DRIVING CHANGE 2023
THE URGENT CARE CONVENTION

The Pediatric Urgent Care Conference
PUCC @ UCA
By PM Pediatric Care

Pediatric X-rays you can't afford to miss

Mark Bittman, MD

URGENT CARE ASSOCIATION®

COLLEGE OF URGENT CARE MEDICINE

Weill Cornell Medicine

Financial Disclosures

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THE URGENT CARE CONVENTION

- I have no financial disclosures

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Learning Objectives
After completing this activity the participant should be able to:

- Understand the imaging work-up of a limping child
- Understand the Salter Harris classification of fractures and sequela of physeal injury
- Distinguish a supracondylar humeral fracture from lateral condylar fracture
- Be familiar with the imaging work-up for suspected non-accidental trauma

Case 1

Clinical Presentation:

18 month old boy refusing to bear weight and crying. Nonlocalizable symptoms.

The most appropriate next step is:

1. X-ray pelvis, legs and feet
2. X ray tibia/fibula
3. US hip
4. X ray foot
5. Xray lumbar spine

“PAIN”

ACR Appropriateness Criteria:

Limping child 0-5 years

Clinical Condition: **Limping Child — Ages 0-5 Years**

Variant 1: **Nonlocalizable pathology by clinical evaluation (no concern for infection).**

Radiologic Procedure	Rating	Comments	RRL*
X-ray lower leg	8	Tibia/fibula only.	☢
US hip	6	Toxic synovitis and septic arthritis usually present with localizing symptoms.	O
X-ray pelvis and leg and foot	5	May be considered as secondary investigation after negative tibia/fibula examination.	☢☢
X-ray lumbar spine	5	Frontal and lateral views.	☢☢
Tc-99m 3-phase bone scan lower thoracic spine to distal lower extremities	5		☢☢☢
MRI lower thoracic spine to lower extremities without contrast	5	Superior to bone scan for soft-tissue pathology. Data for contrast administration in this scenario are limited. Sedation risks should be considered.	O
MRI lower thoracic spine to lower extremities without and with contrast	5	Superior to bone scan for soft-tissue pathology. Data for contrast administration in this scenario is limited. Use contrast if needed based on evaluation of noncontrast MRI findings. Sedation risks should be considered. See statement regarding contrast in text under "Anticipated Exceptions."	O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Milla S, Coley BD, Karmazyn B et al ACR Appropriateness Criteria® Limping Child – Ages 0-5. Available at http://www.acr.org/Quality-Safety/Appropriateness-Criteria. American College of Radiology. Accessed August 31, 2015

ARTICLE

Utility of Total Lower Extremity Radiography Investigation of Nonweight Bearing in the Young Child

