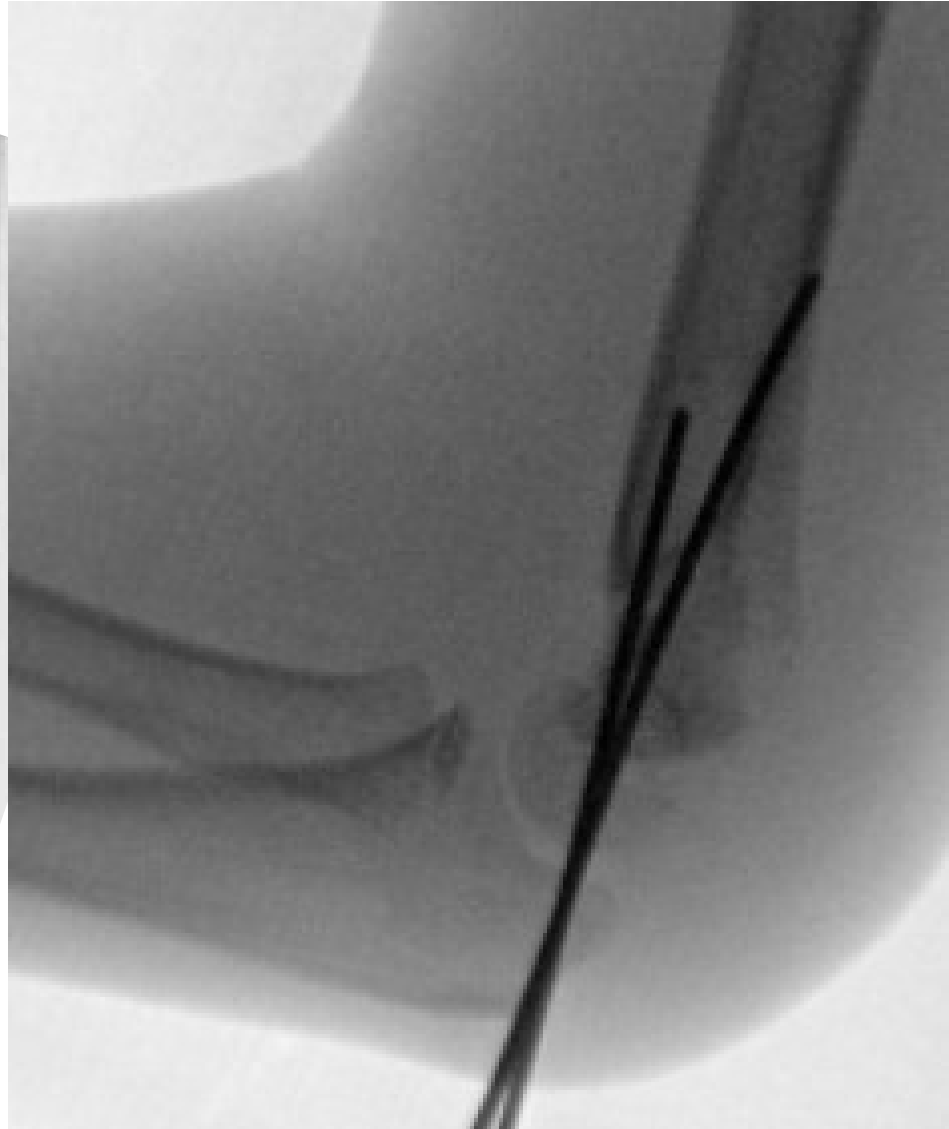


# Supracondylar Humerus Fx





# Supracondylar Humerus Fx



# Supracondylar Humerus Fx



# Medial Epicondyle Fractures



# Medial Epicondyle Fractures

50% associated with elbow dislocation

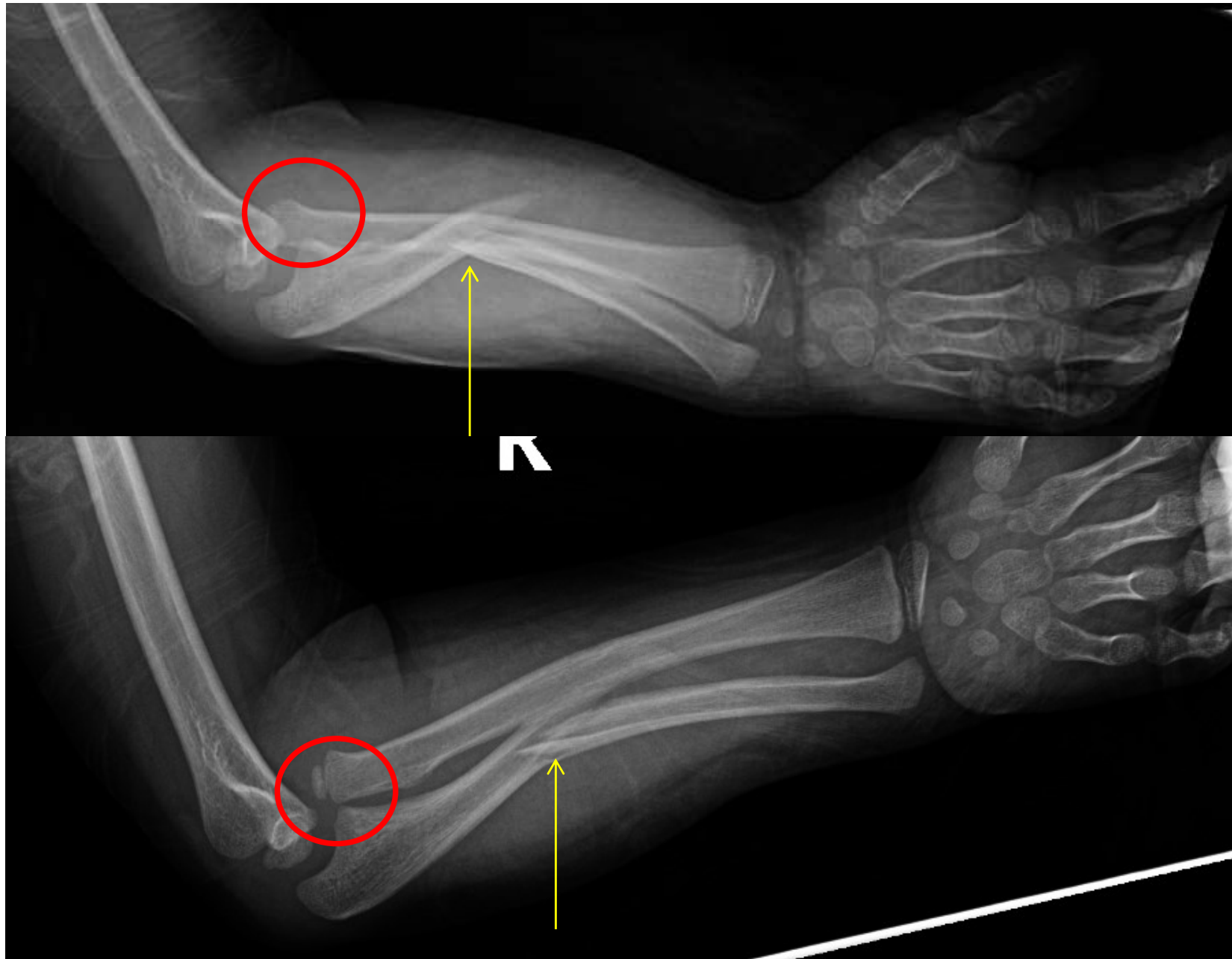
Should try to reduce elbow



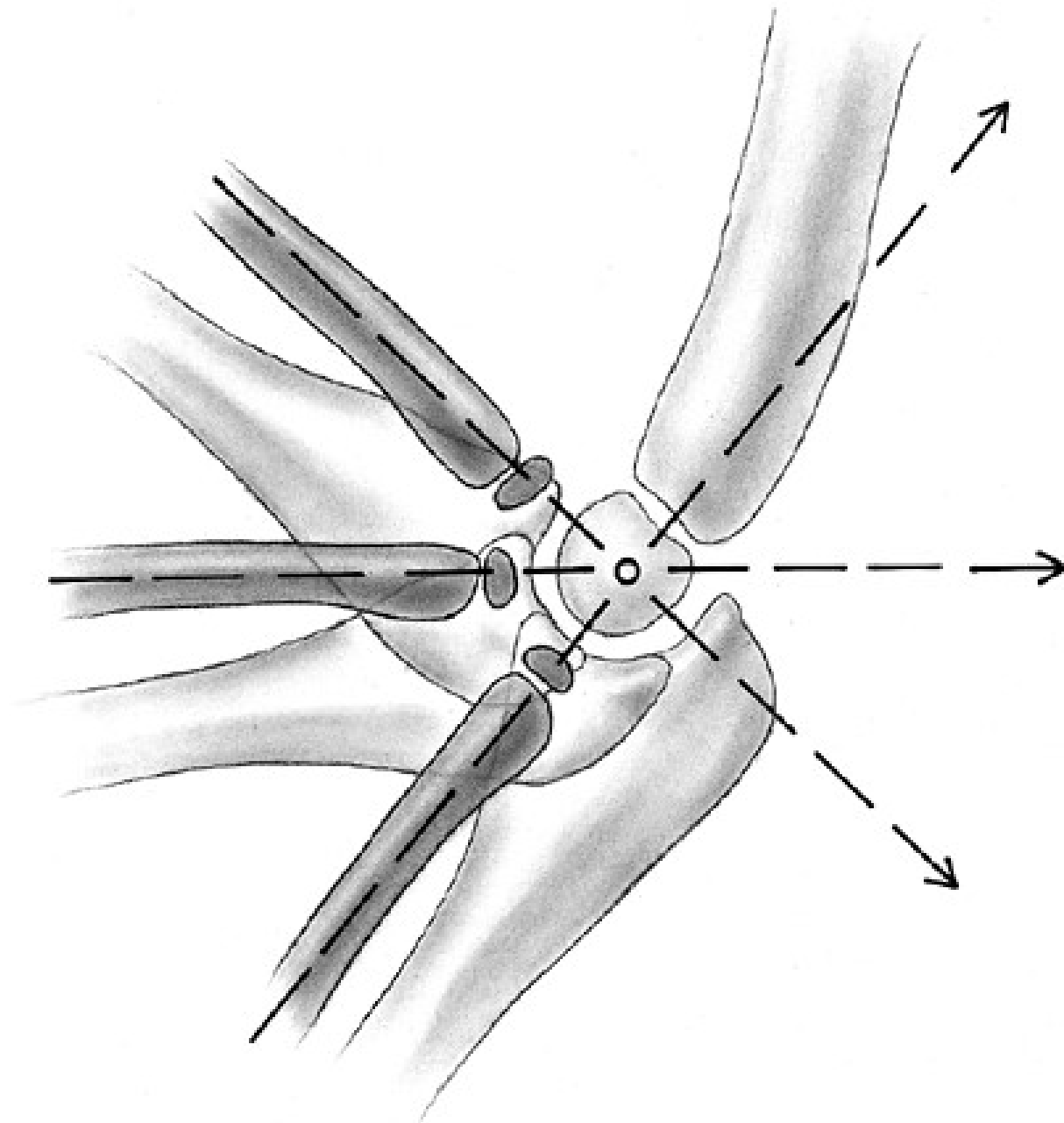
# Medial Epicondyle Fractures



# Monteggia Fractures



# Imaging



# Imaging





# Treatment

Closed reduction and casting

Closed reduction, IMN

Open reduction and plating



# Monteggia Fractures



# Monteggia Fractures



# Monteggia Fractures



# Lateral Condyle Fractures

2<sup>nd</sup> Most common elbow fracture

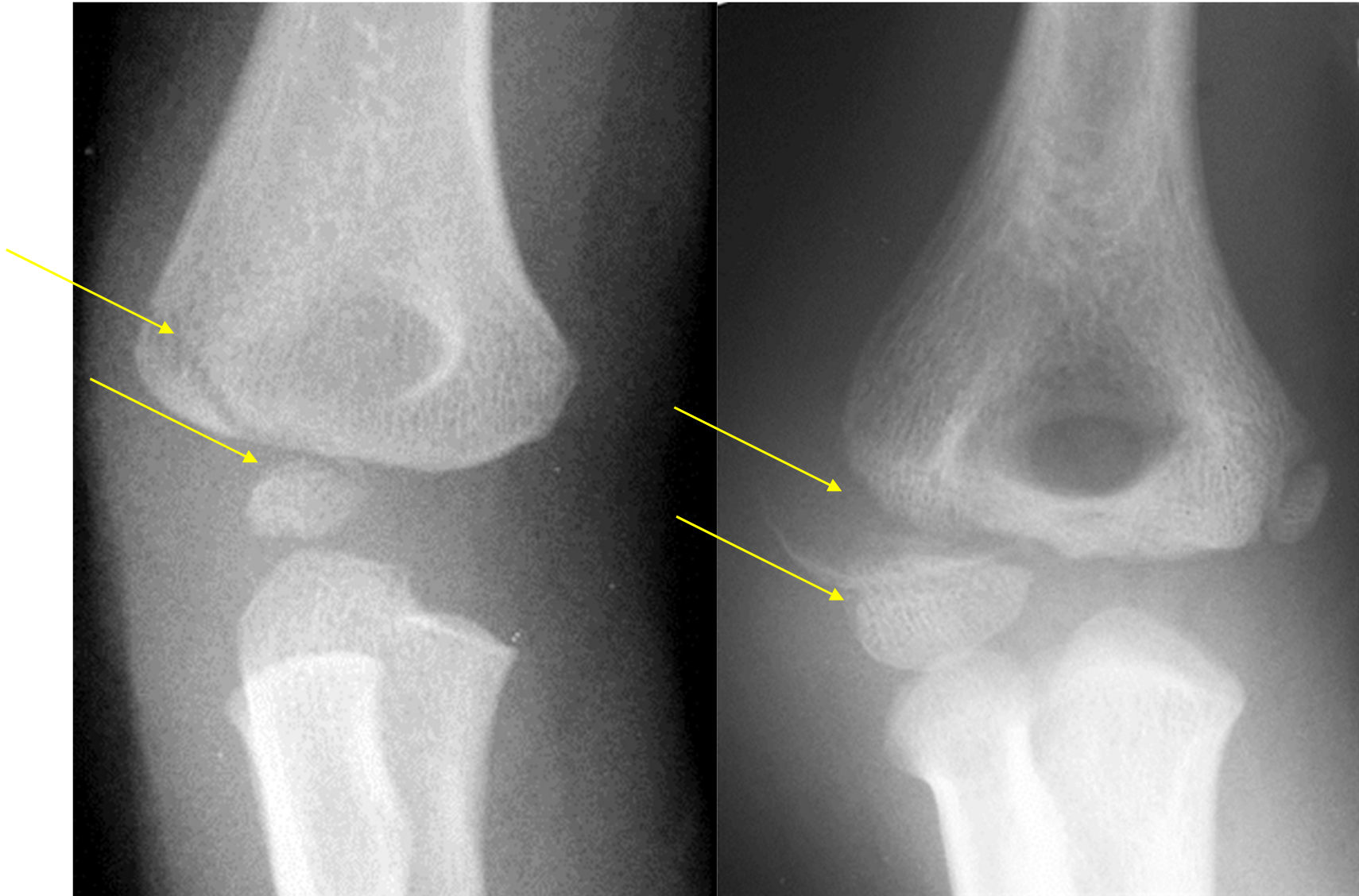
**Most** need operative fixation



# Lateral Condyle Fractures



# Lateral Condyle Fractures

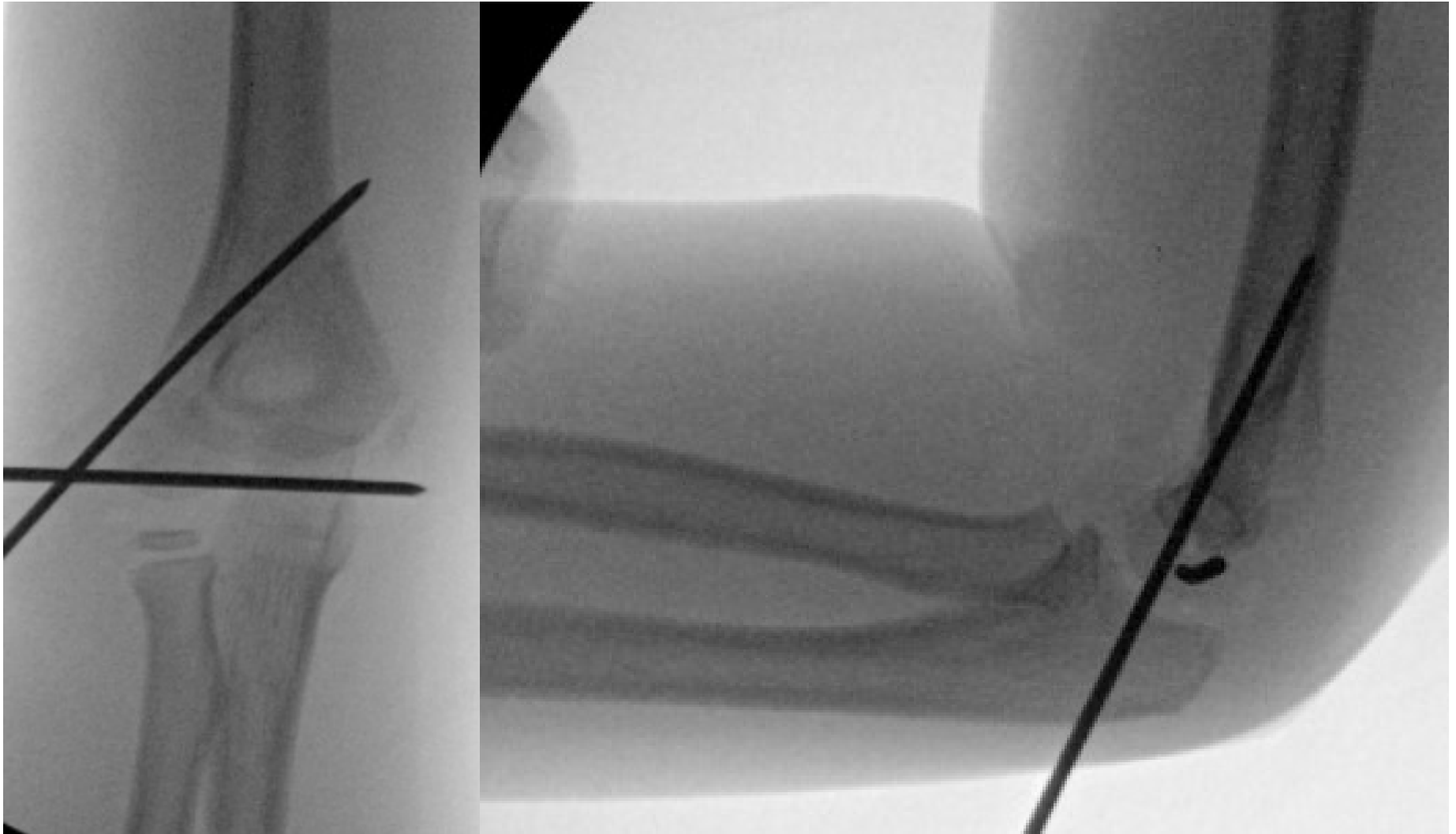