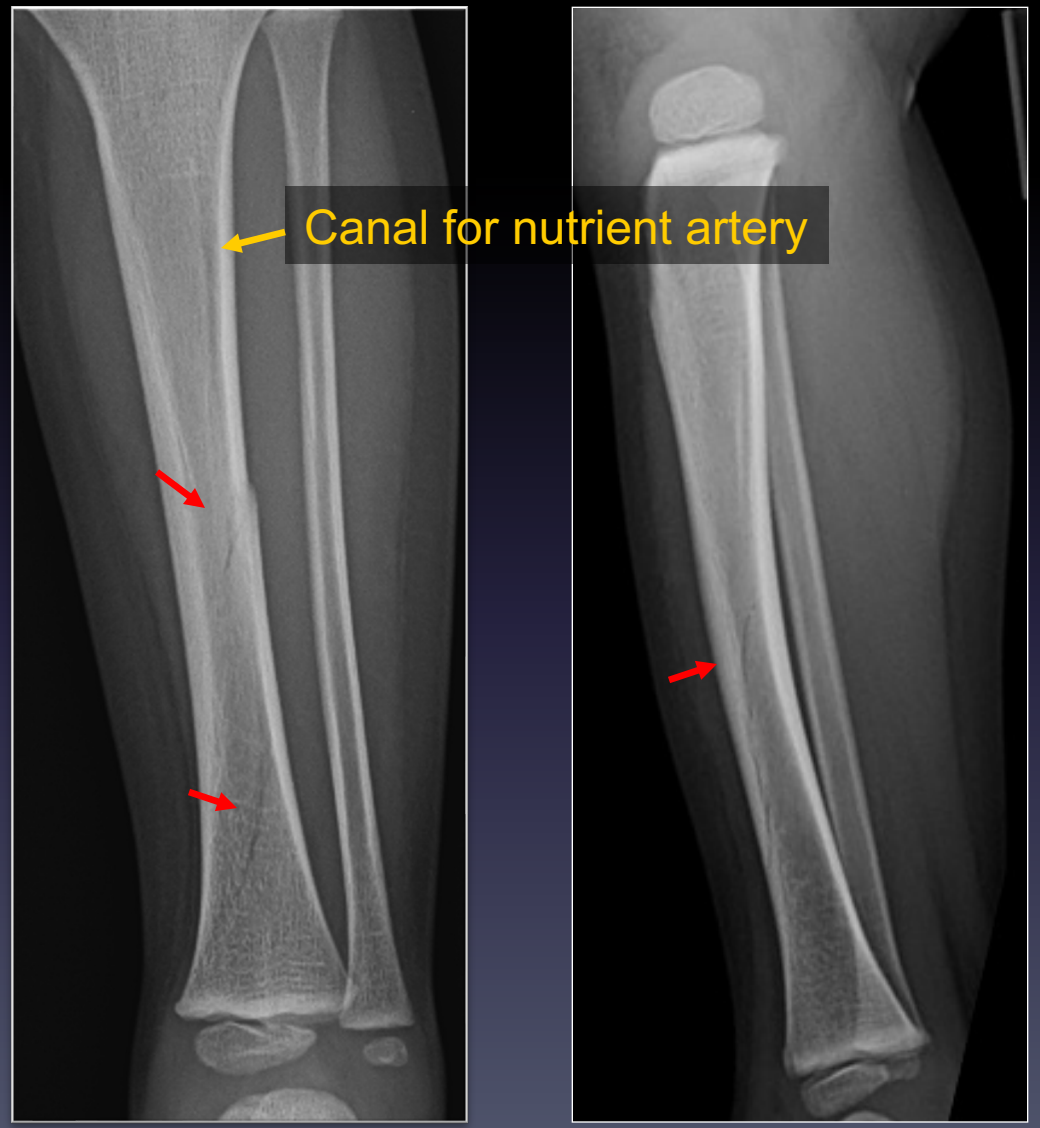
Christopher M. Baron, MD[a], Jayne Seekins, DO[a], Marta Hernanz-Schulman, MD[a], Chang Yu, PhD[b], J. Herman Kan, MD[a]

PEDIATRICS Volume 121, Number 4, April 2008

The most appropriate next step is:

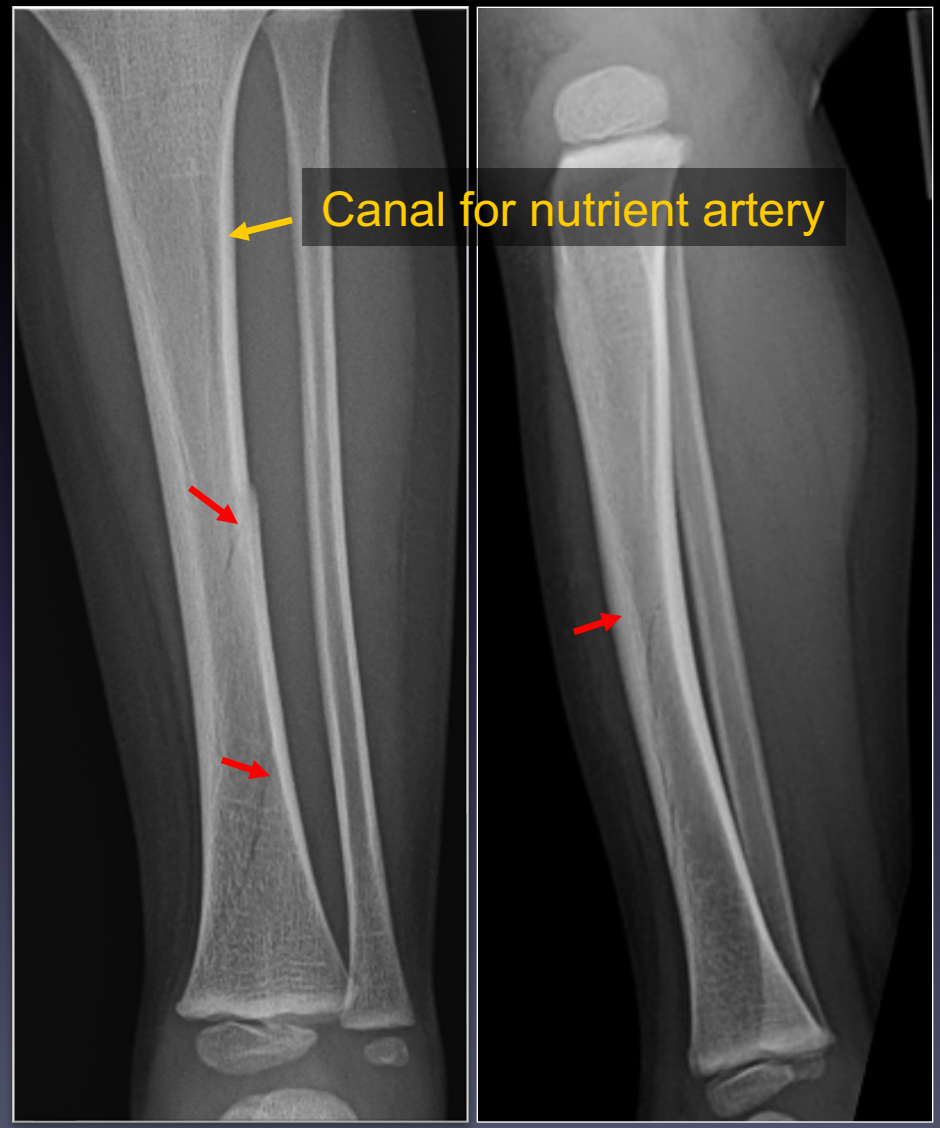
1. X-ray pelvis, legs and feet
2. X ray tibia/fibula
3. US hip
4. X ray foot
5. Xray lumbar spine