# Lateral Condyle Fractures





# Lateral Condyle Fractures



# Lateral Condyle Fractures



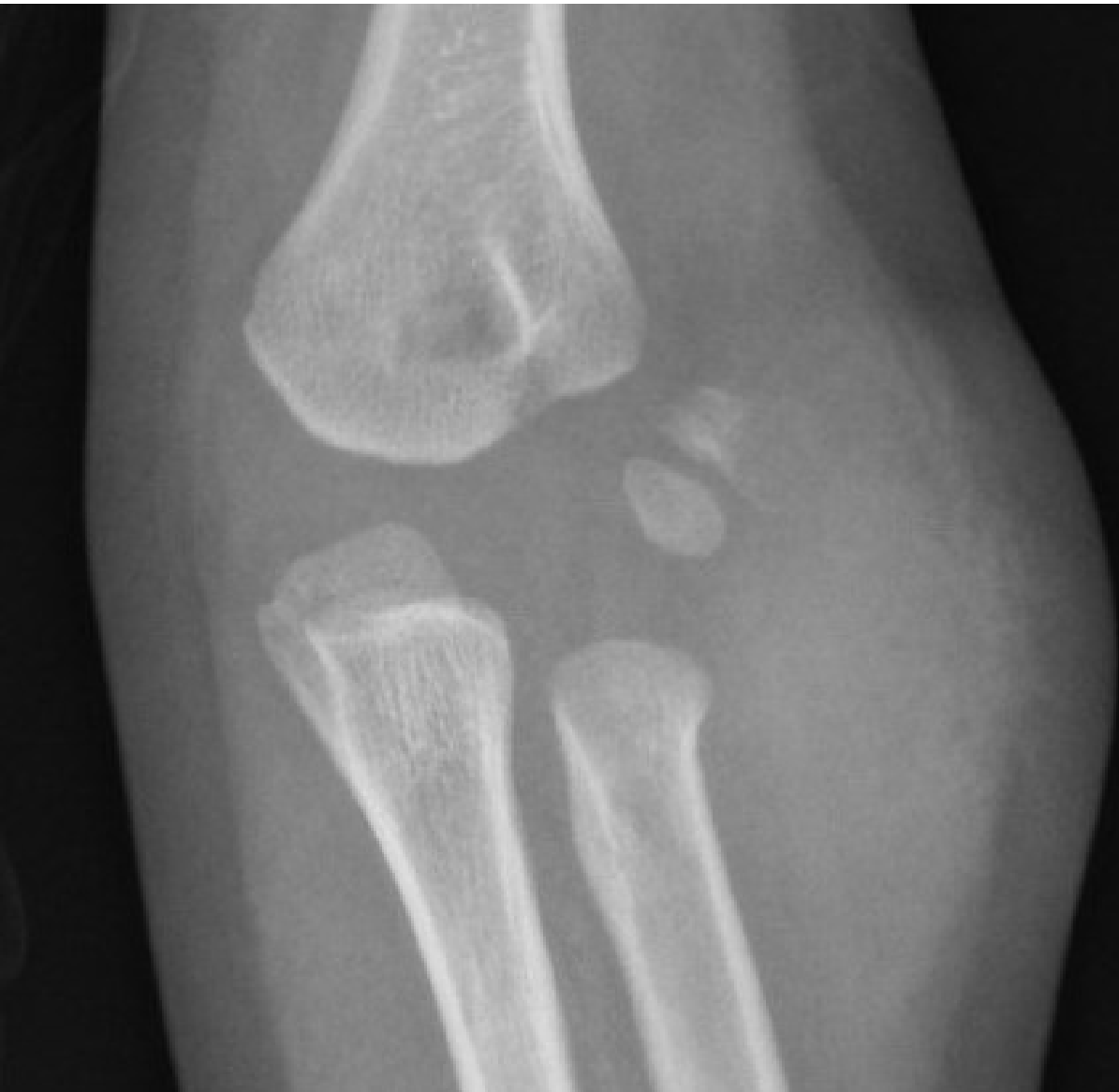
# Lateral Condyle Fractures



# Lateral Condyle Fractures



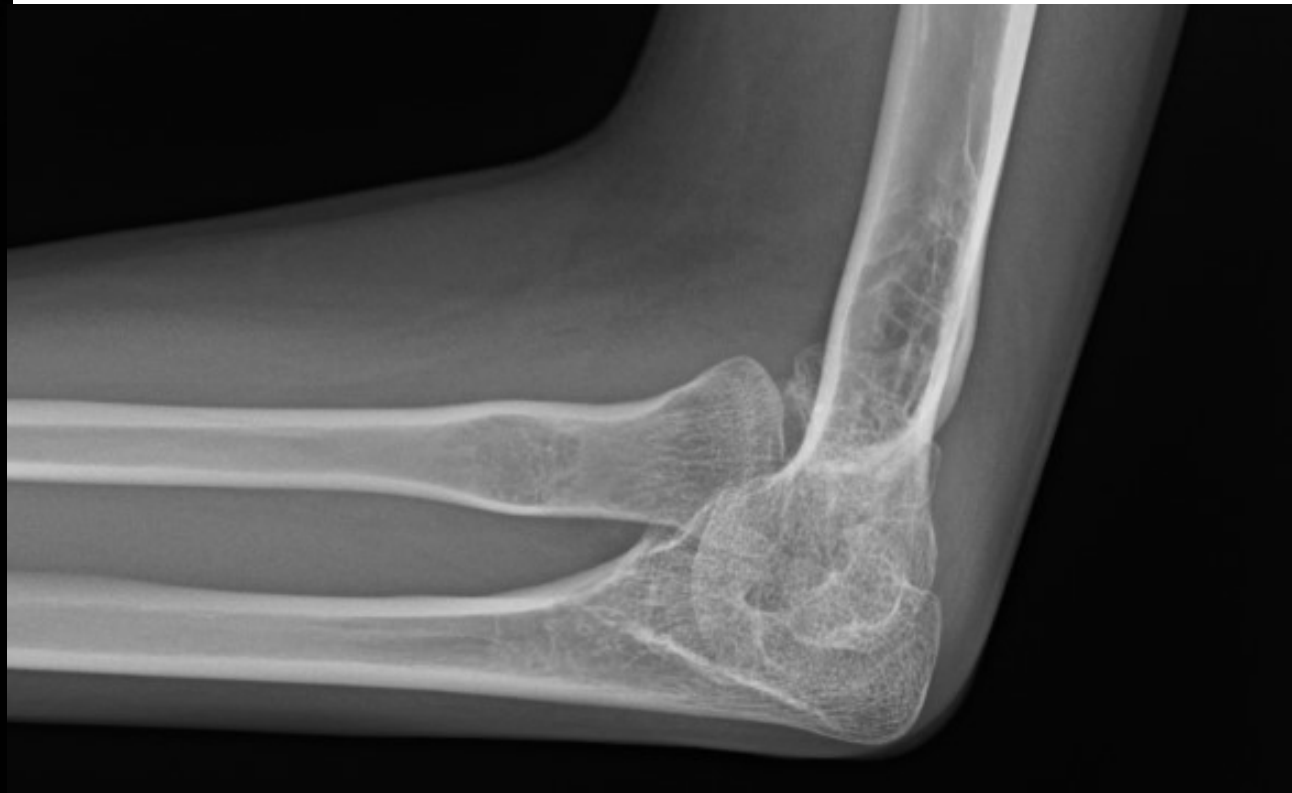
# Lateral Condyle Fractures



# Lateral Condyle Fractures



# Lateral Condyle Fractures



Questions?



# INTERMISSION



# Outline

Elbow Fractures

## **Physeal Fractures**

Femur Fractures

Non-accidental Trauma

SCFE

Tarsal Coalitions

DDH

# Physeal Fractures

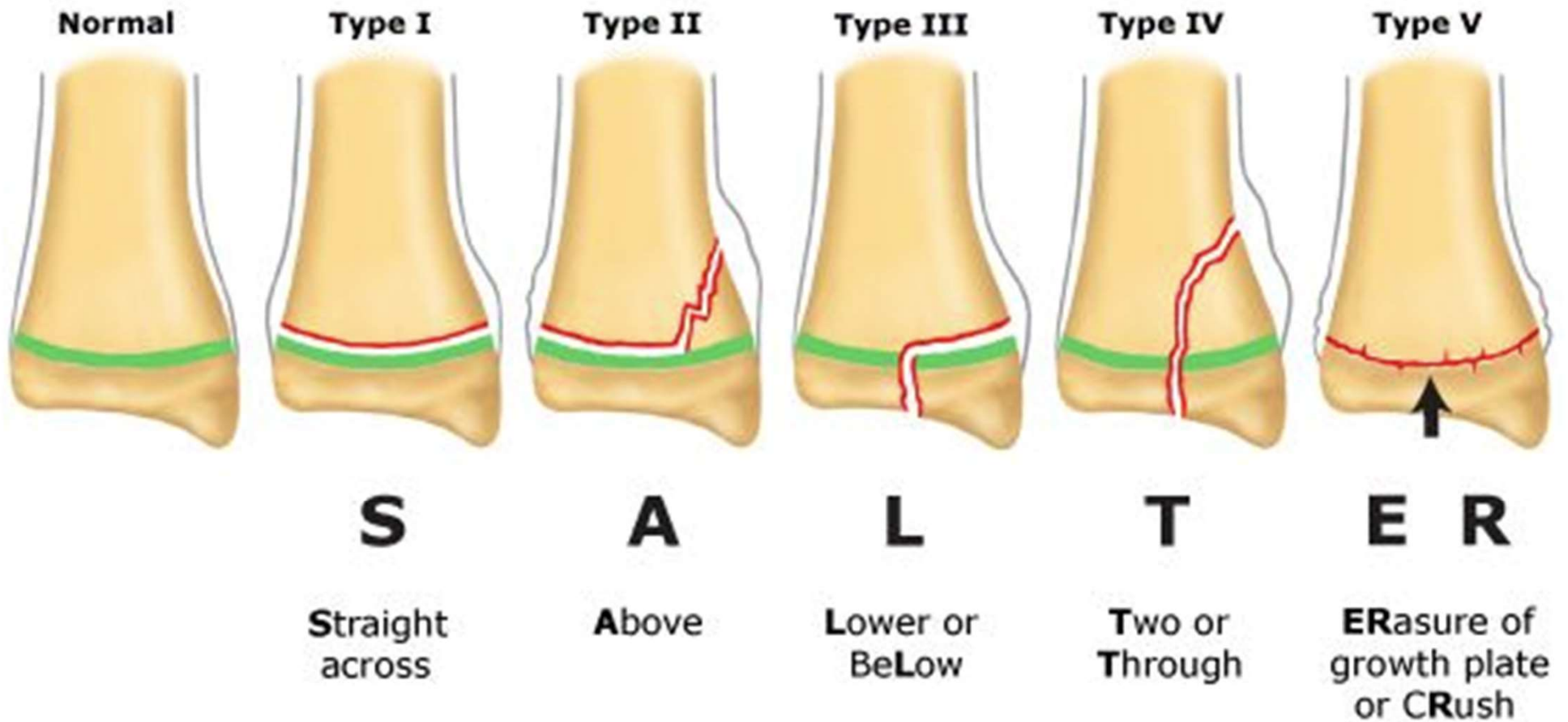
Salter Harris 1-5

↑Growth arrest 1-5

↑Remodeling potential at active physes



# Physeal Fractures



# Physeal Fractures

## General Rules:

1. ↑ Arrest SH1 -> SH5
2. ↑ Remodeling shoulder, w knee
3. More remodeling <10yo

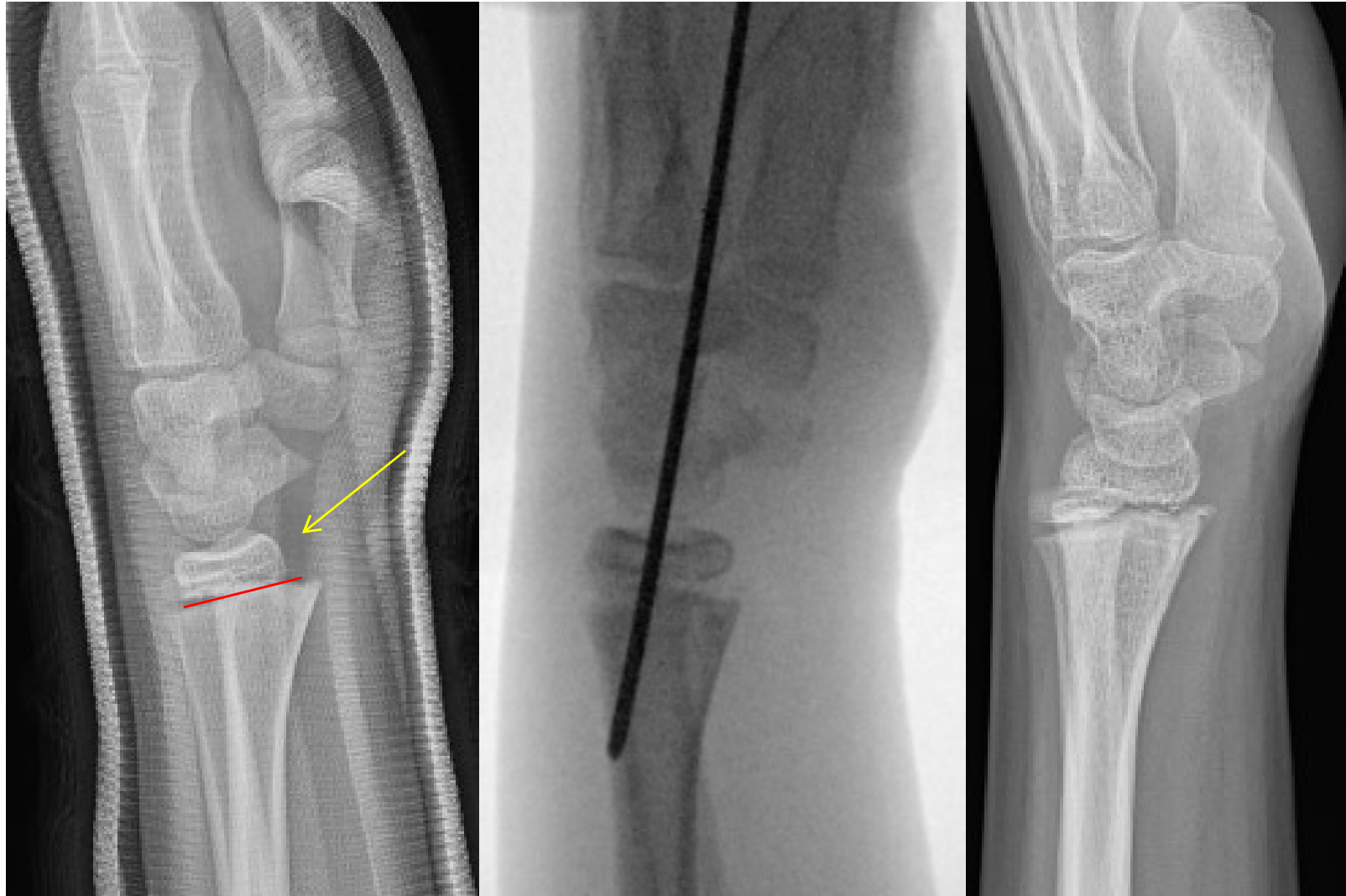


# Physeal Fractures – Treatment

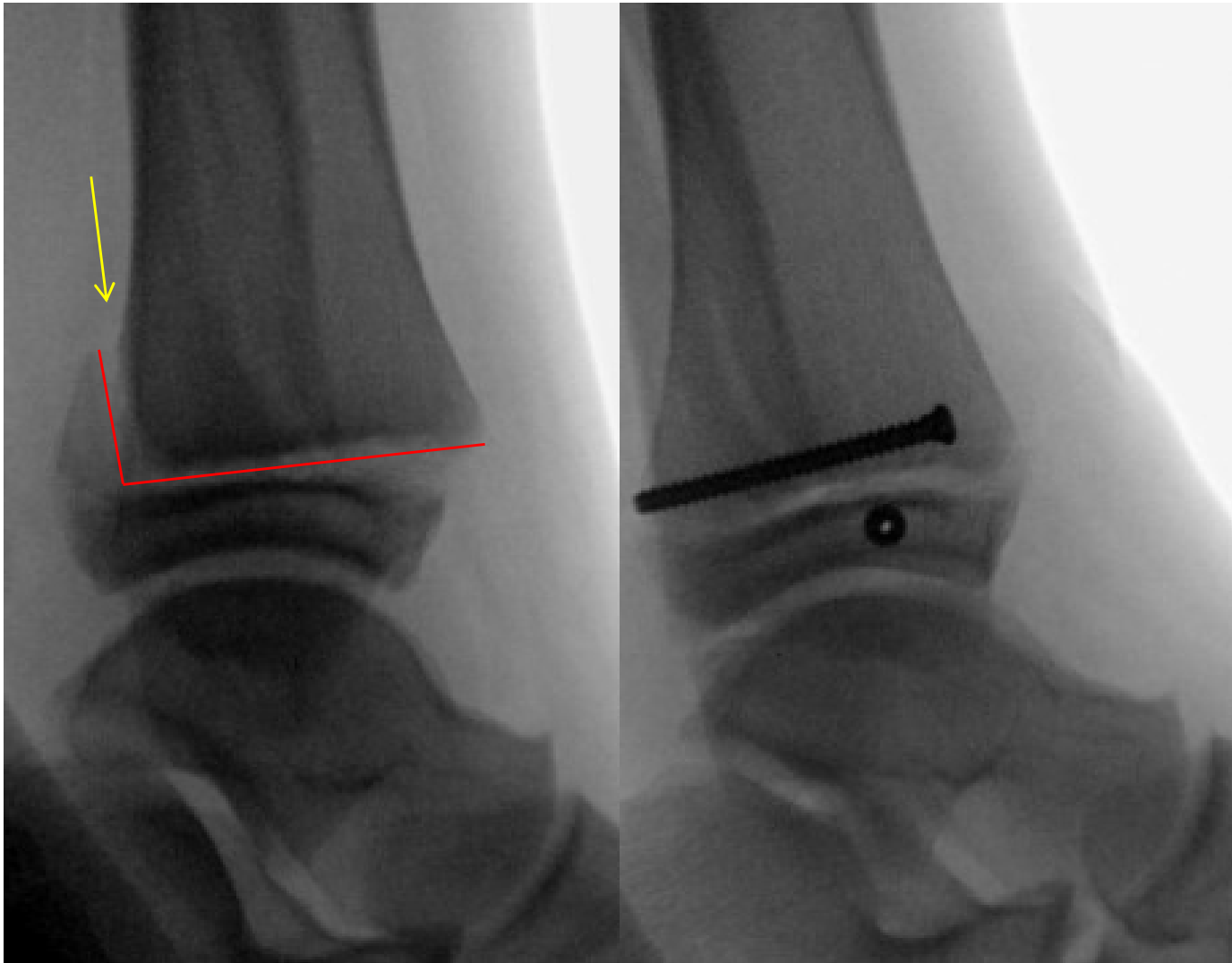
## General Rules:

1. Minimal displacement - cast
2. Joint displacement – closed reduction +/- metal
3. <8yo non-op, >8 op

# Physeal Fractures – SH1

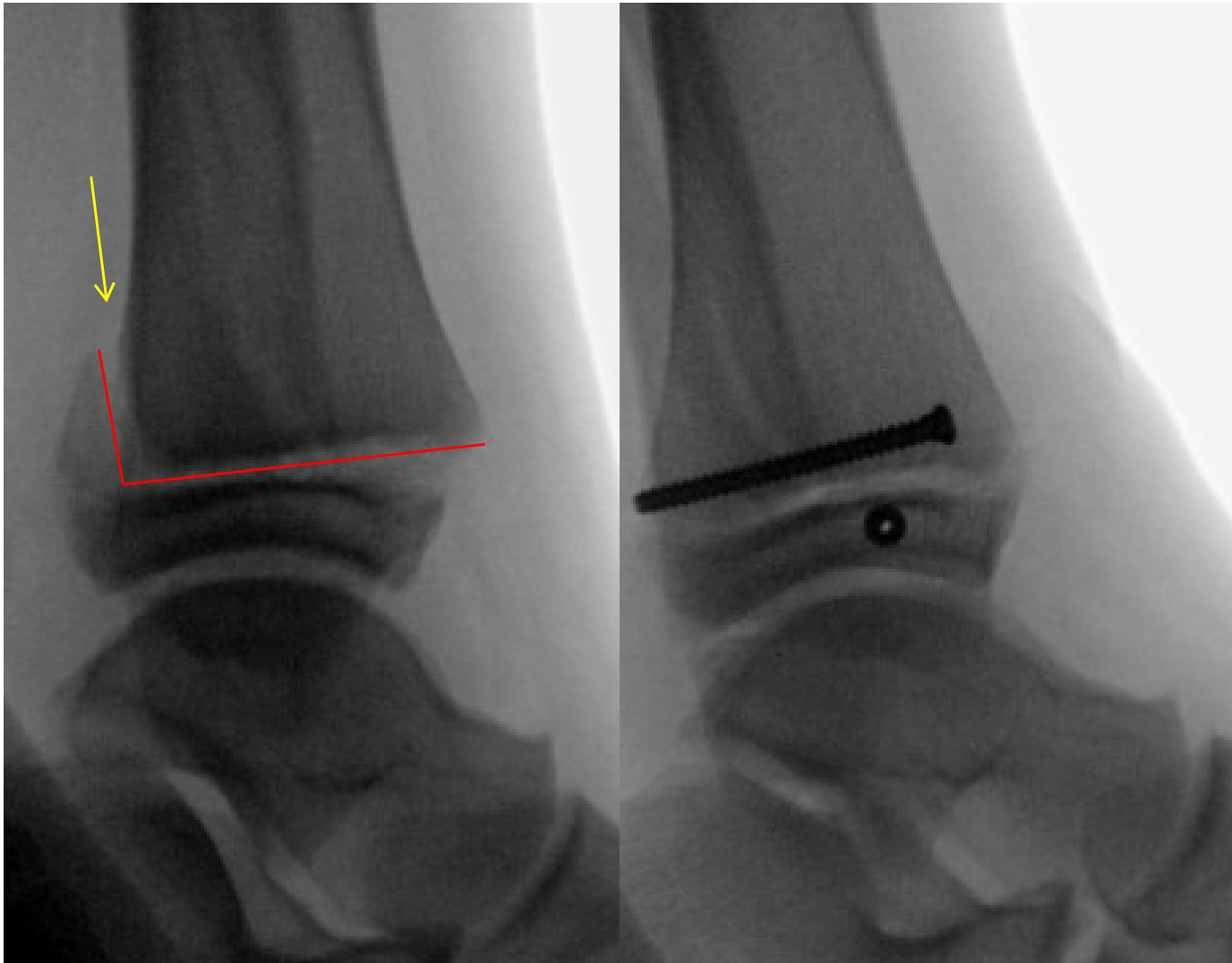


# Physeal Fractures SH2





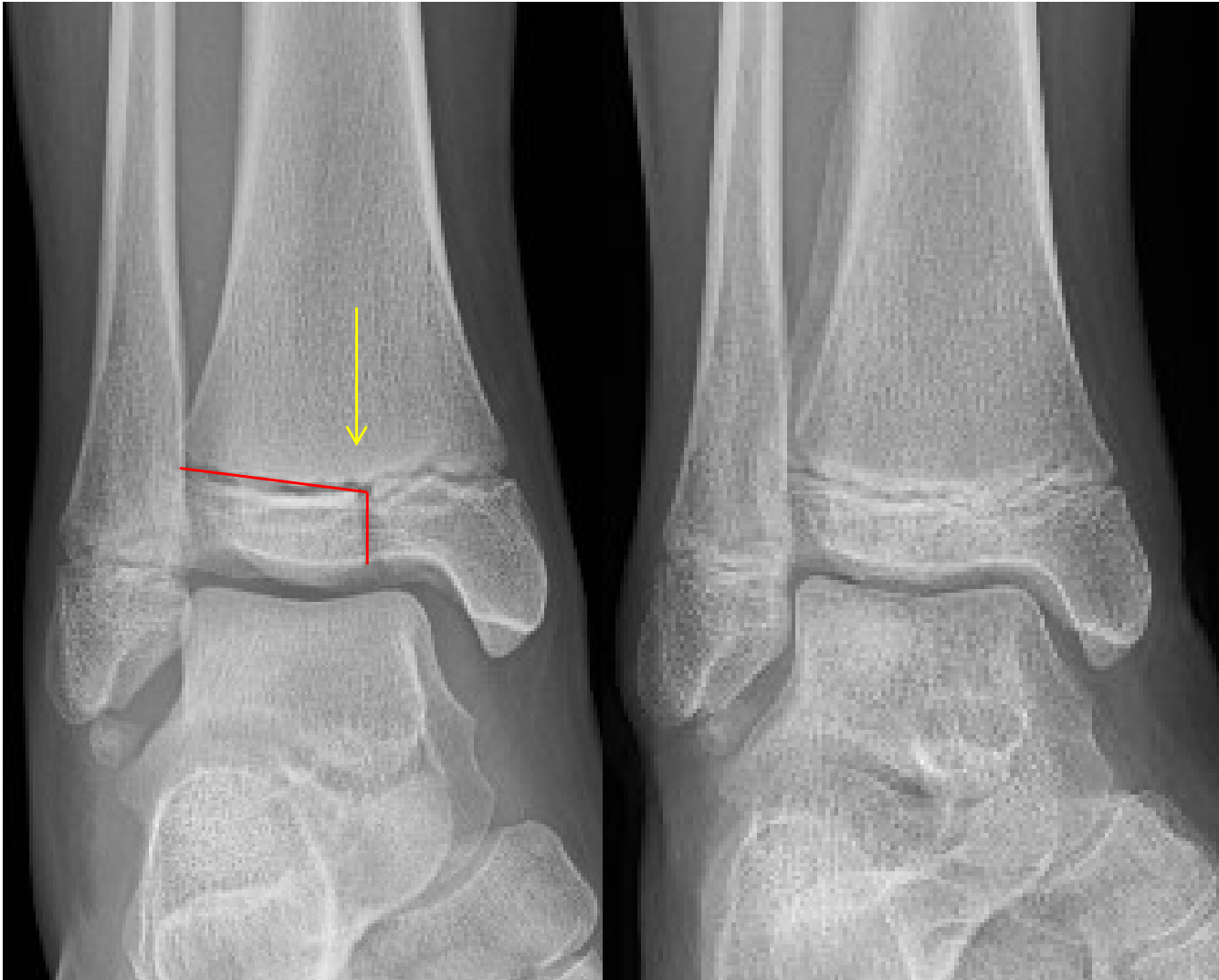
# Physeal Fractures SH2



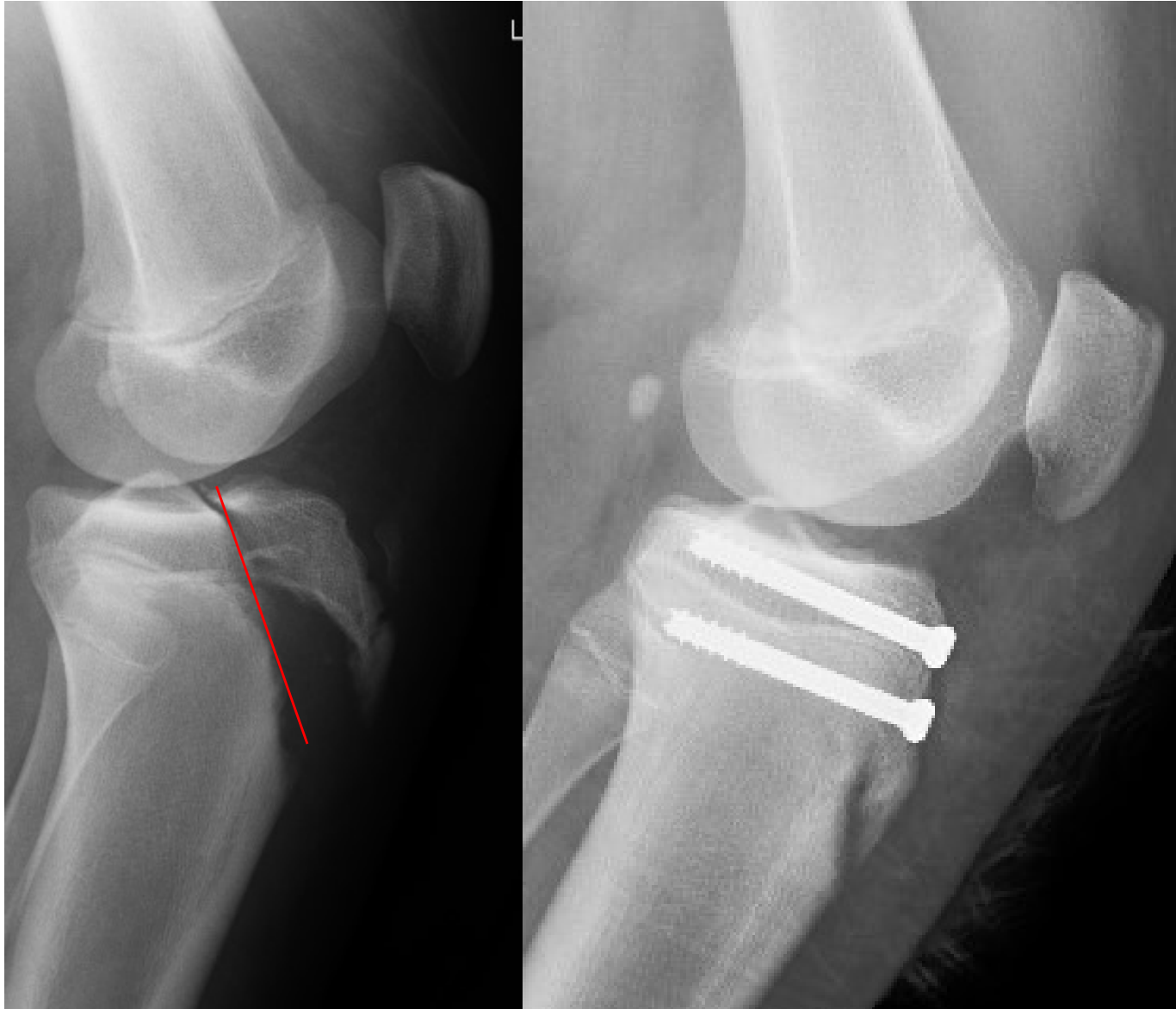
# Physeal Fractures



# Physeal Fractures



# Physeal Fractures



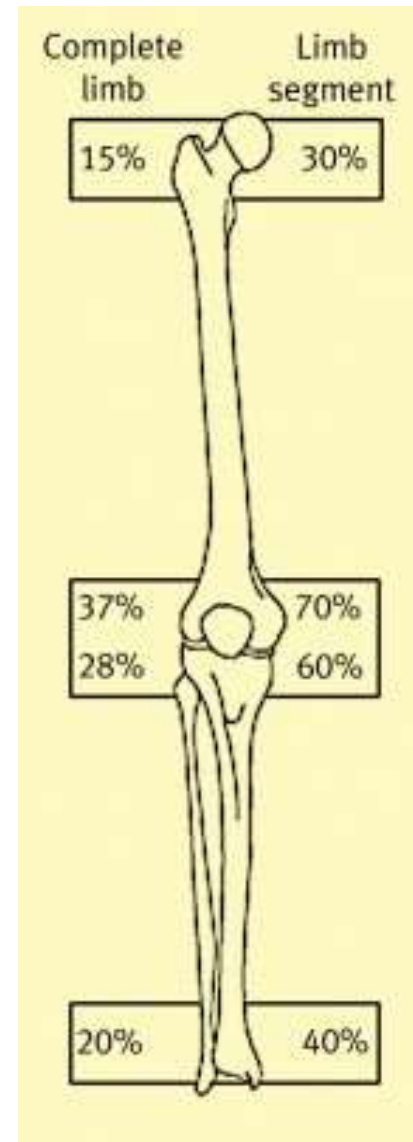
# Lower Extremity Physeal Growth

Proximal femur - 3 mm / yr

Distal femur - 10 mm / yr

Proximal tibia - 6 mm / yr

Distal tibia - 3 mm / yr



# Upper Extremity Physeal Growth

Humerus

80% Proximal



Forearm

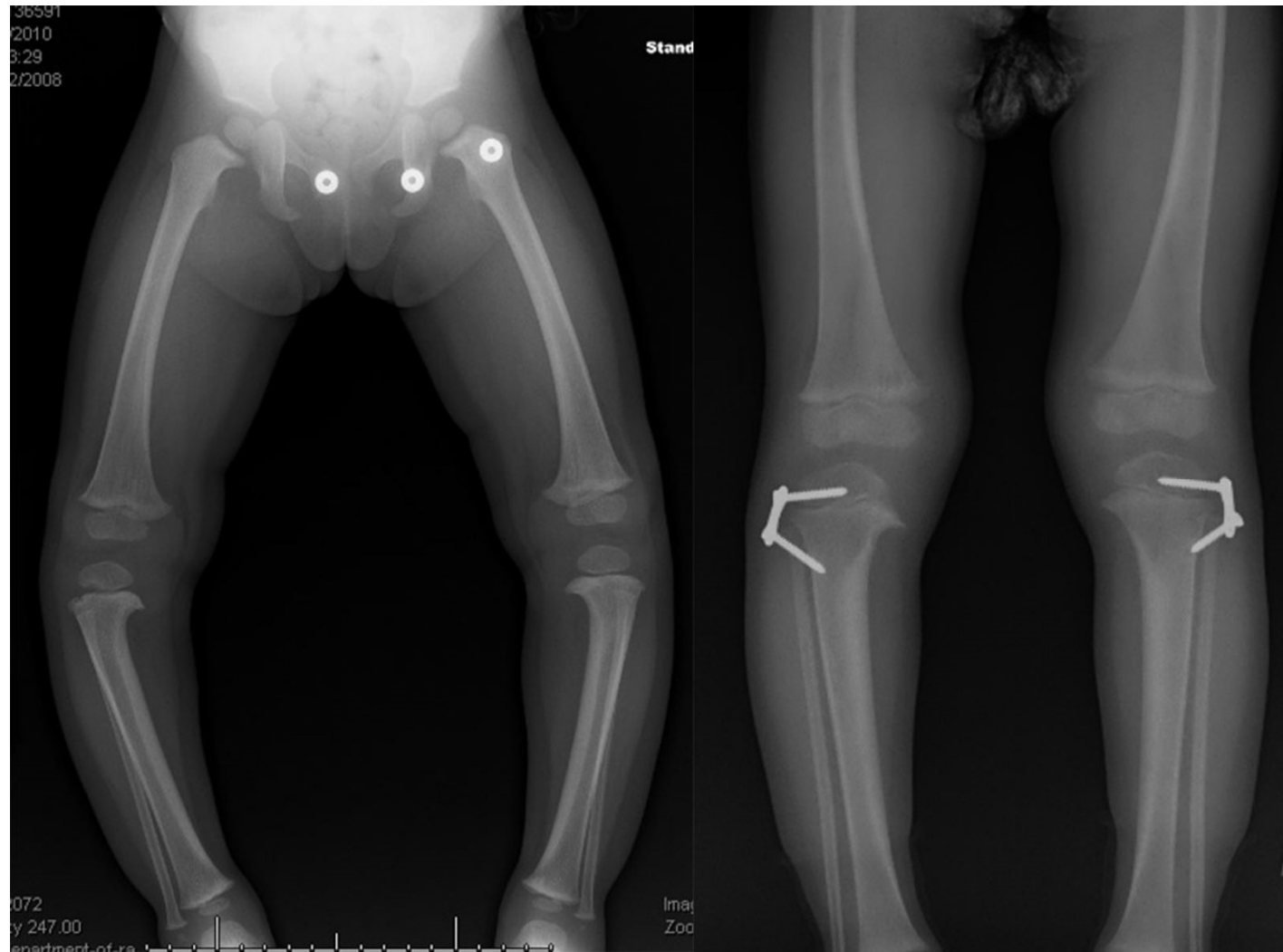
80% Distal

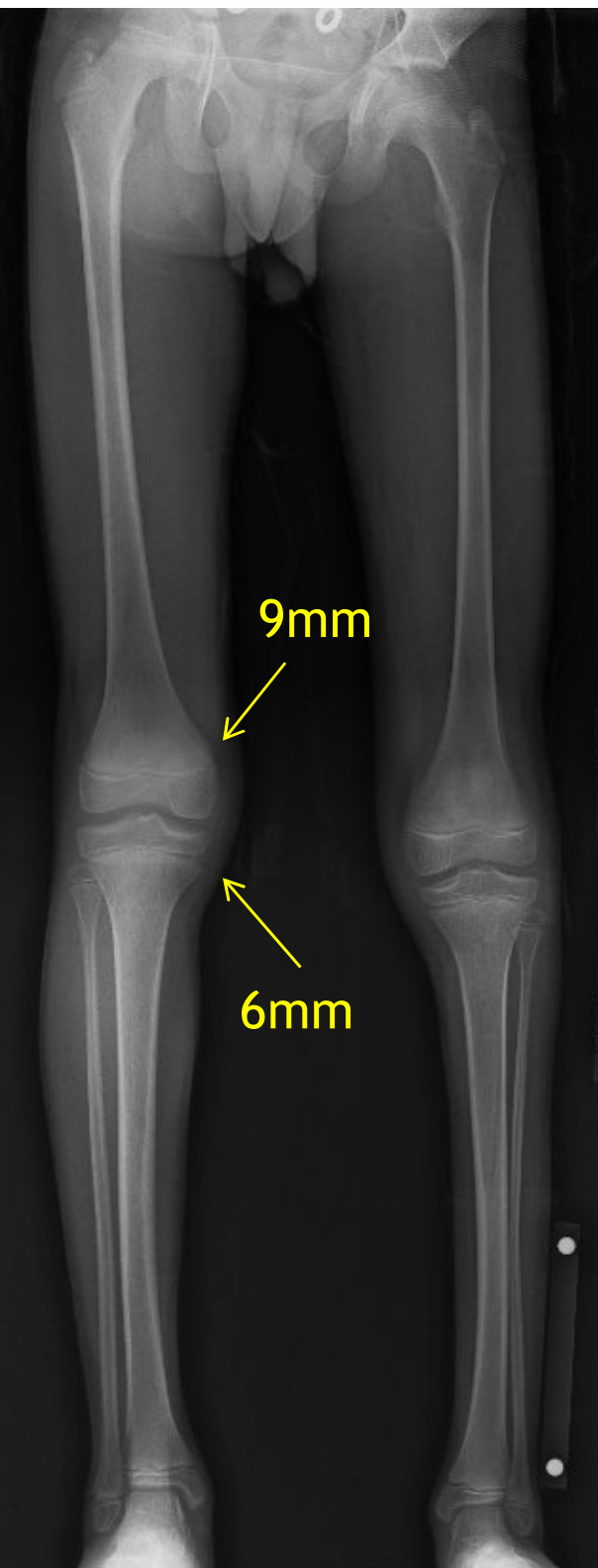


# Age at skeletal maturity

Girls – 14

Boys – 16





## Example

- 14yo Male
- 2yrs growth left
  - 3cm LLD



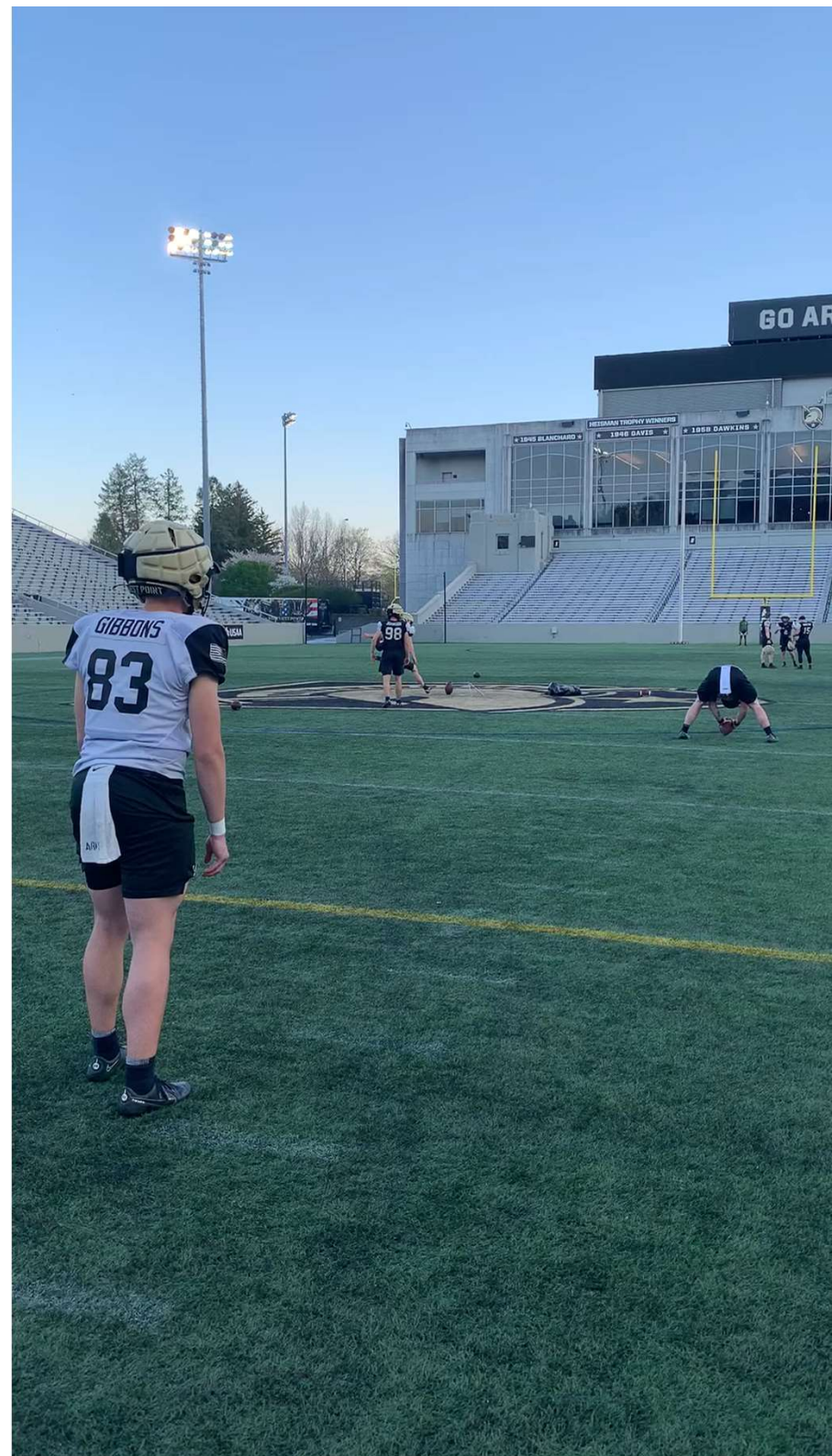


Questions?