Toddler’s Fracture

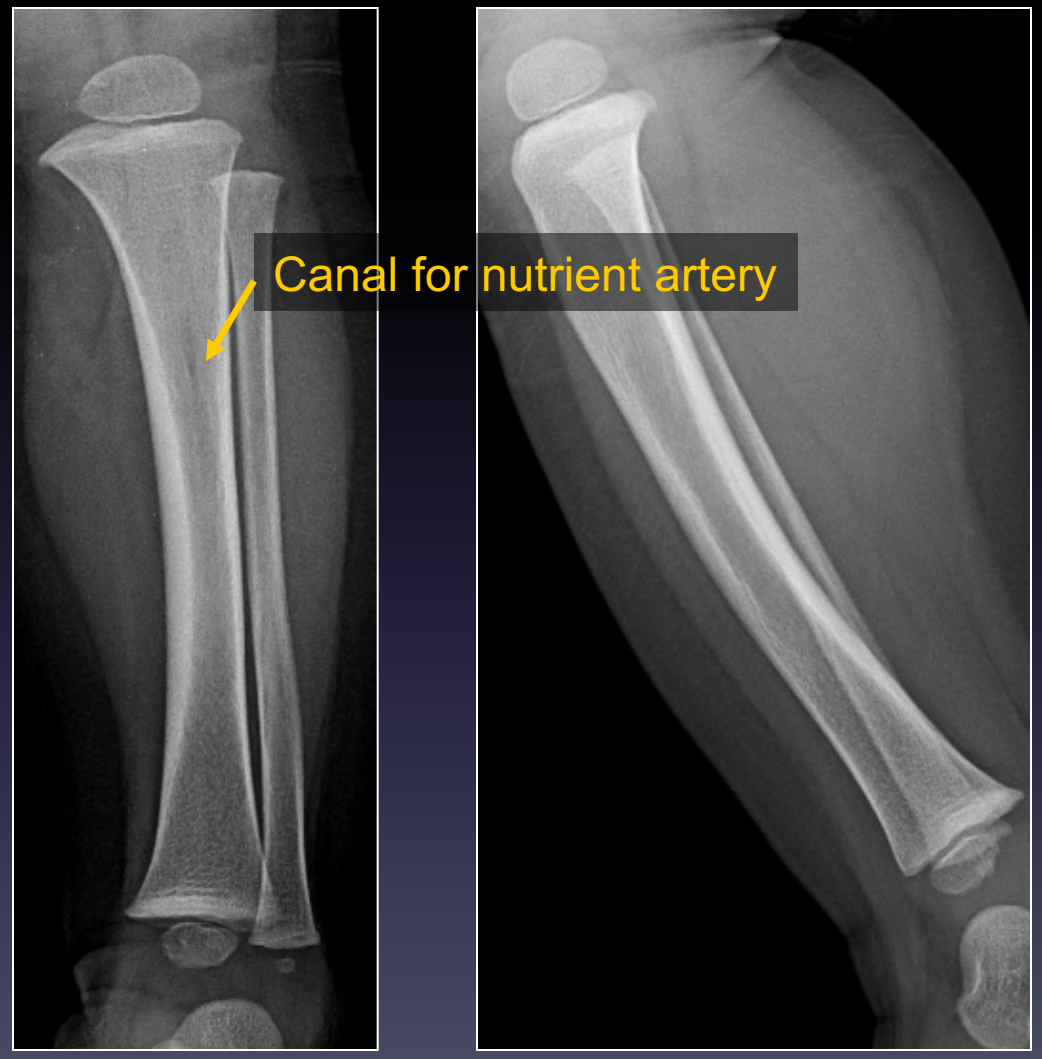


Toddler's Fracture

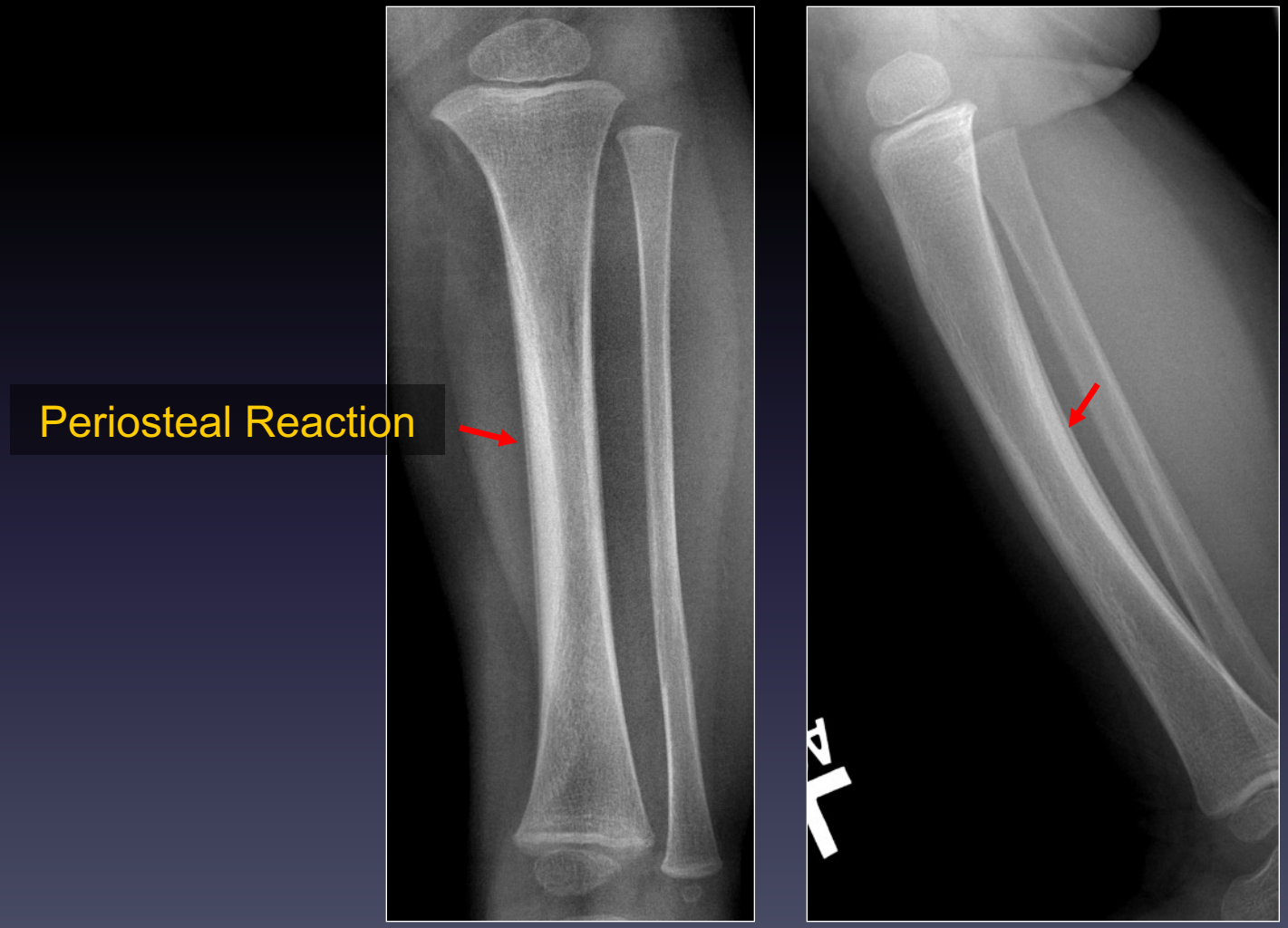
- Spiral fx distal 2/3 tibia
  - Stable fracture
  - Heals without treatment
- Not suspicious for abuse in an ambulatory child
- Often occult
  - Internal oblique radiograph may show fracture
  - Treatment with long leg cast