# INTERMISSION



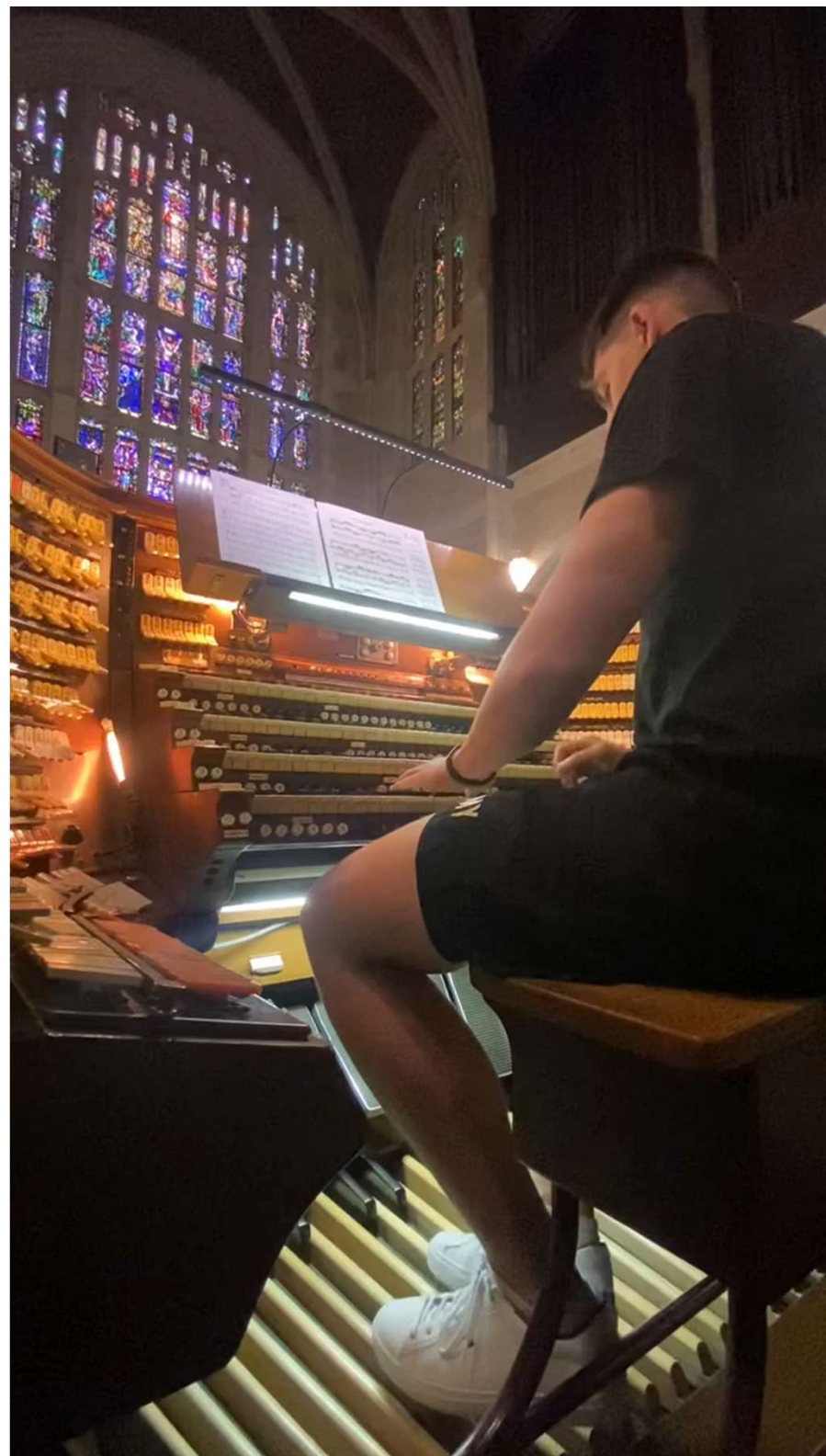
# INTERMISSION



# INTERMISSION



# INTERMISSION



# Outline

Elbow Fractures

Physeal Fractures

**Femur Fractures**

Non-accidental Trauma

SCFE

Tarsal Coalitions

DDH

# Femur Fractures

High Energy

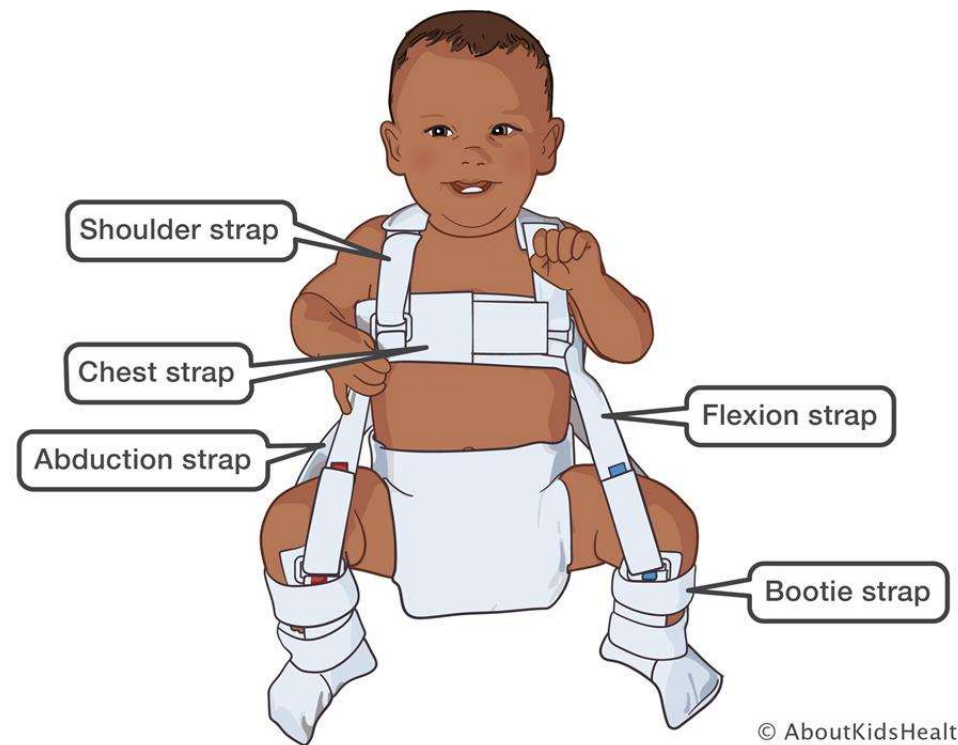
Majority are shaft fractures

Treatment based on age

Heal reliably

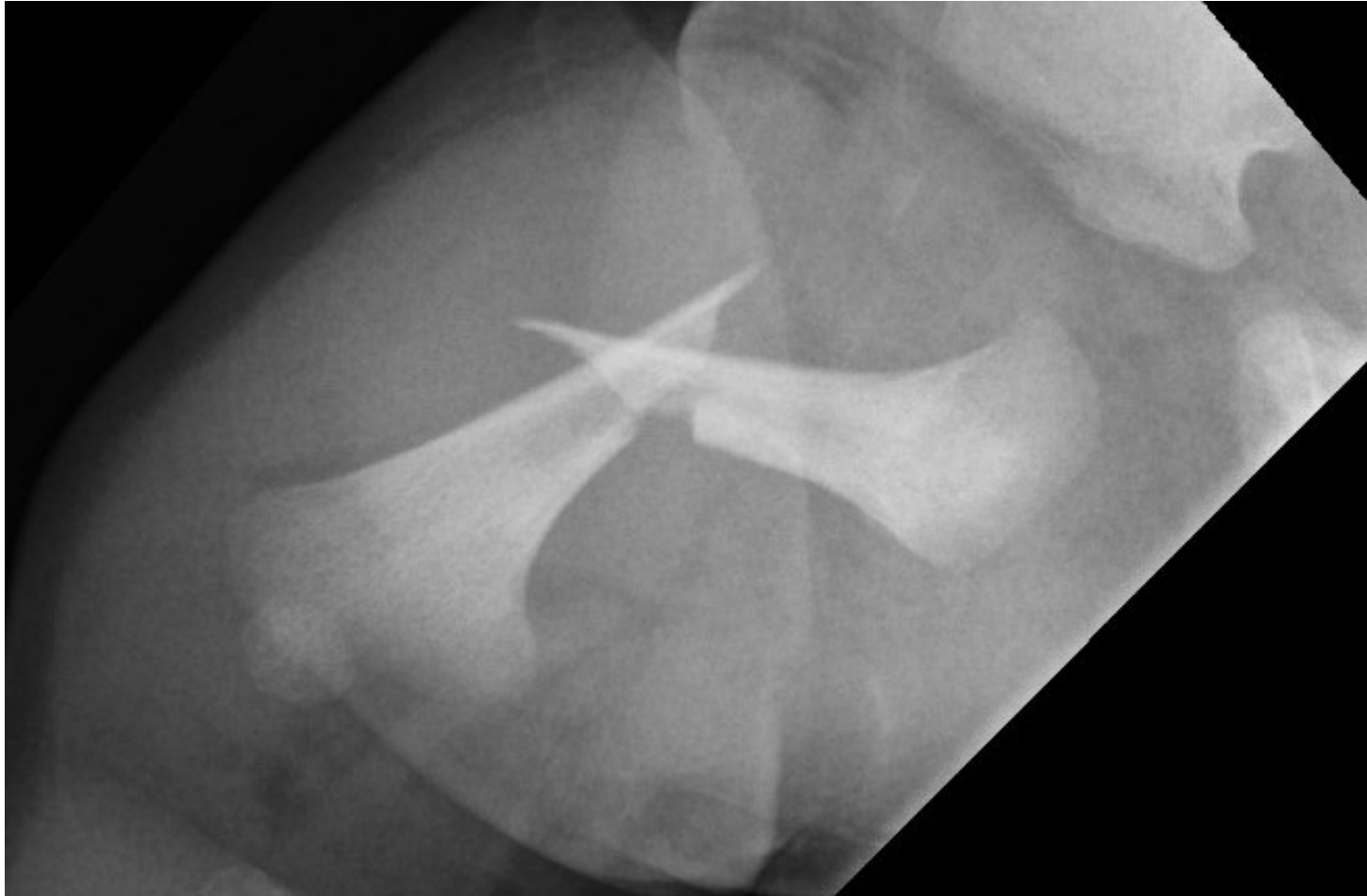


# <6mo – Pavlik





<6mo – Pavlik



<6mo – Pavlik



## 6mo-6 yr – Spica Cast



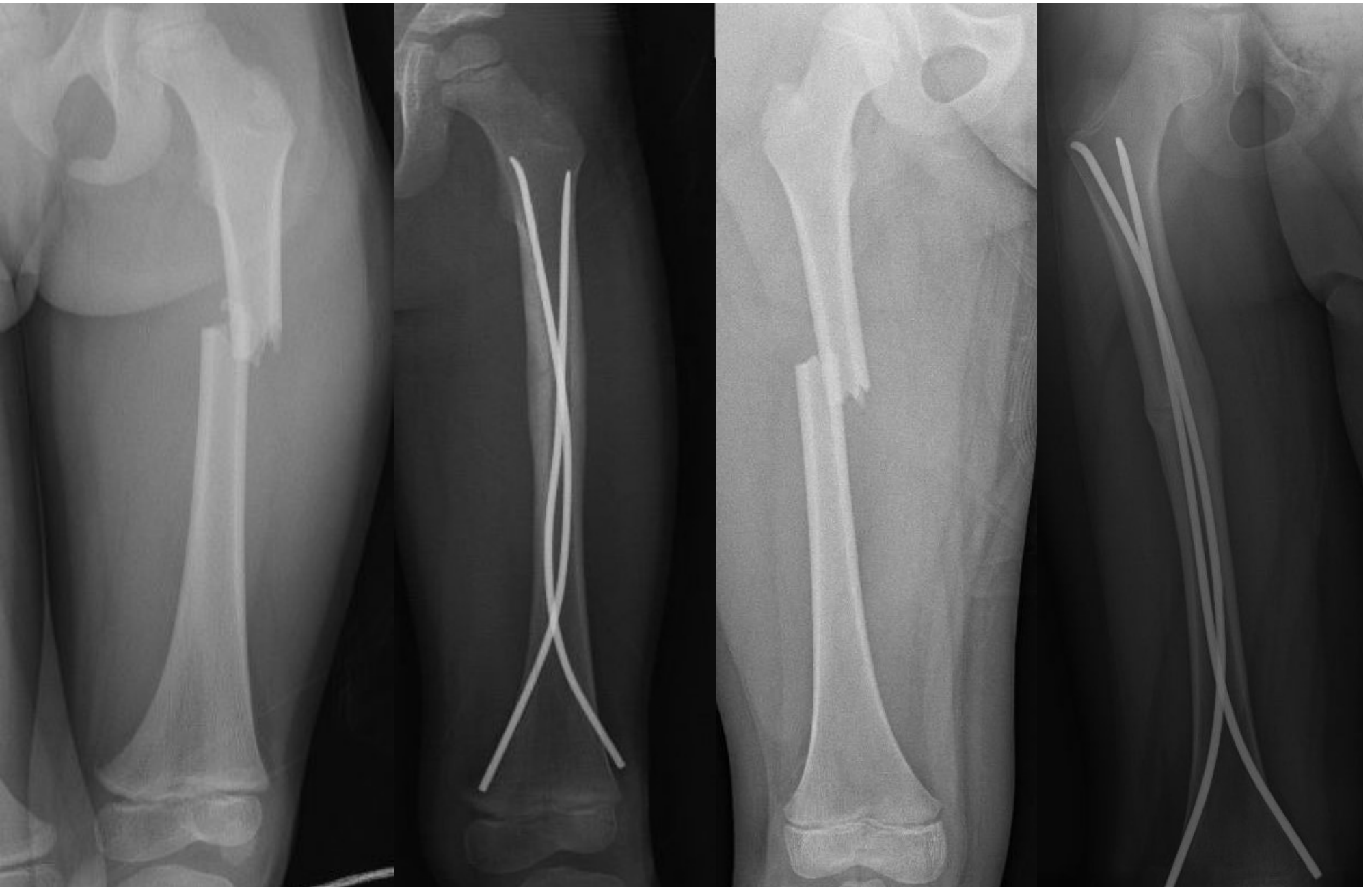




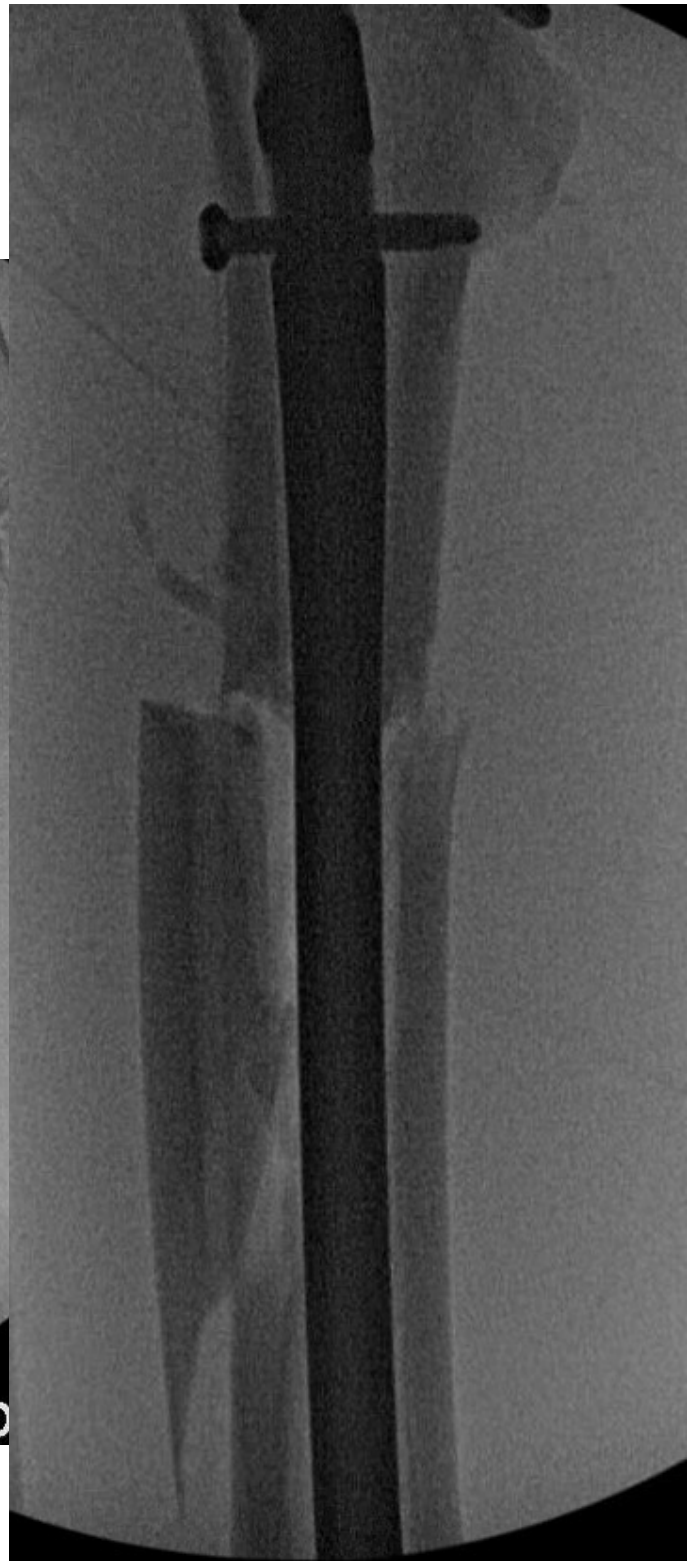
## 6-11yr – Plate vs Flex Nail



## 6-11yr – Plate vs Flex Nail

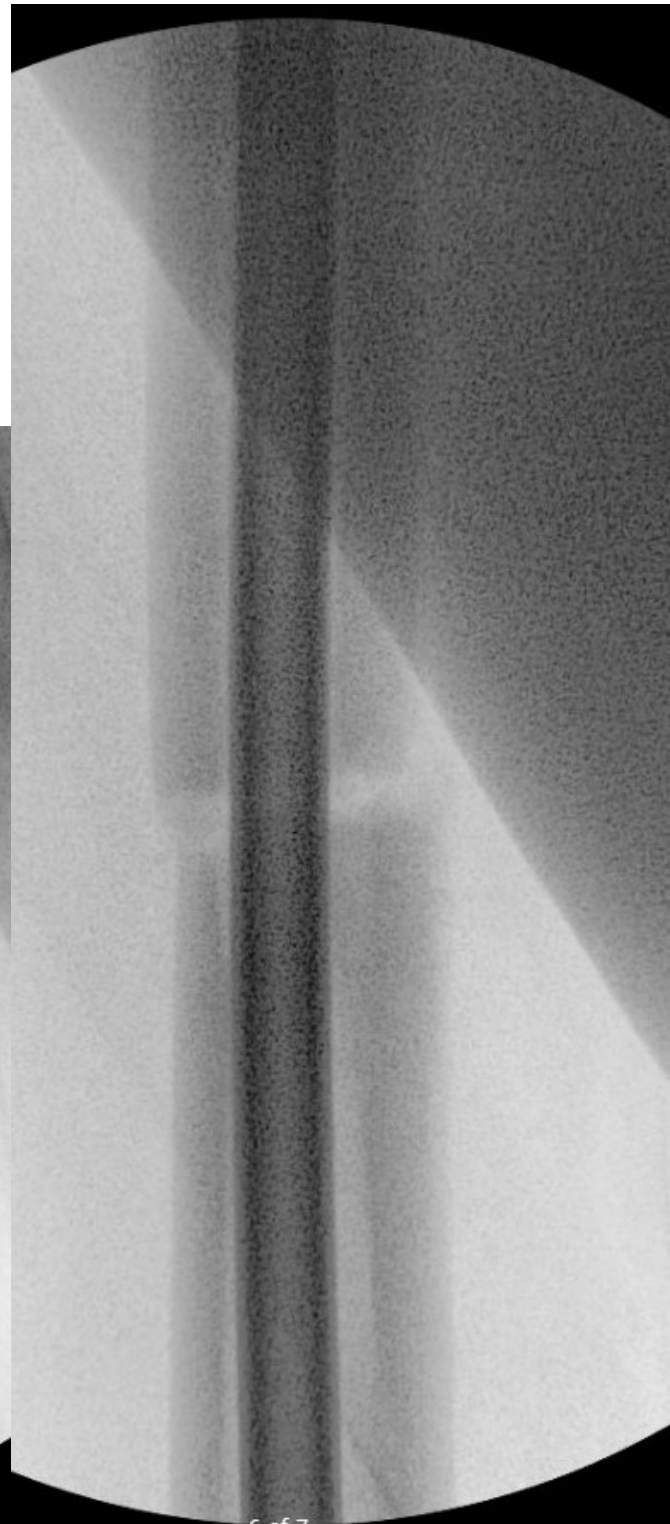
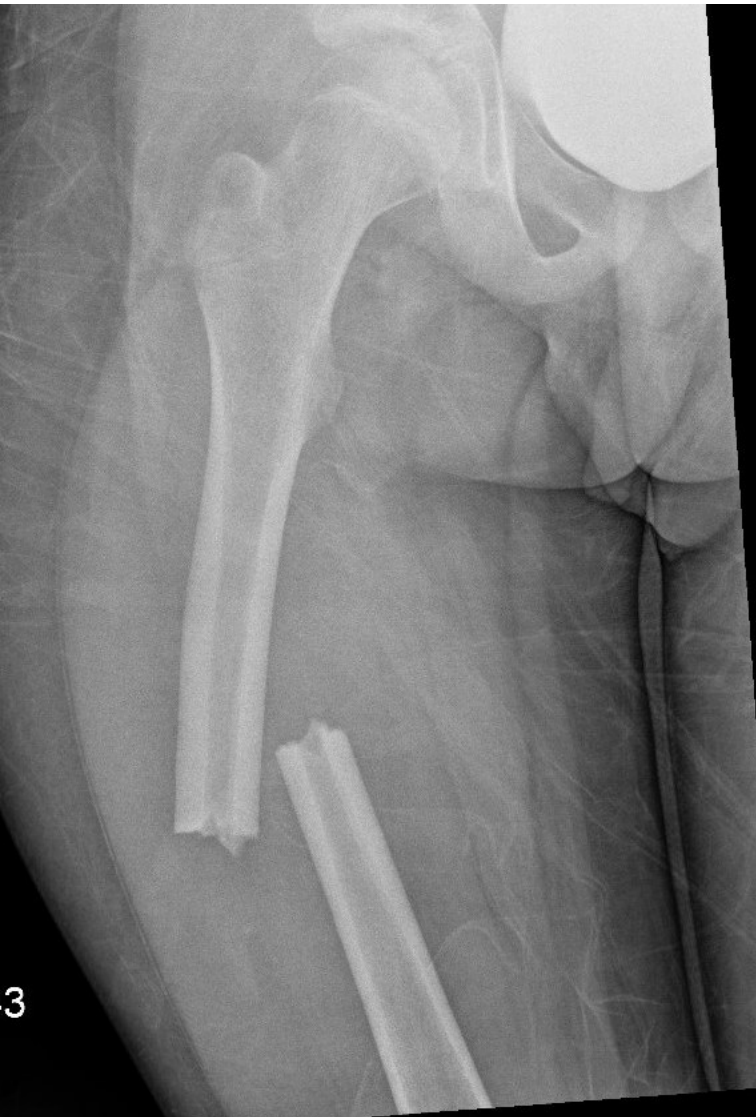


>12yr or 100lbs Rigid IMN





>12yr or 100lbs Rigid IMN



Questions?

# INTERMISSION



# Outline

Elbow Fractures

Physeal Fractures

Femur Fractures

**Non-accidental Trauma**

SCFE

Tarsal Coalitions

DDH

# Non-accidental Trauma

50% of fractures in children younger than 1 year of age

What to look for?

- Delay
- Weird story
- Multiple injuries
- Specific injuries



# Non-accidental Trauma

## Risk Factors

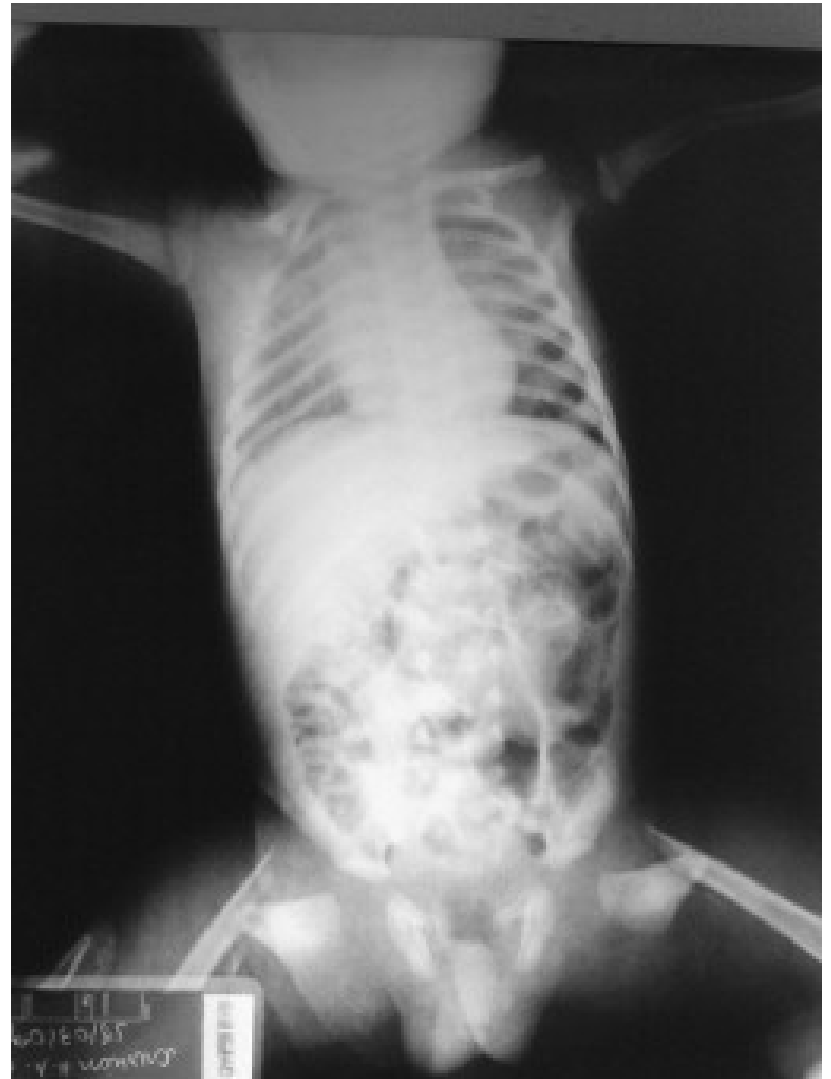
1<sup>st</sup> born

Unplanned

Premature

Disabilities/CP

Step-child



# Non-accidental Trauma

## Risk Factors

single-parent home

unemployment

drug-use

lower socioeconomic status

lack of support system



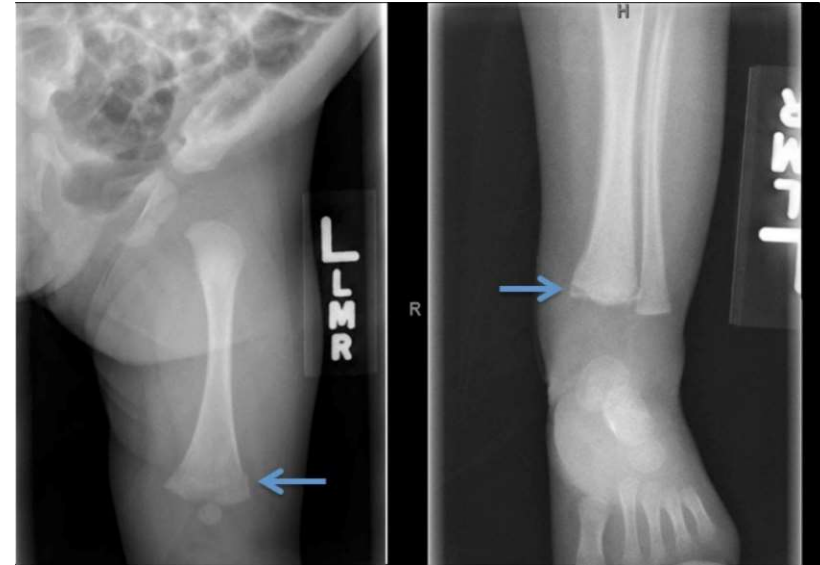
# Non-accidental Trauma

Femur fracture <1yr

Corner Fracture

Metaphyseal junction

Distal Humerus physeal fracture





# Non-accidental Trauma

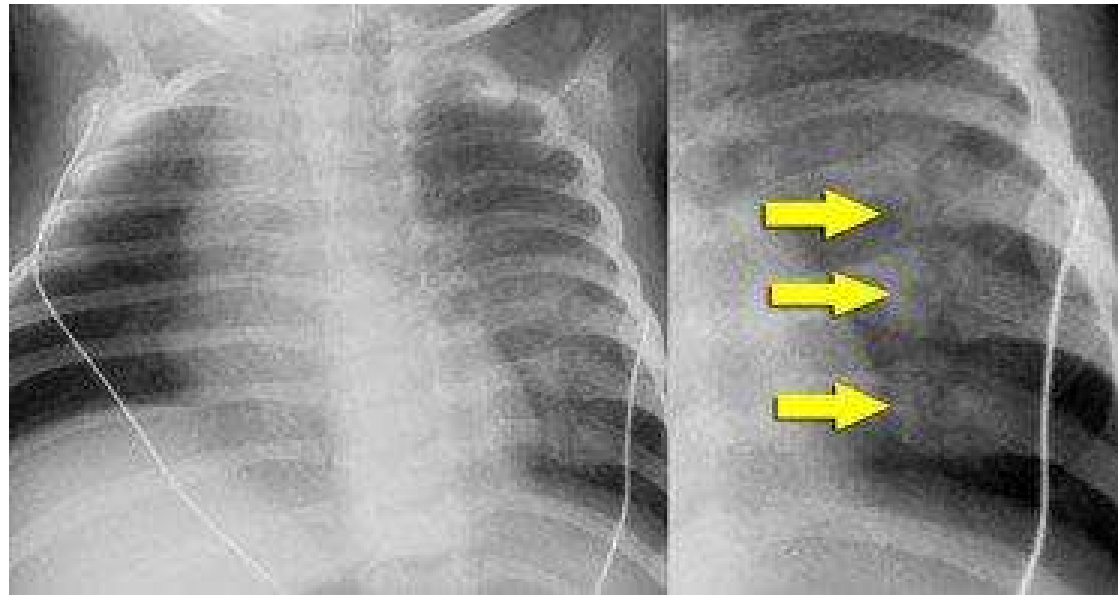
## Report

Unreported – 50% repeat abuse, 5-10% death

## Admit

Social Worker  
Skeletal Survey

## Treat



Questions?

# INTERMISSION



# Outline

Elbow Fractures

Physeal Fractures

Femur Fractures

Non-accidental Trauma

**SCFE**

Tarsal Coalitions

DDH

# SCFE

Male

Obese

12-14 yo

**KNEE PAIN**



# SCFE

KNEI

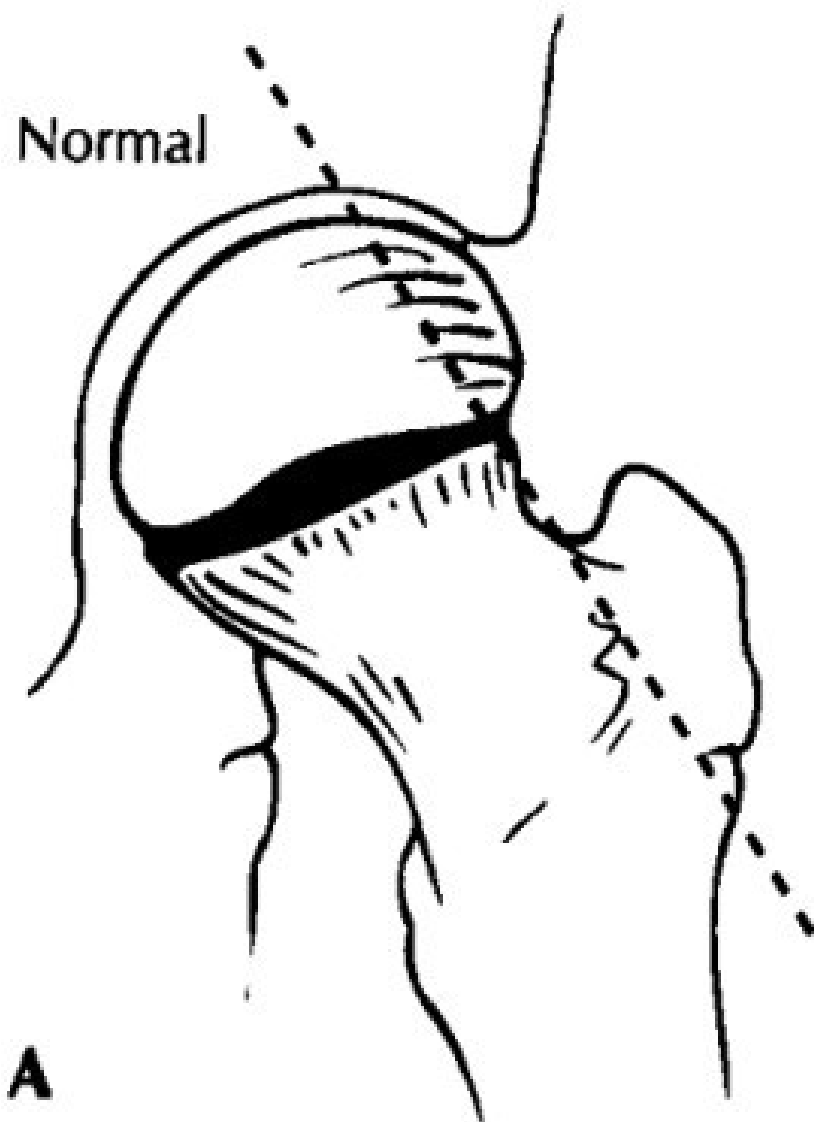


12-1

BL?



# SCFE

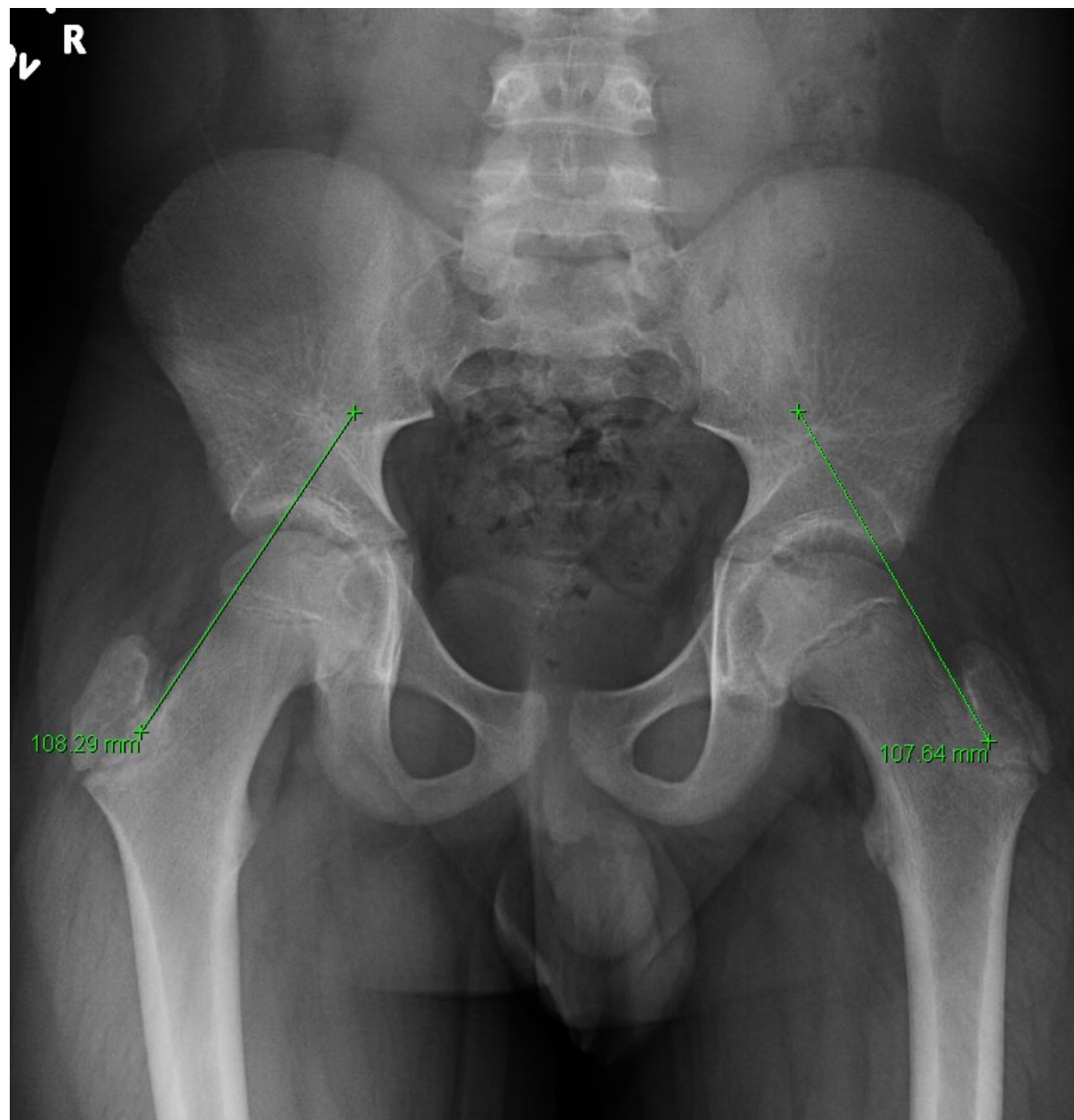


# SCFE





# SCFE



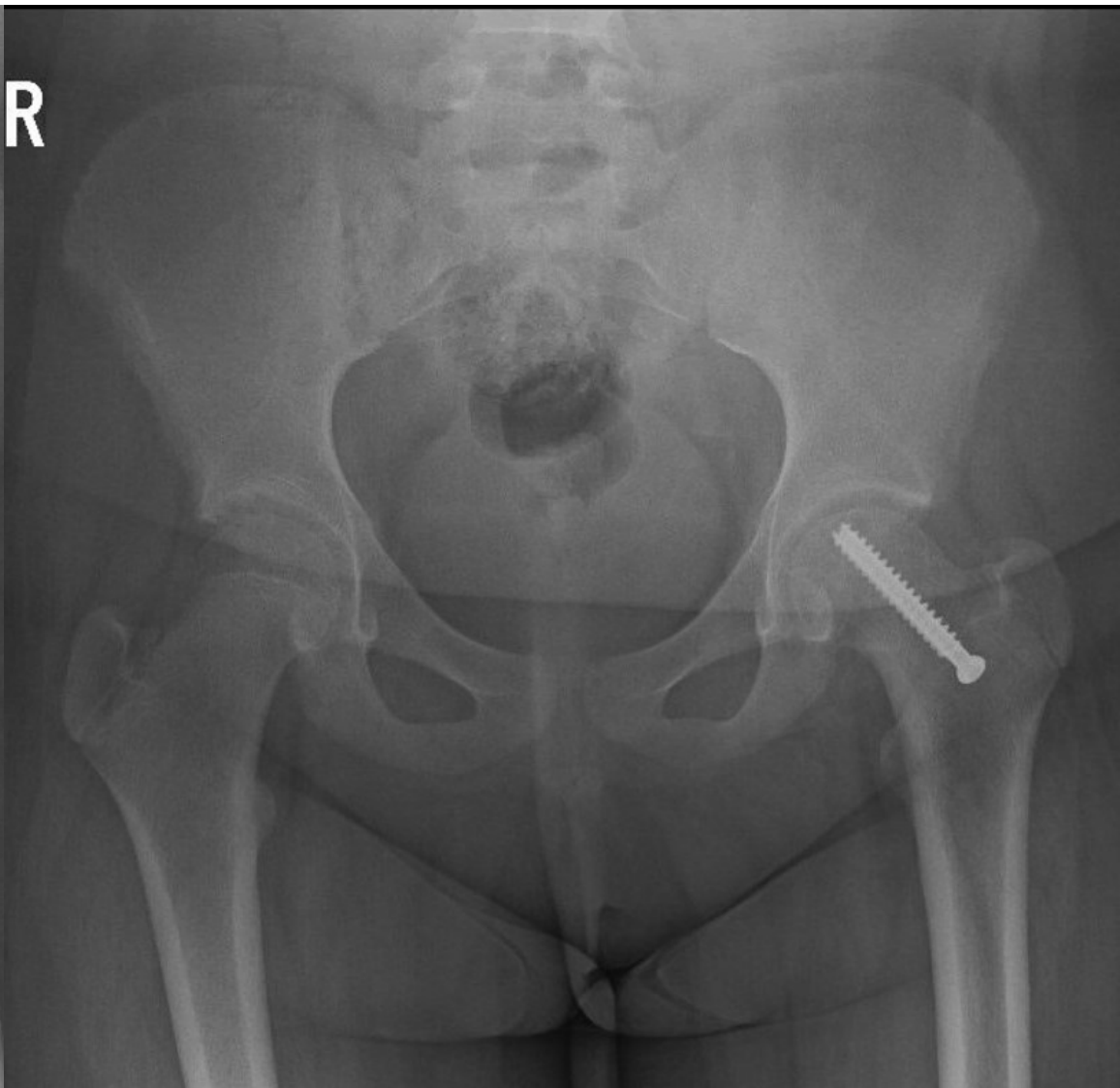
# SCFE



# SCFE



# SCFE



Questions?

# INTERMISSION



# Outline

Elbow Fractures

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Femur Fractures

Non-accidental Trauma

SCFE

**Tarsal Coalitions**

DDH

# 11yo F w/ Ankle Pain





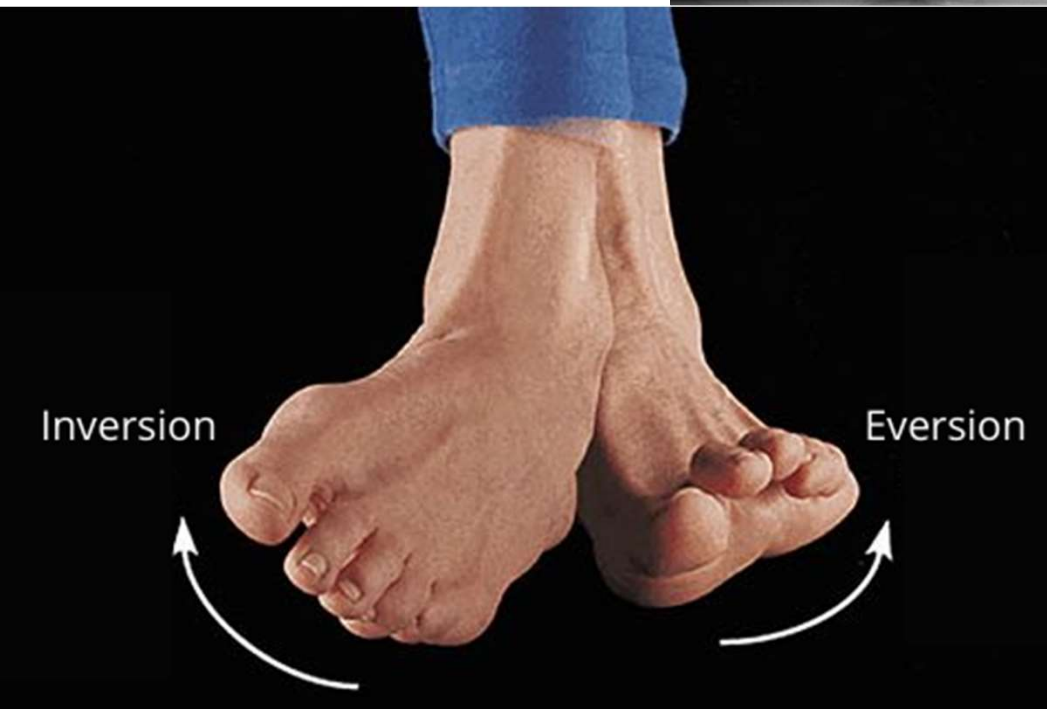
# 11yo F w/ Ankle Pain



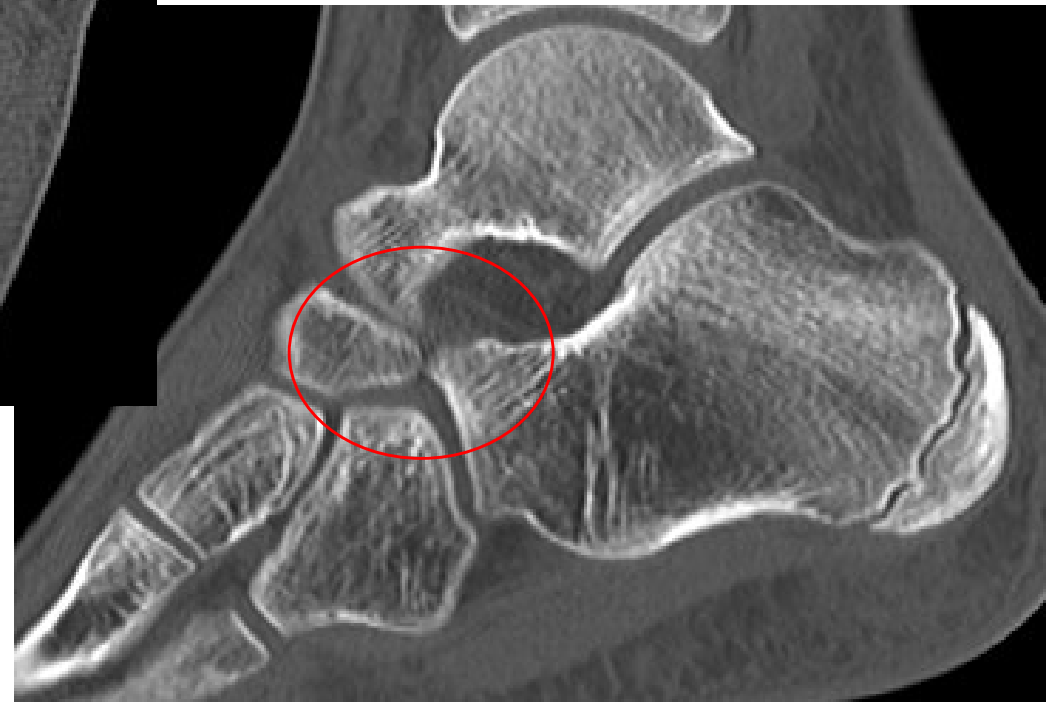
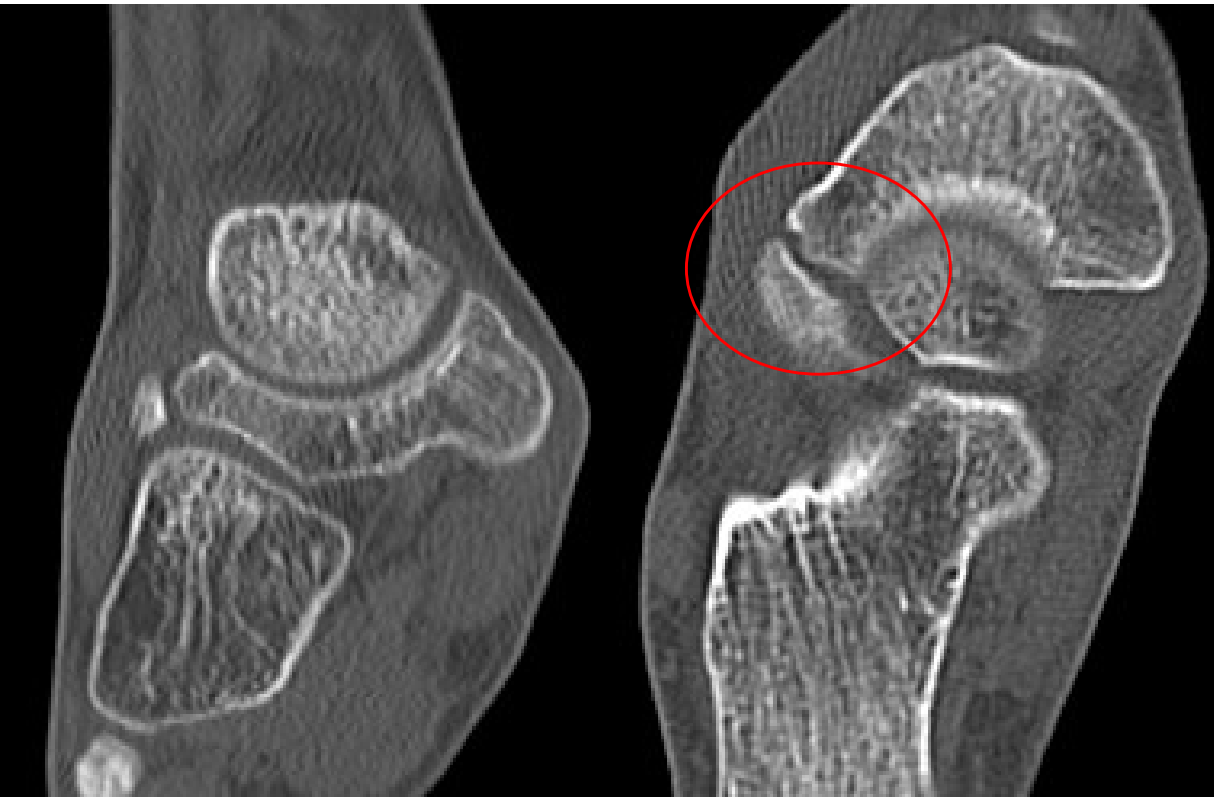
# 11yo F w/ Ankle Pain