Toddler’s Fracture



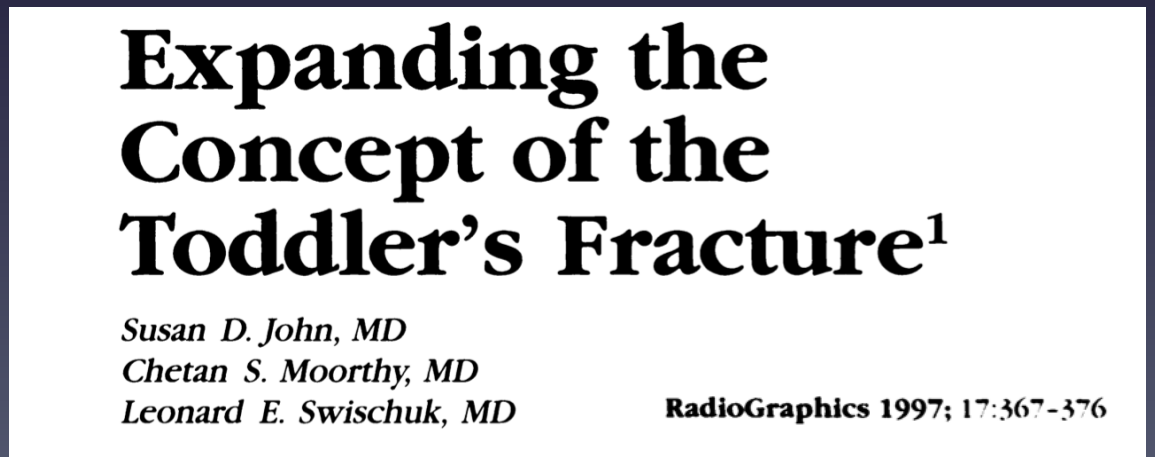
Toddler's Fracture



2 weeks later: healing occult toddler's fracture

Toddler Fracture Spectrum

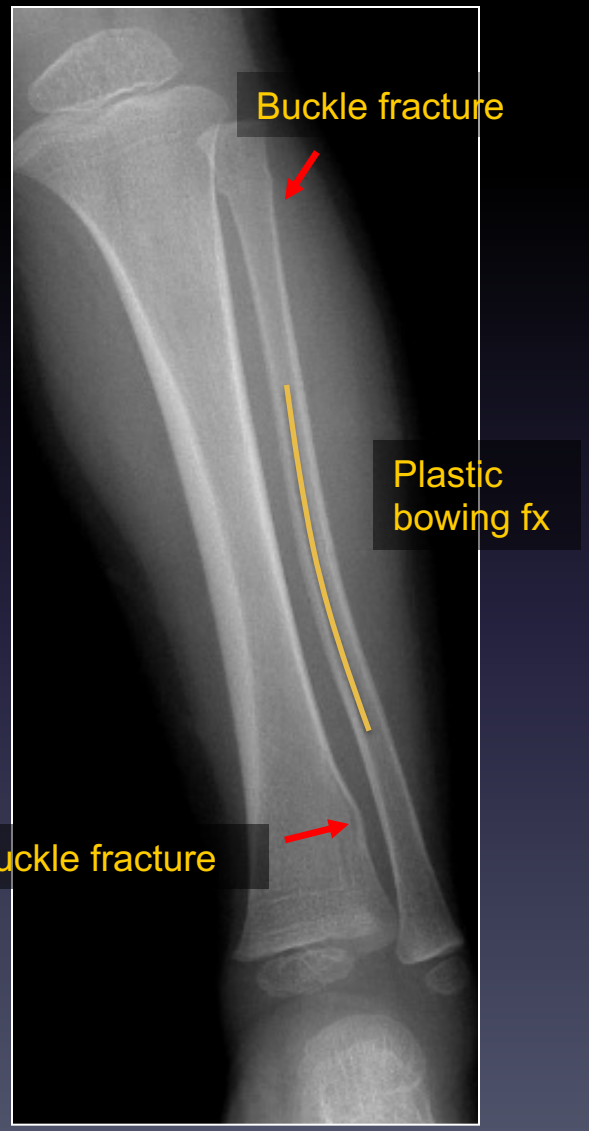
- Includes variety of often subtle fractures
  - Fibula
  - Proximal and distal tibia
  - Cuboid
  - Calcaneus
  - Metatarsals



Expanding the Concept of the Toddler's Fracture[1]

Susan D. John, MD
Chetan S. Moorthy, MD
Leonard E. Swischuk, MD

RadioGraphics 1997; 17:367-376



Toddler Fracture Spectrum

- Proximal Tibial Fx:
  - Hyperextension force
  - Buckle fx anterior tibia
  - Anterior tilting physis
  - Increased “scooping” of tubercular notch

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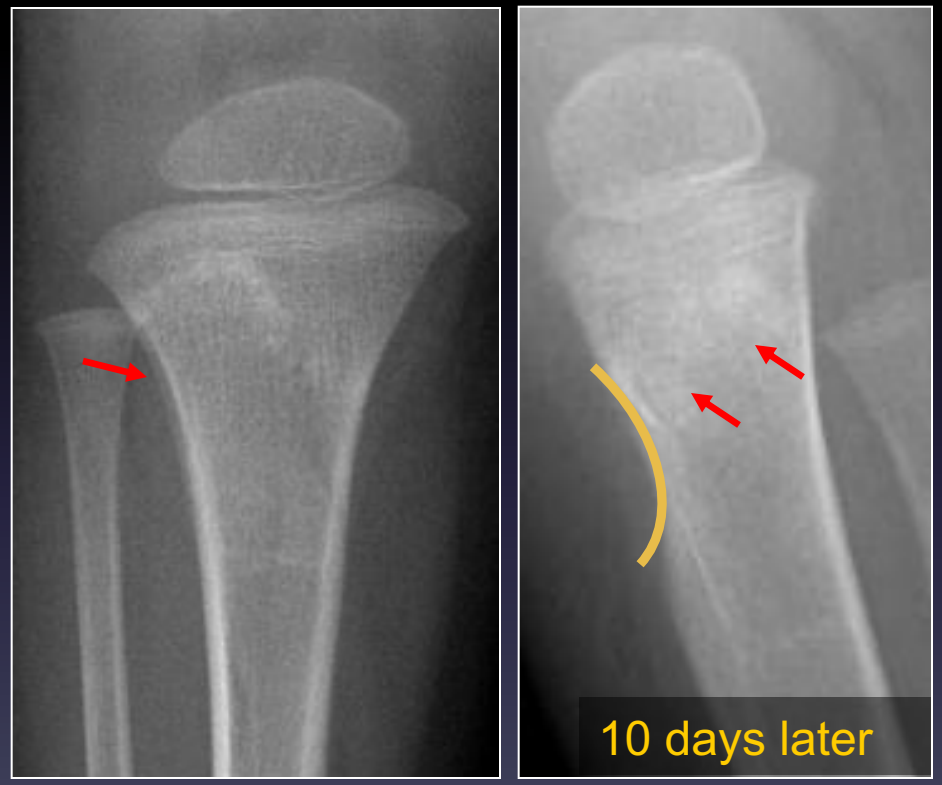