Hx – lateral ankle pain

PE – ↓subtalar motion



# 11yo F w/ Ankle Pain



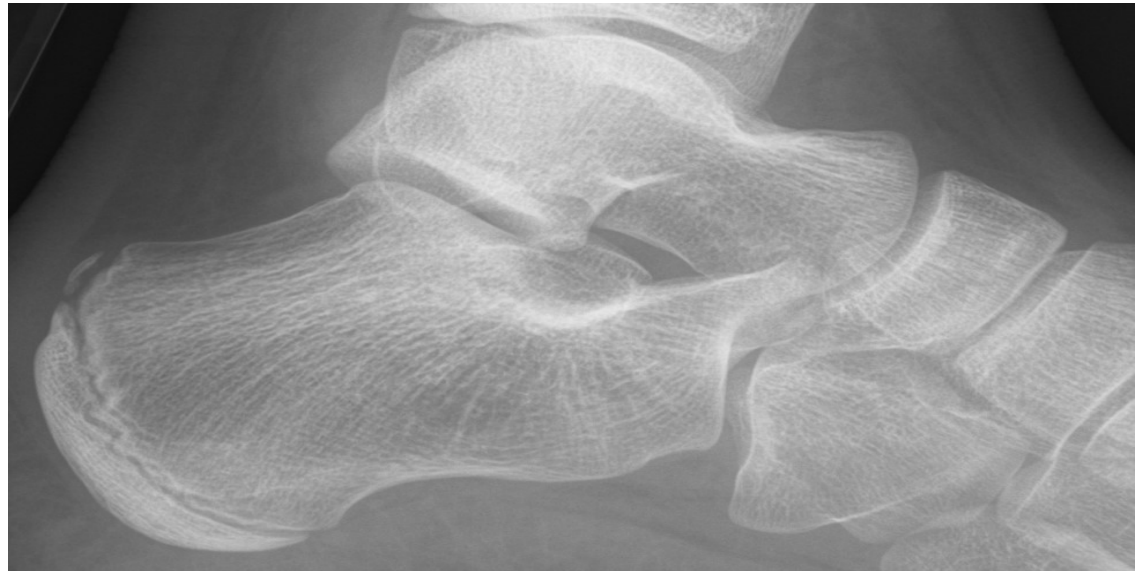
# Tarsal Coalition

Most common coalitions:

Calcaneonavicular

Talocalcaneal

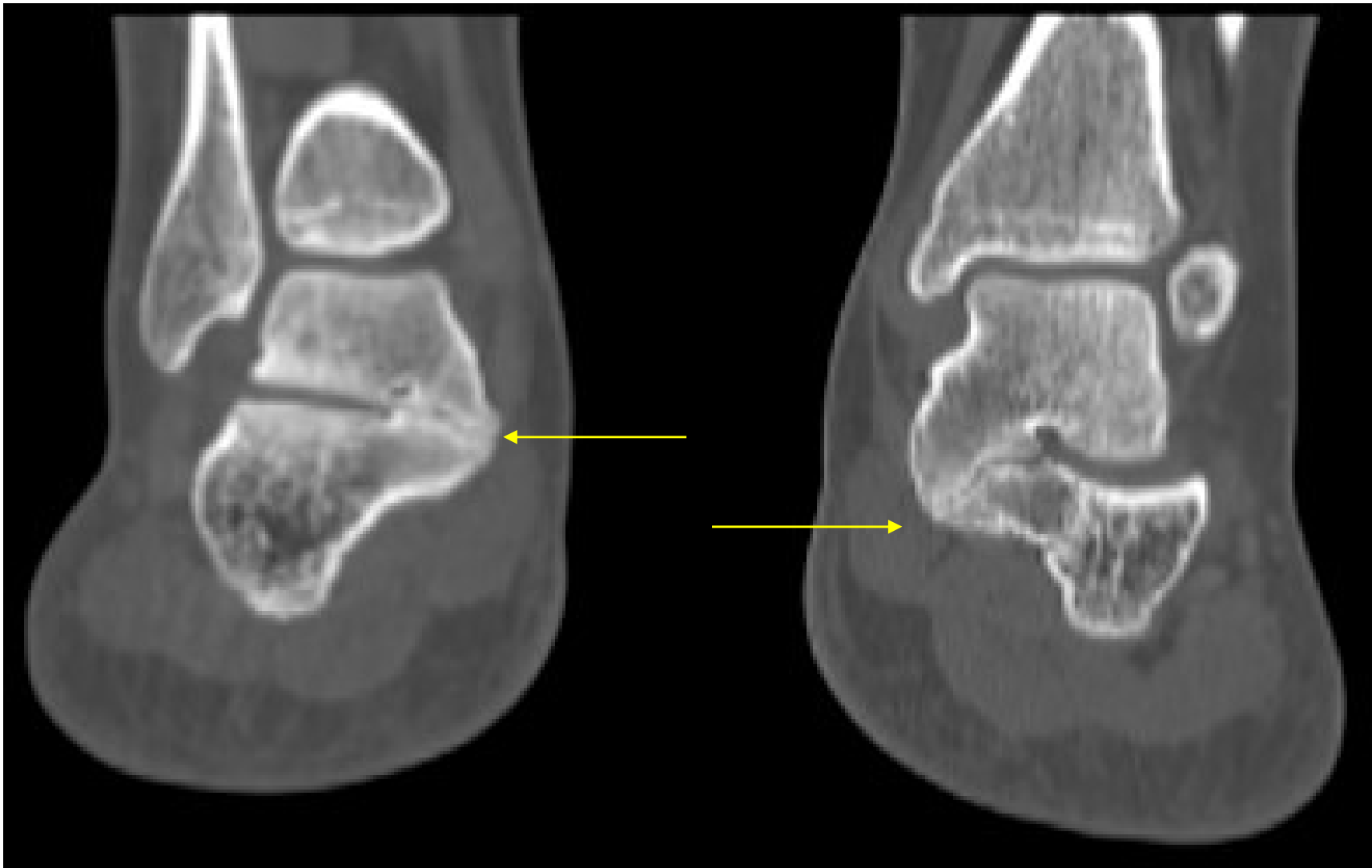
Bilateral up to 60%



# Calcaneonavicular



# Talocalcaneal



# Tarsal Coalition

## Symptoms

Anterior/lateral ankle pain

recurrent ankle sprains

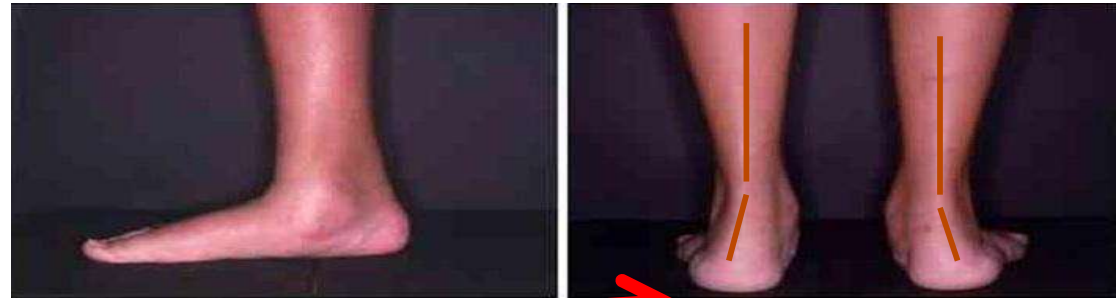


# Tarsal Coalition

## Physical Exam

### Inspection

hindfoot valgus

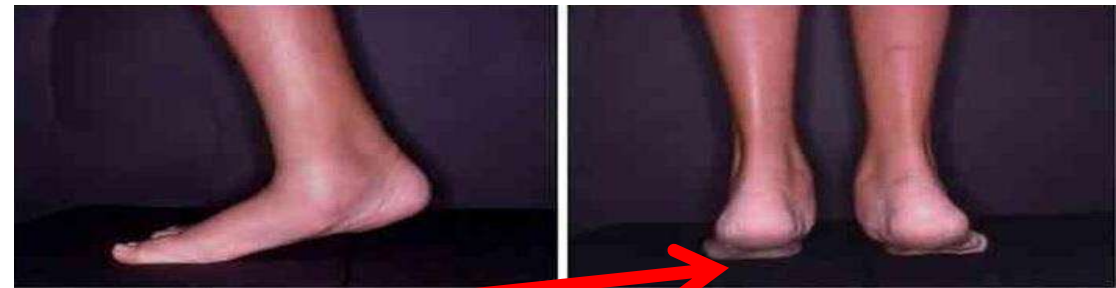


### Range of motion

limited subtalar motion

heel cord contractures

arch of foot may not reconstitute upon toe-standing





# Tarsal Coalition

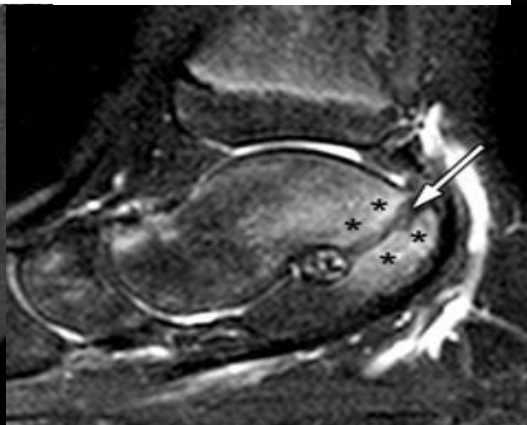
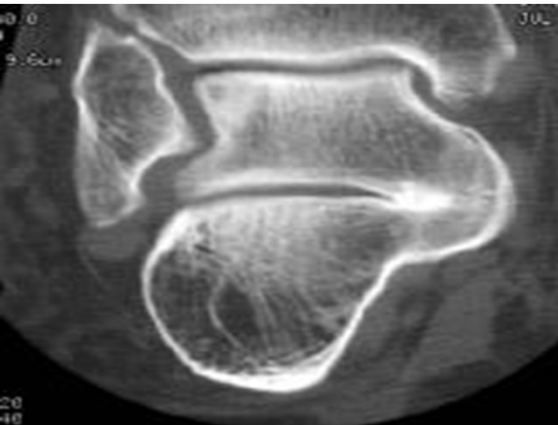


# Tarsal Coalition

## Imaging

AP, Lat, Oblique, Harris

CT or MRI



# Tarsal Coalition

Activity modification, casting,  
orthotics

Resection and fat/EDB interposition



# Tarsal Coalition



# Tarsal Coalition



Questions?

# Intermission



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Elbow Fractures

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**DDH**

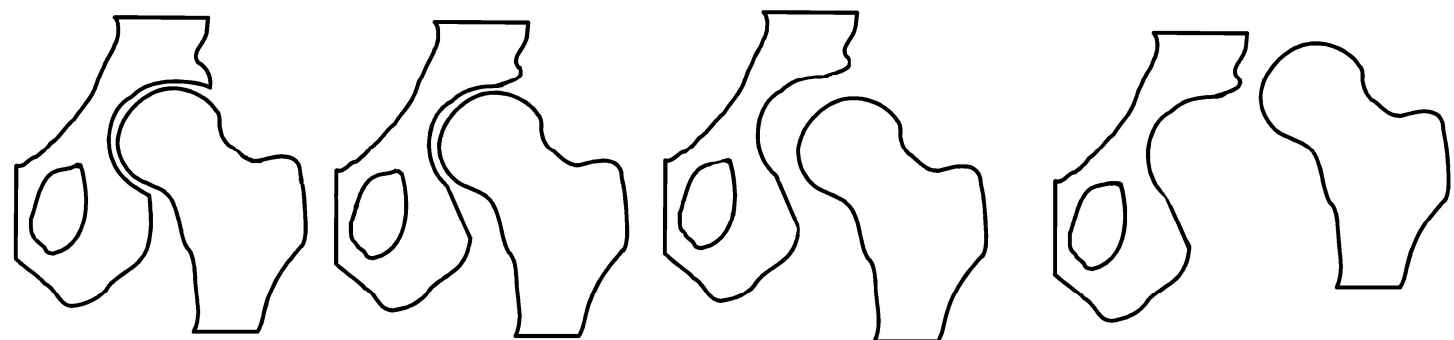


# DDH Terminology

Dysplasia – shallow or underdeveloped acetabulum

Subluxation

Dislocation



Teratologic hip

Dislocated in utero and irreducible

## Catastrophic If Missed



## Catastrophic If Missed



# Etiology

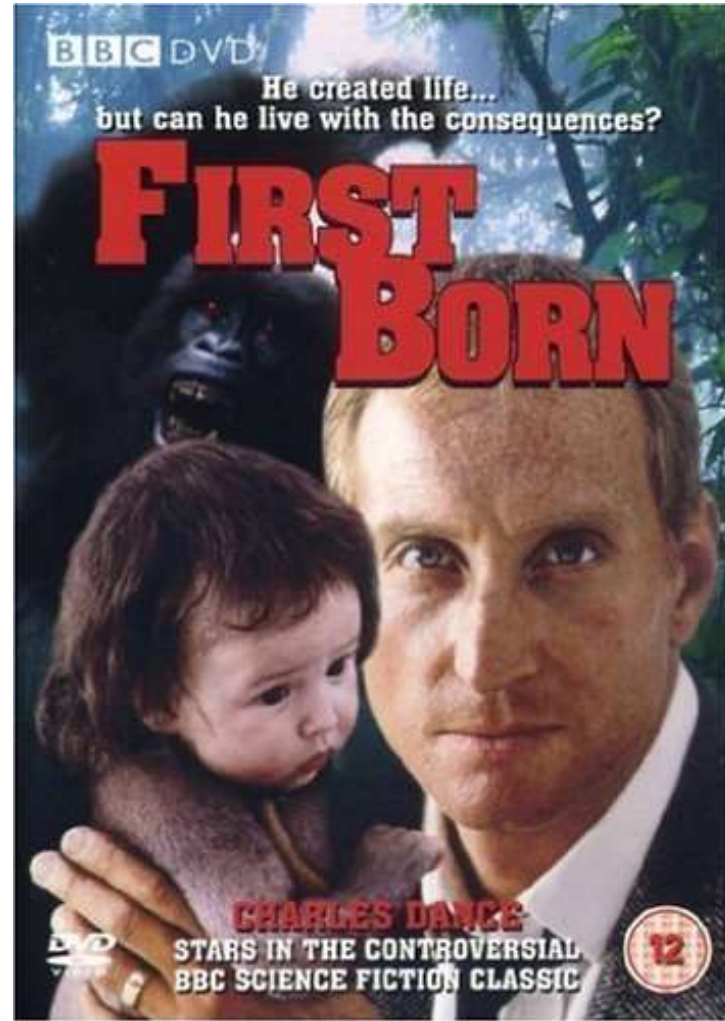
First born

Tighter space

Female – 80%

Family History

+12-33%



# Etiology

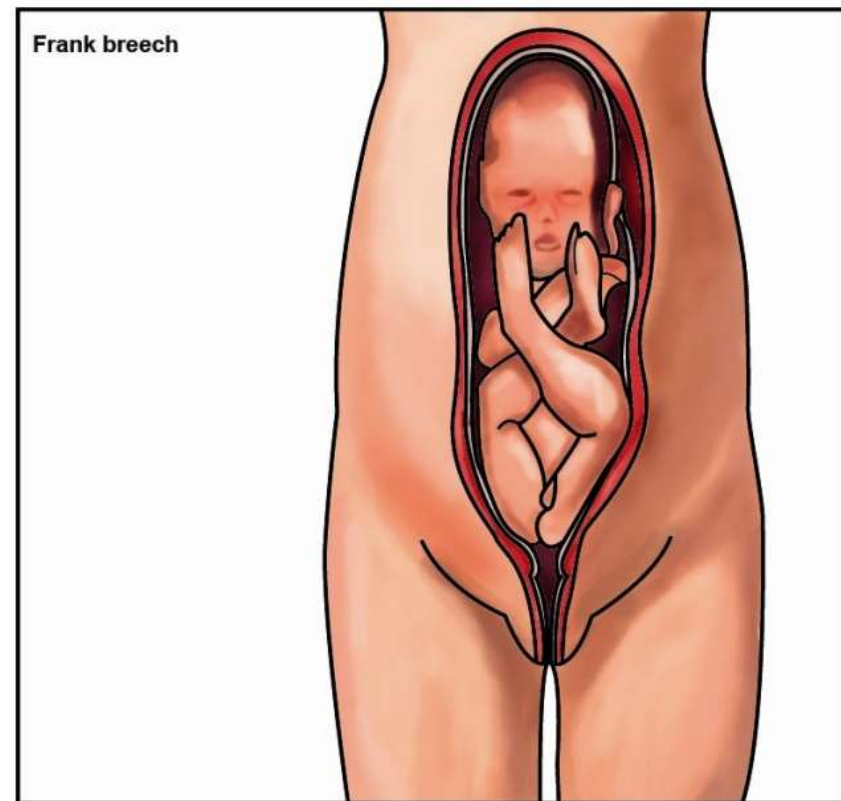
Breech – 20%

60% are 1<sup>st</sup> born

66% are Female

LEFT

BL 20%



# Incidence

0.1/1000 Chinese  
Similar in Africans

25-50/1000 NA

Abn newborn exam 1/100

Actual dislocation 1/1000



# Presentation

## History

FH

Birth order

Position

Oligohydramnios

Reason for referral



## Exam

Hip abduction

Barlow/Ortolani

Galeazzi

Kliscic

Foot and spine exam

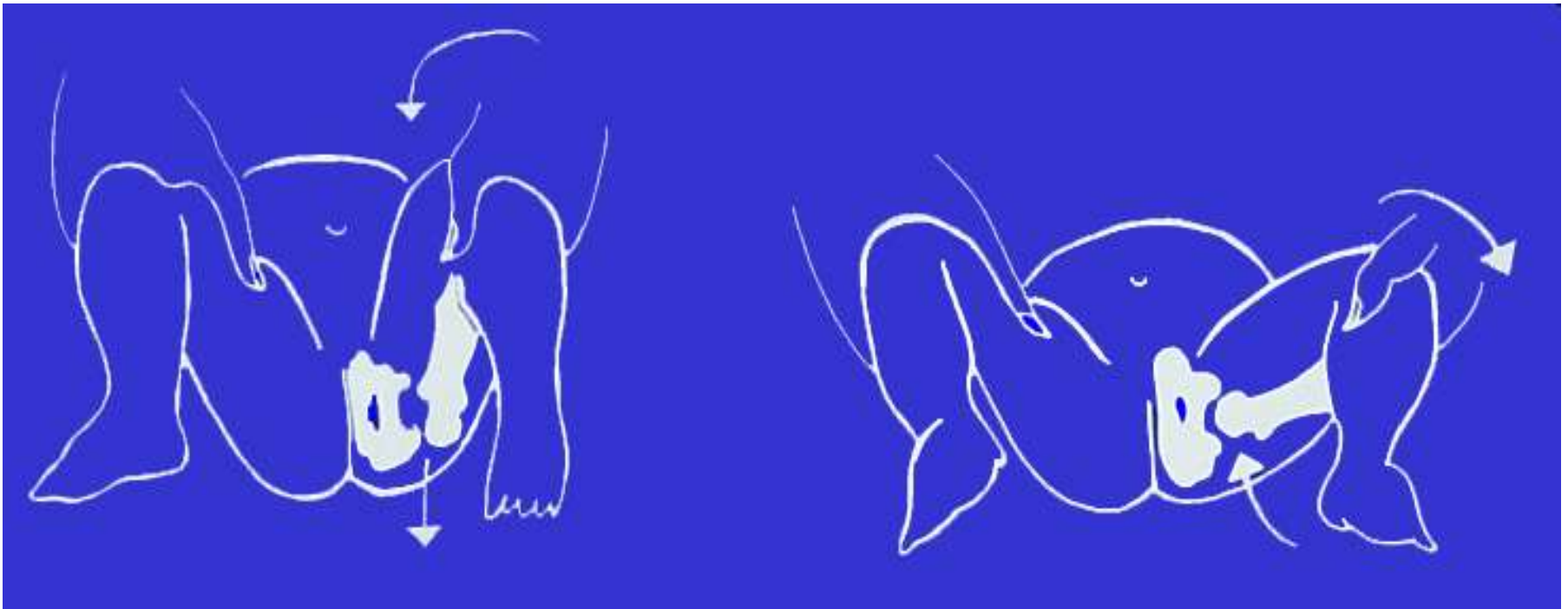
Waddling Gait

Hyperlordosis





# Exam Maneuvers



Barlow = Dislocatable

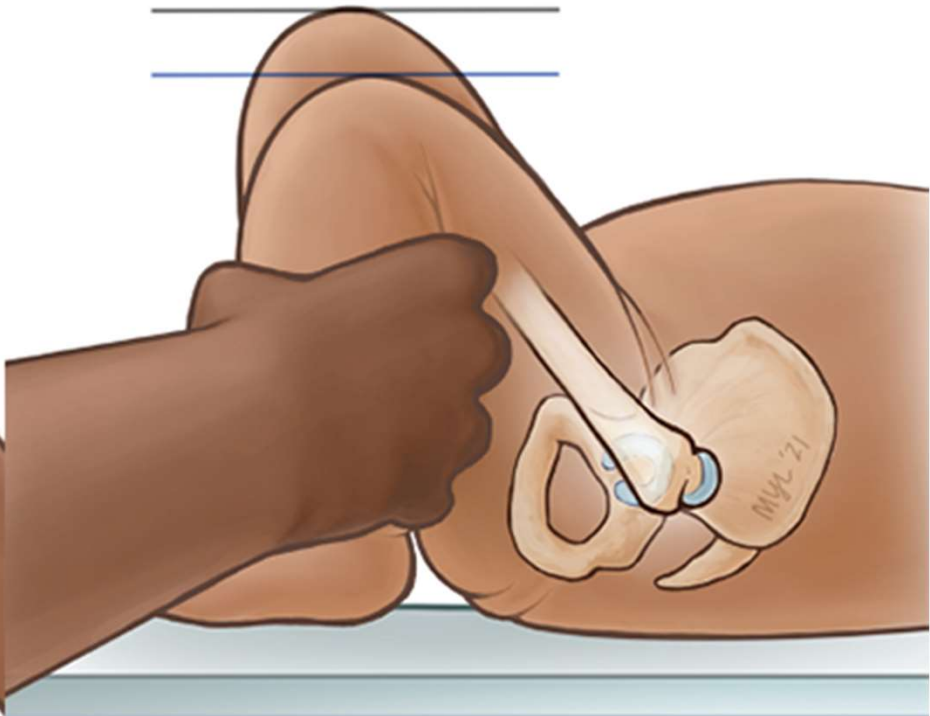
Ortolani = Reducible

# Galeazzi

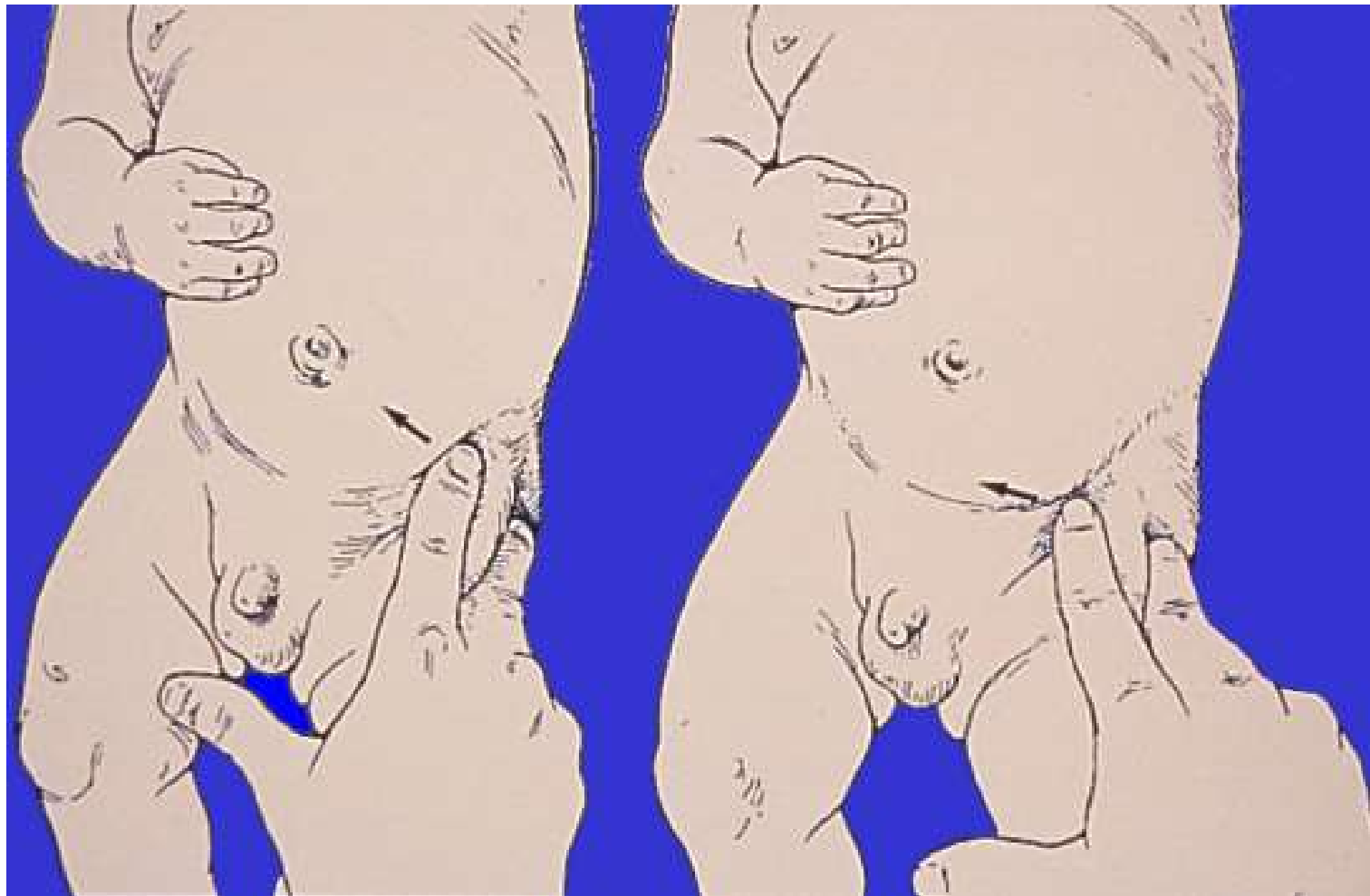
Inferior



Lateral



# Klasic



## Late Diagnosis



# DDH



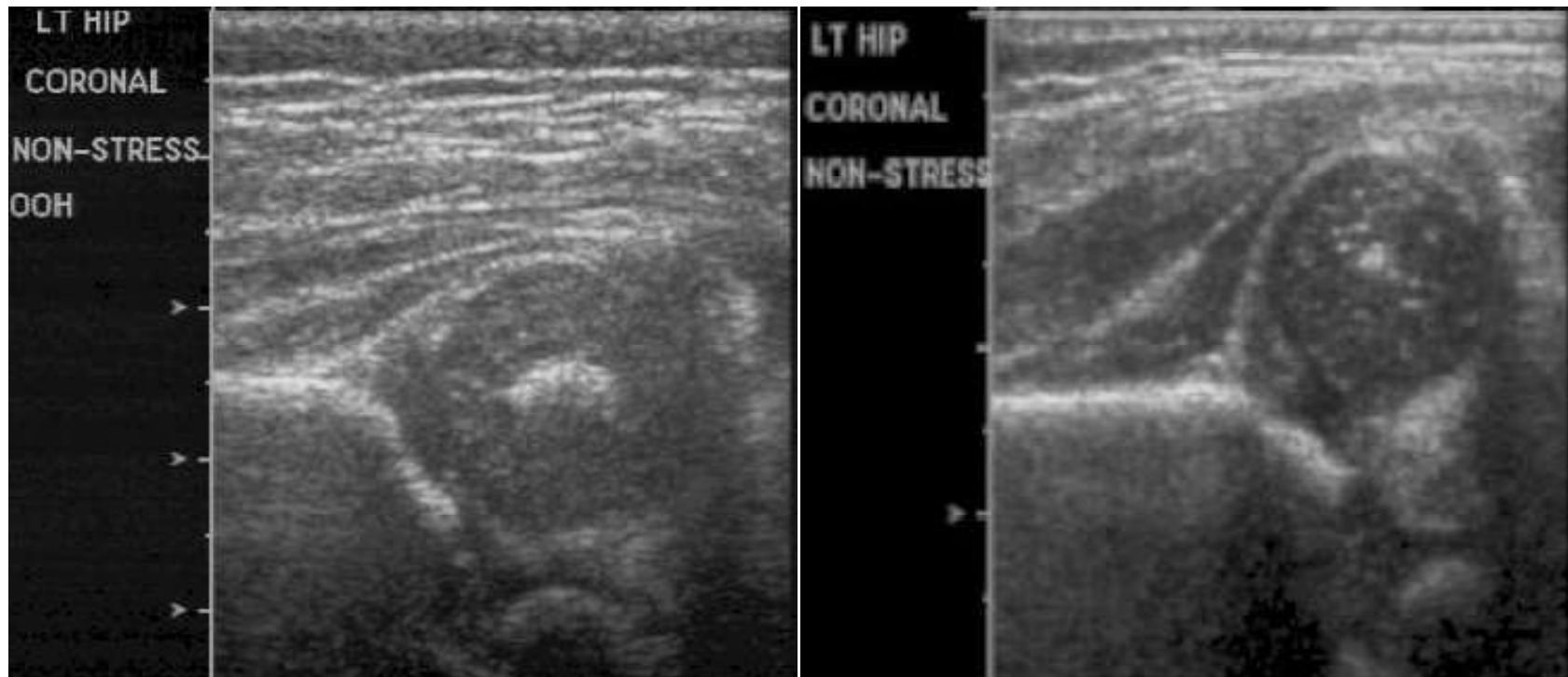
Late Diagnosis

# Imaging

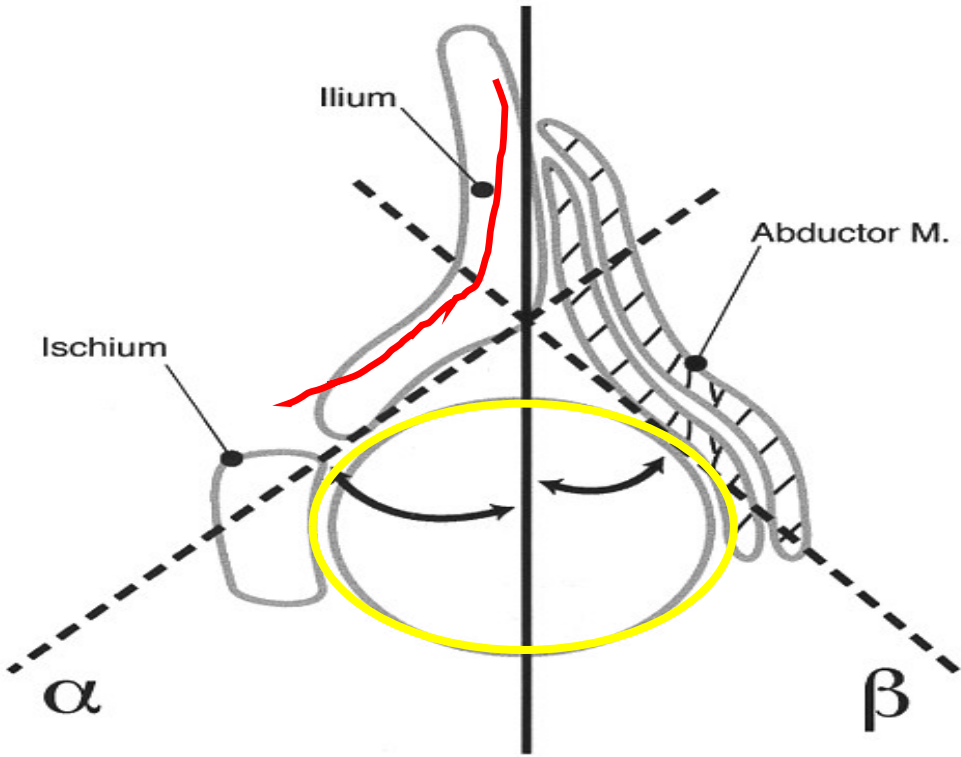
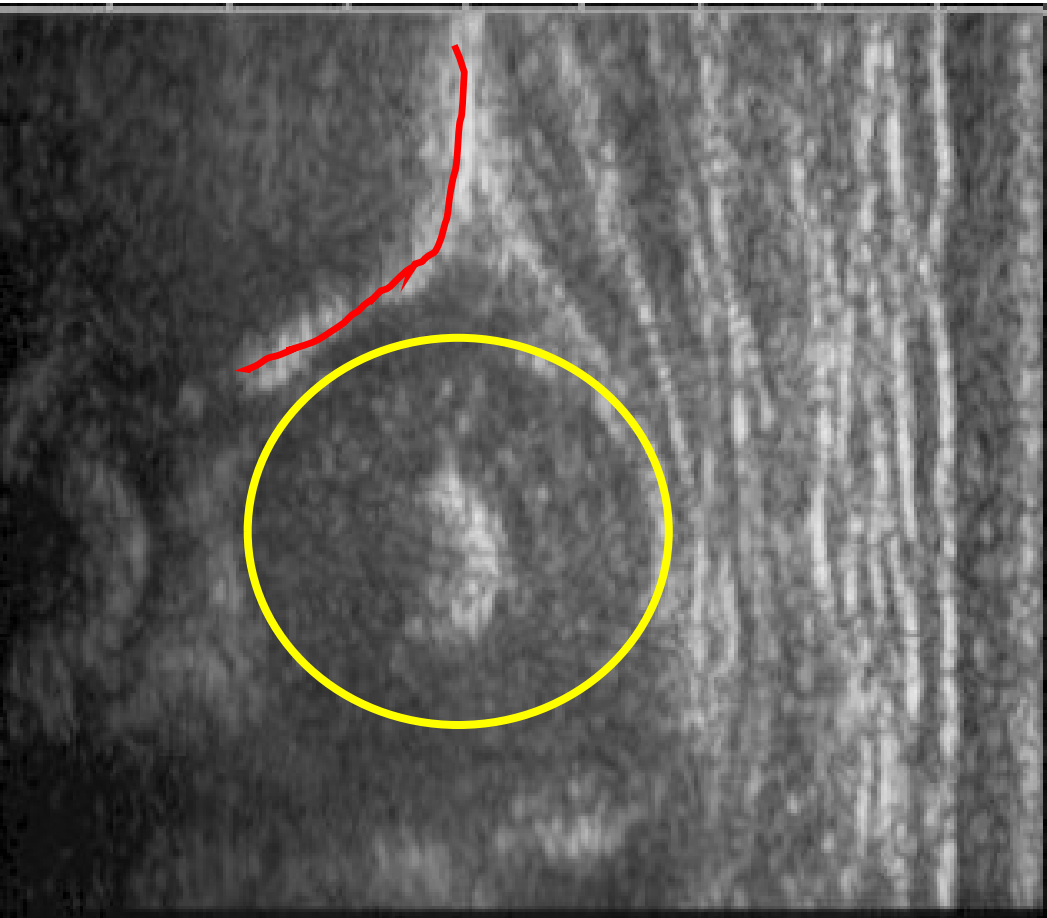
US

Alpha angle

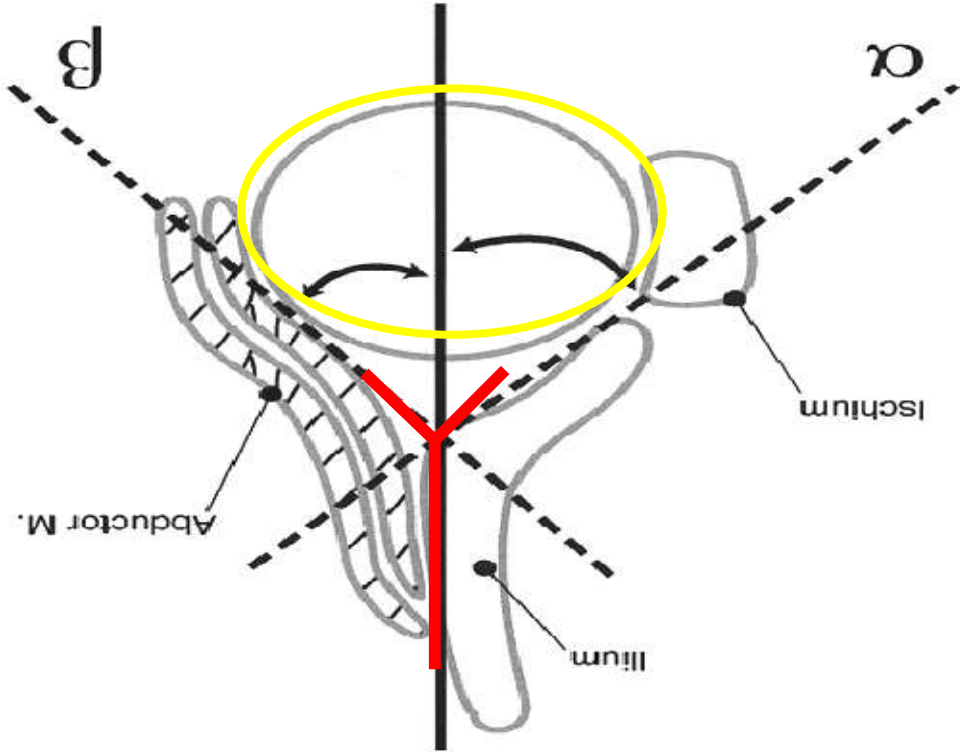
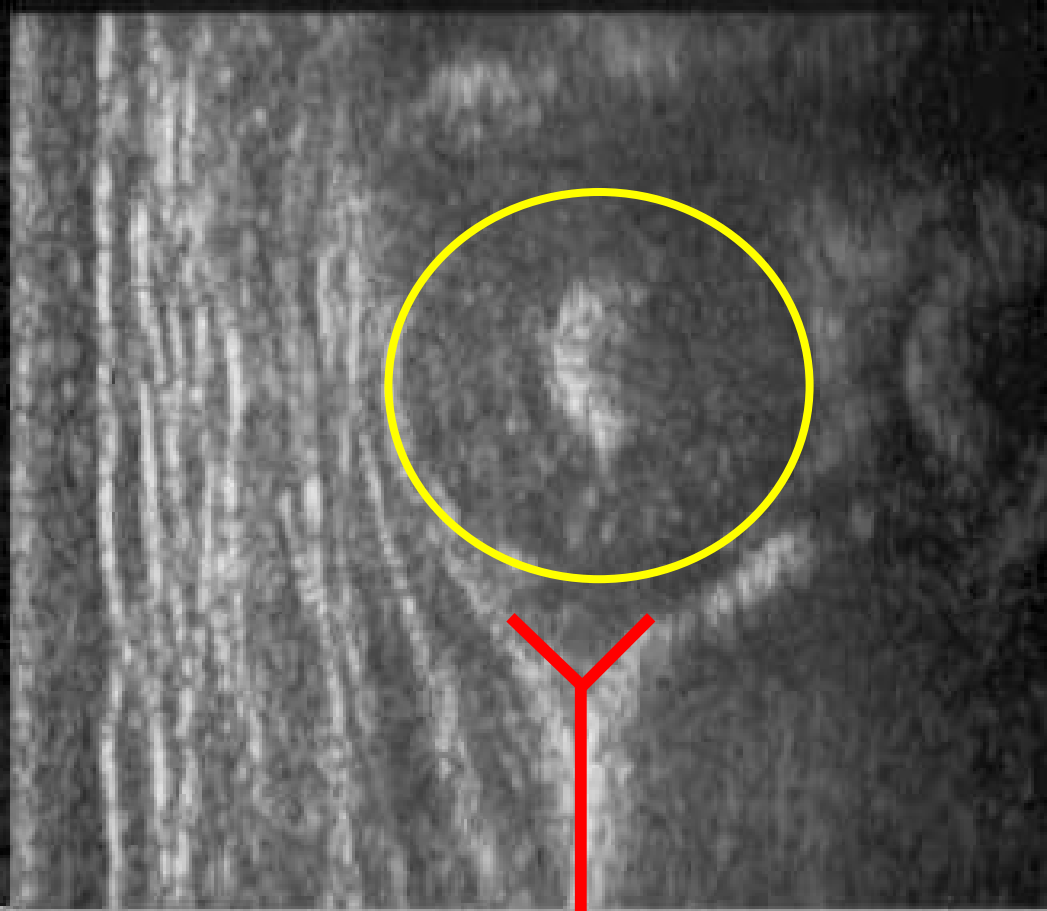
% coverage



# Imaging

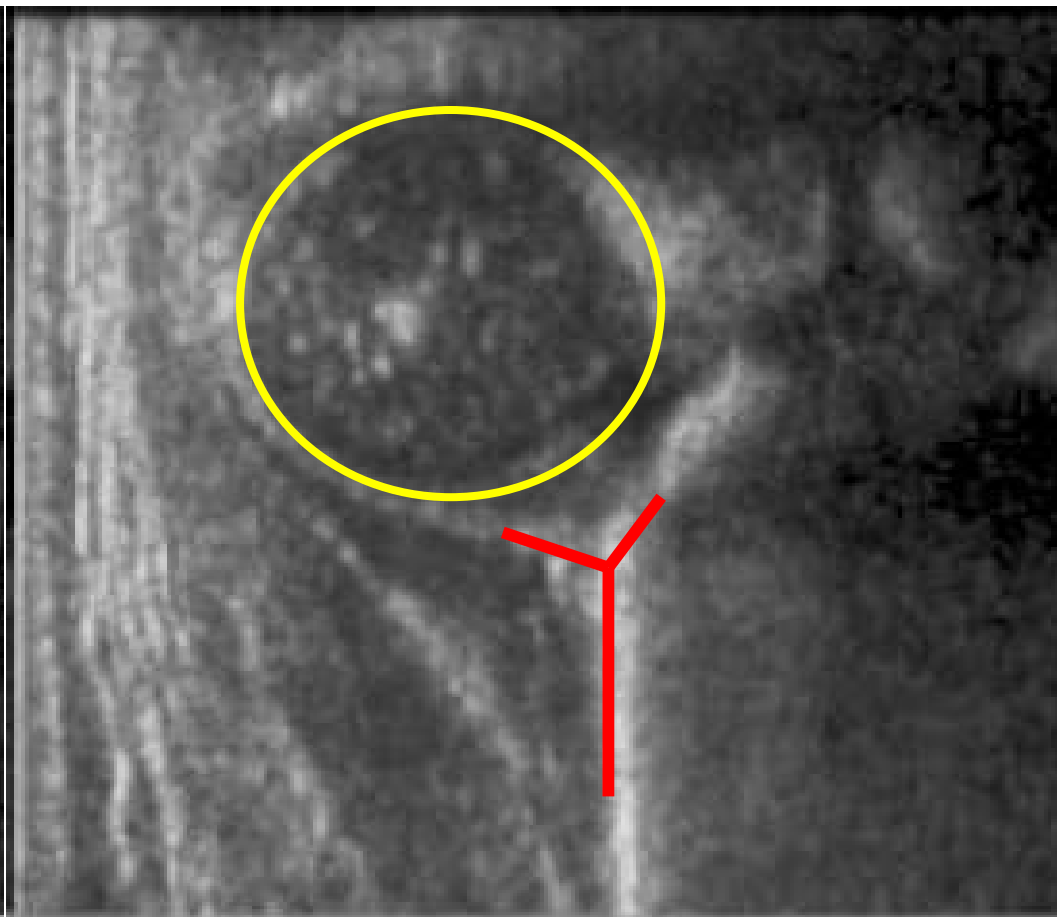
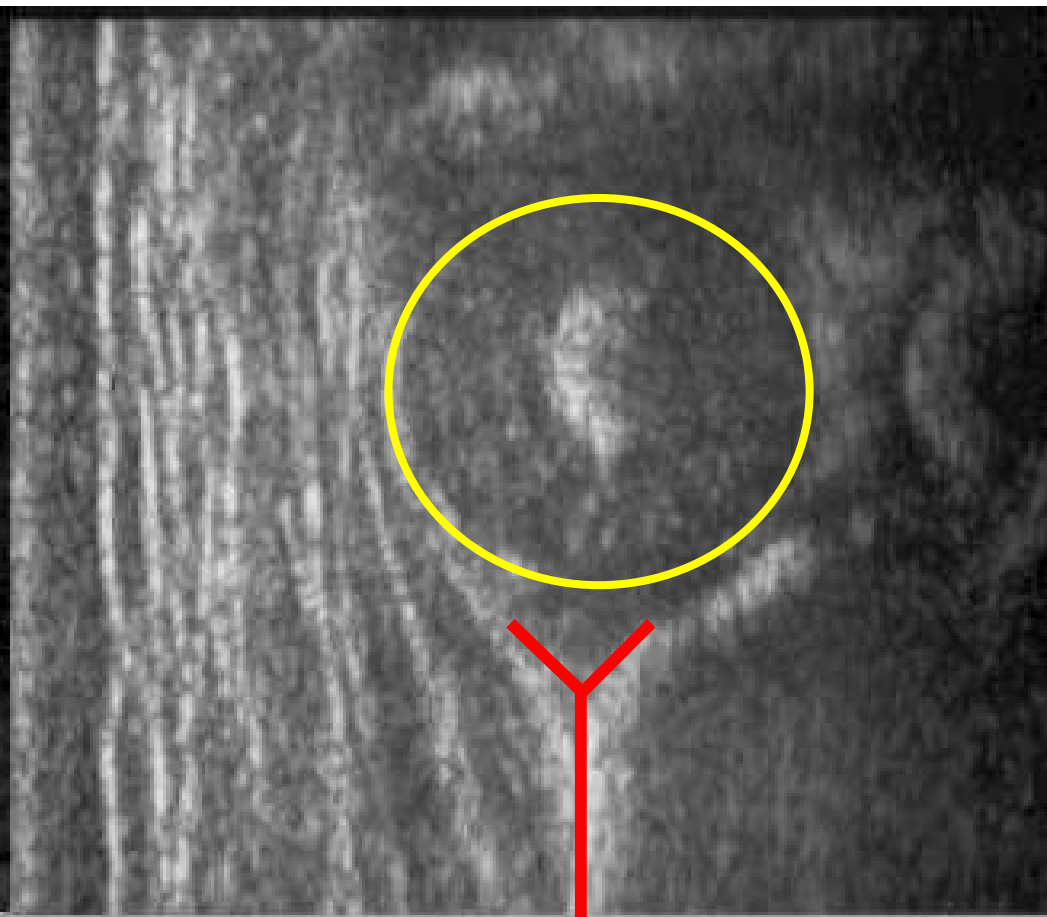