Case 2

Clinical Scenario:

3 yo girl with limp; swelling over dorsum of foot

The most appropriate next step is:

1. X-ray pelvis, legs and feet
2. X ray tibia/fibula
3. US hip
4. X ray foot
5. Xray lumbar spine

ACR Appropriateness Criteria:

Limping child 0-5 years

Variant 2: **Localized pathology by clinical evaluation (no concern for infection).**

Radiologic Procedure	Rating	Comments	RRL*
X-ray area of interest	9		Varies
MRI area of interest without contrast	6	Sedation risks should be considered.	O
MRI area of interest without and with contrast	6	Use contrast if needed based on evaluation of noncontrast MRI findings. Sedation risks should be considered. See statement regarding contrast in text under "Anticipated Exceptions."	O
US area of interest	5	Consider for palpable soft-tissue mass or suspected joint effusion. Provides only limited data for evaluation of osseous abnormalities.	O
CT area of interest without contrast	3		Varies
CT area of interest with contrast	2		Varies
CT area of interest without and with contrast	1		Varies
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

acr.org/~/media/ACR/Documents/AppCriteria/Diagnostic/LimpingChildAges0To5Years.pdf

The most appropriate next step is:

1. X-ray pelvis, legs and feet
2. X ray tibia/fibula
3. US hip
4. X ray foot
5. Xray lumbar spine

1st Metatarsal Buckle Fracture

1st Metatarsal Fracture

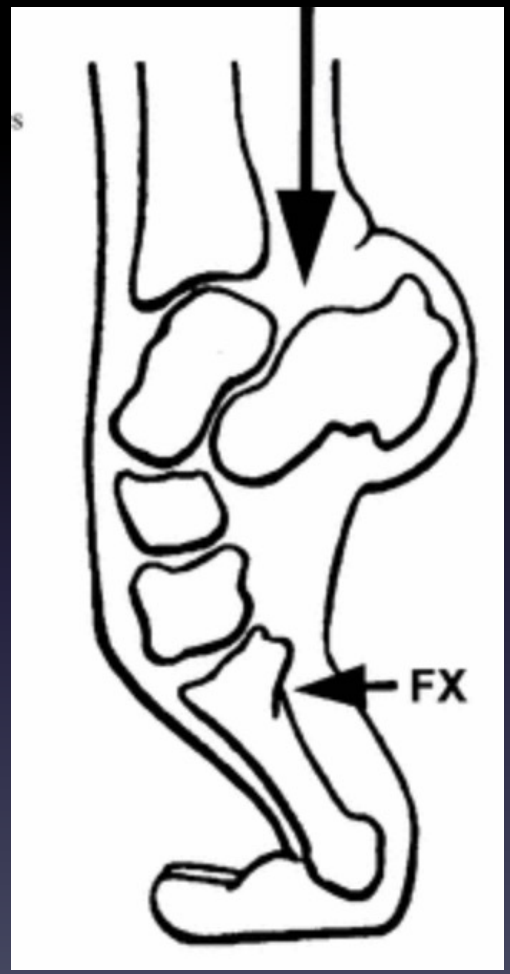
- Compressive axial loading

1st Metatarsal Fracture

- Compressive axial loading
- “Bunk bed” fracture

1st Metatarsal Fracture

- Compressive axial loading
- “Bunk bed” fracture



RadioGraphics 1997; 17:367-376

1st Metatarsal Buckle Fracture

- Compressive axial loading
- Radiographs
  - Undulation of cortex
  - Hairline spiral fracture
    - Not seen on AP or lateral
    - Seen only on internal oblique radiograph

Cuboid Fracture

- Second “bunk bed” fx
  - Same mechanism
  - Impaction injury of cuboid
  - Band of sclerosis confirms healing occult fracture