# Imaging



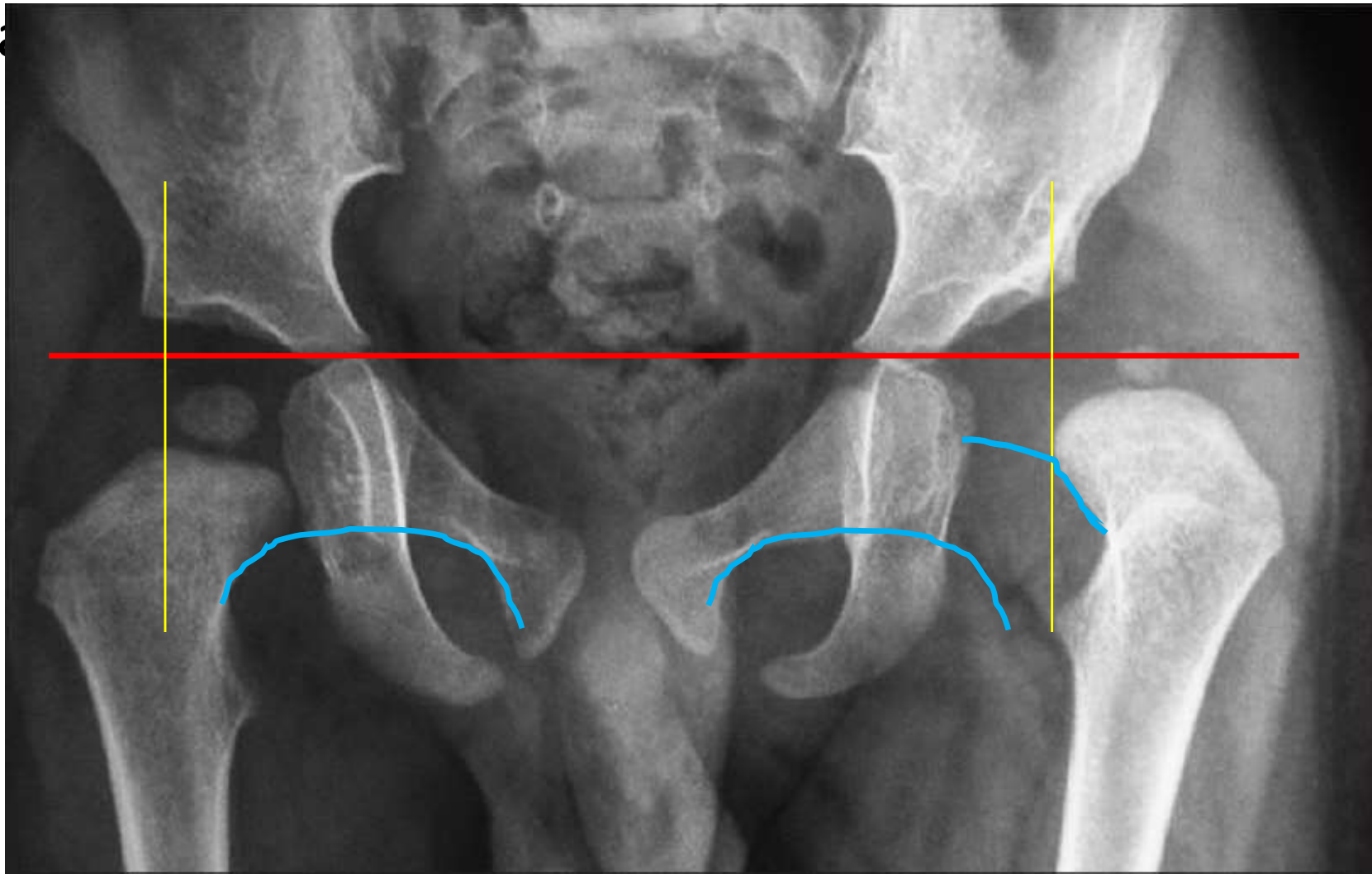


# Imaging



# Imaging

AP &



# Treatment <6mo



Arnold Pavlik

Pavlik Harness

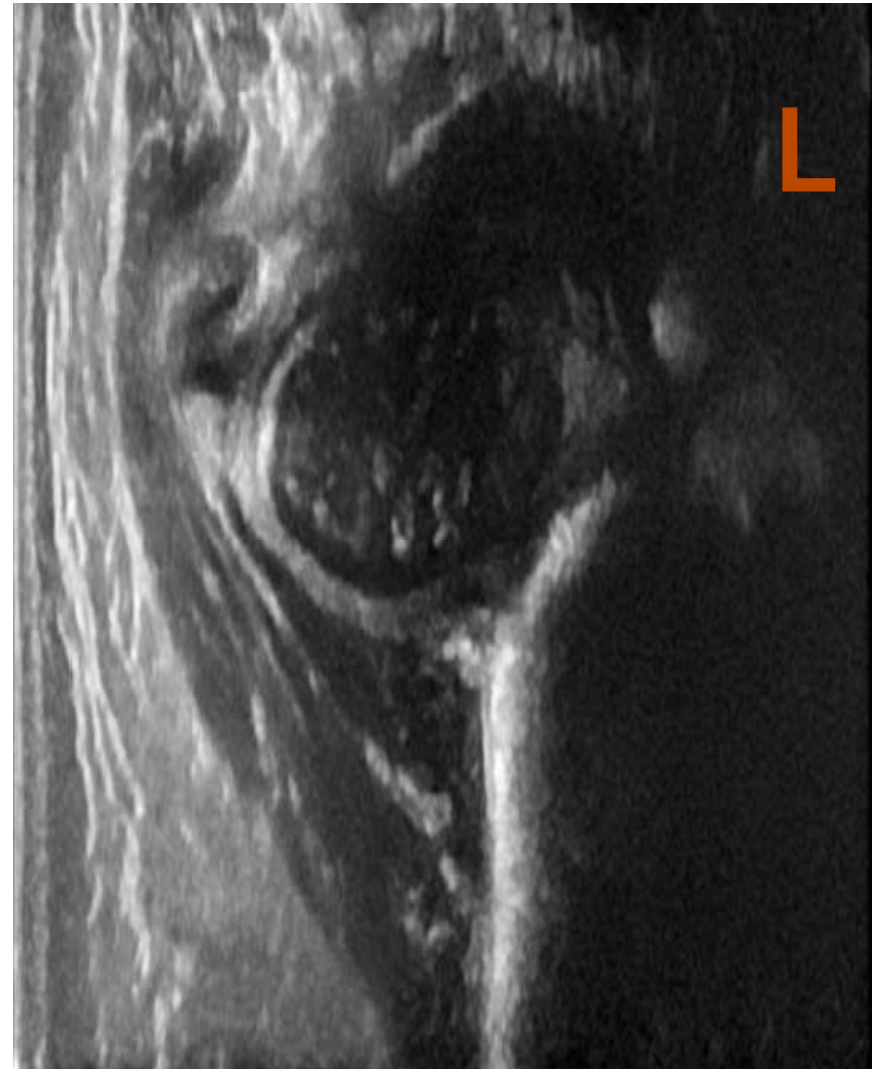
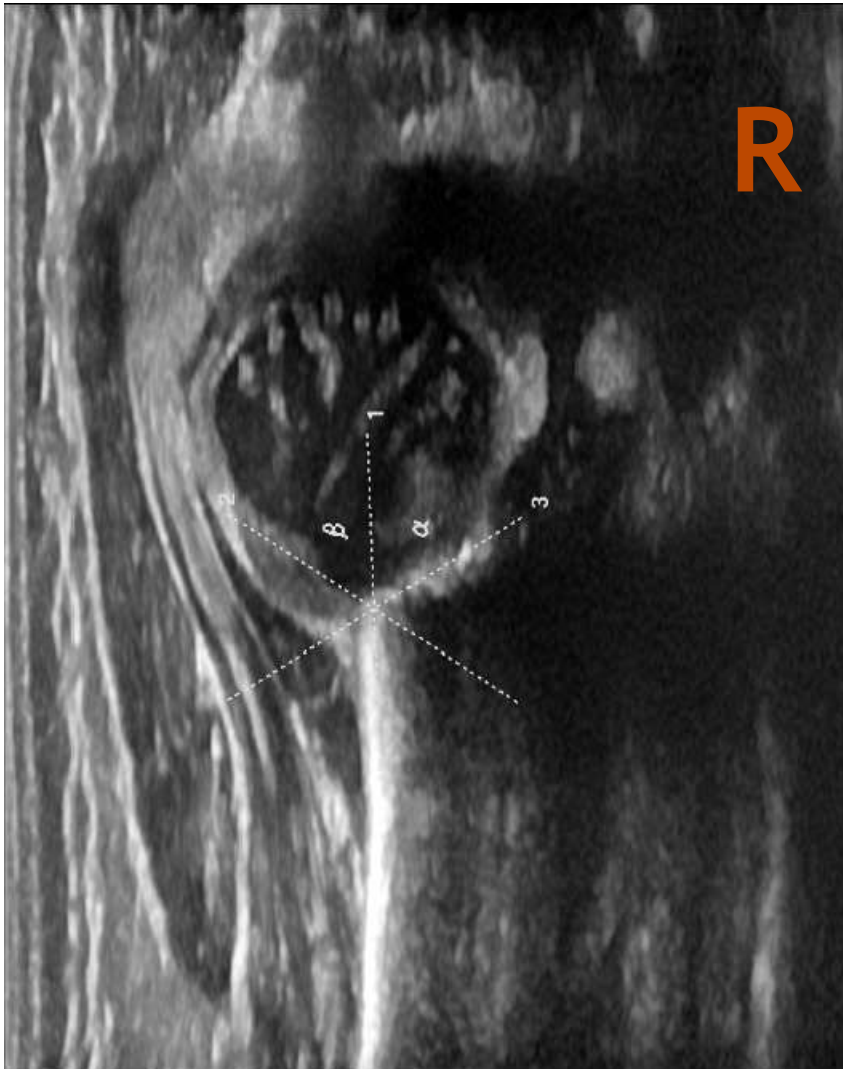
Confirm w/ US

D/c after 3wks if not reduced

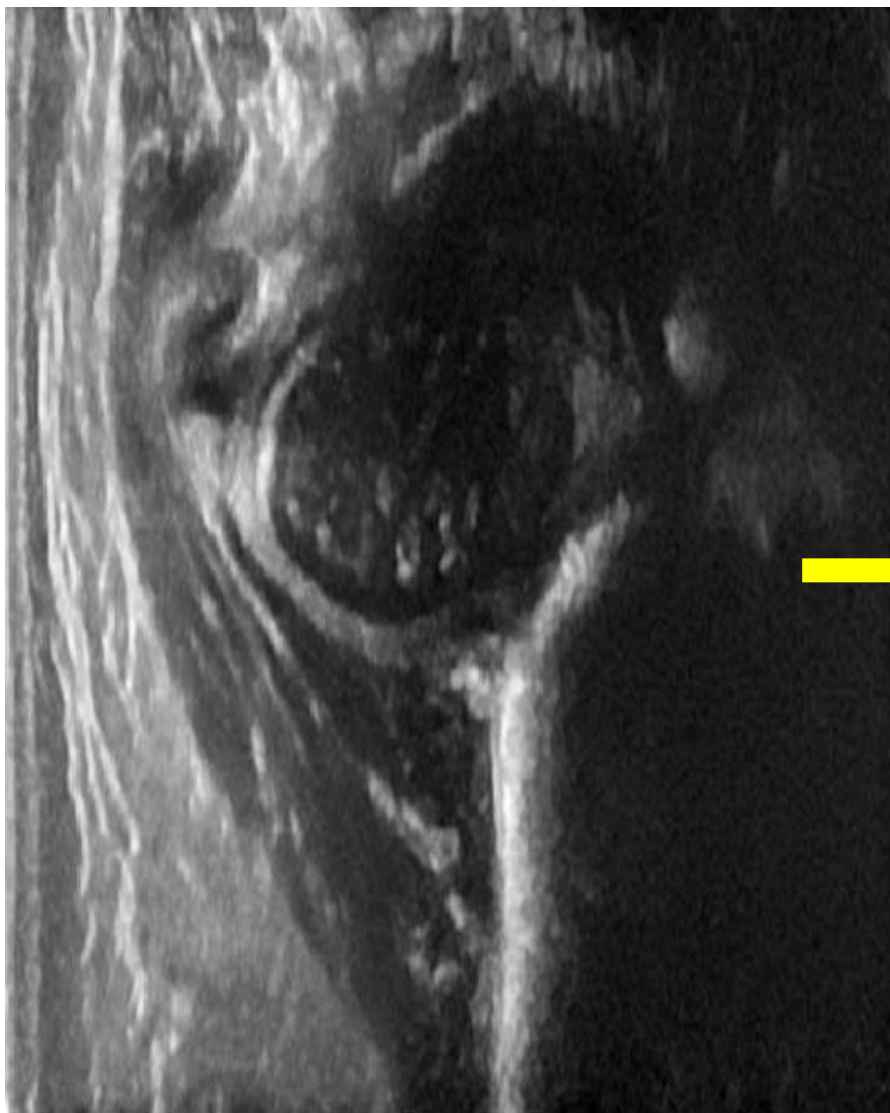
Tx – at least 6 weeks



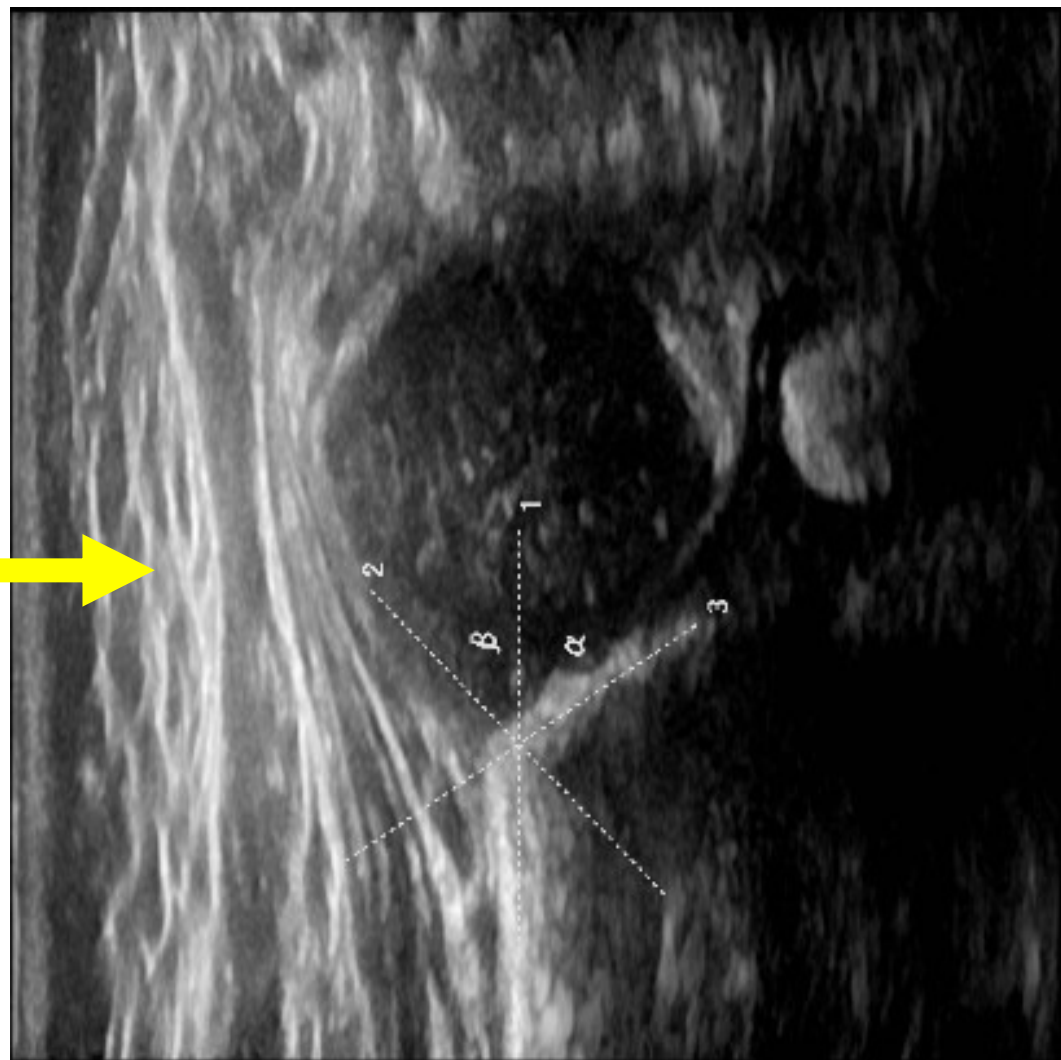
# DDH



## DDH 2 weeks



# DDH 6 weeks

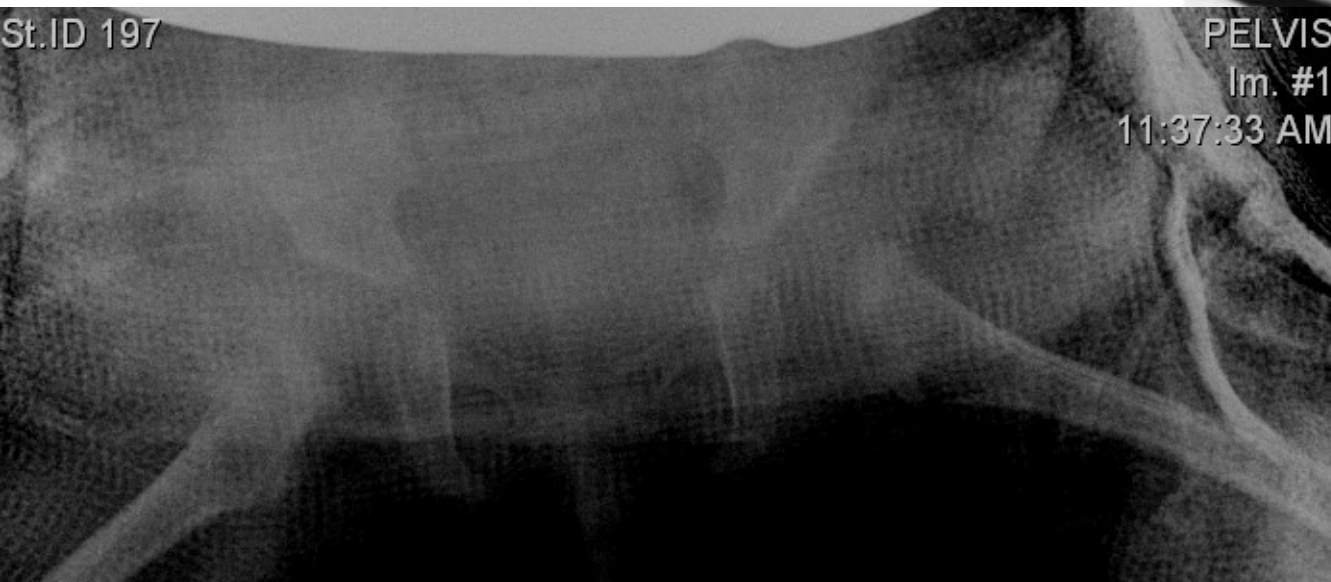


# Treatment 6-18mo

Closed vs Open Reduction

EUA with arthrogram

Change cast at 6wks



Questions?

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Thank You!



# Thank You