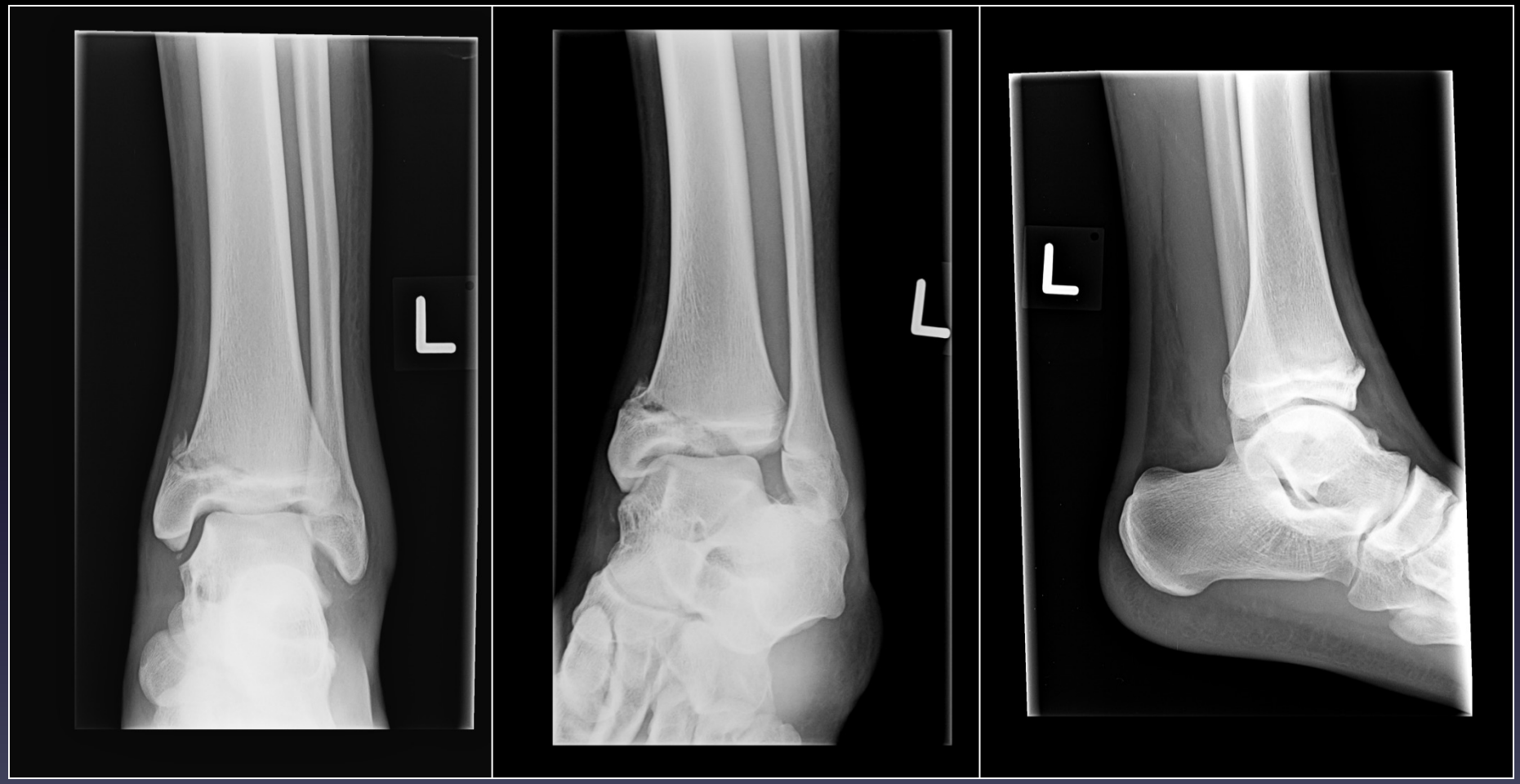
Cuboid Fracture

- Second “bunk bed” fx
  - Same mechanism
  - Impaction injury of cuboid
  - Band of sclerosis confirms healing occult fracture

Case 3

Clinical Scenario:

13 year old boy, s/p fall playing soccer. He was kicking a ball and fell back, twisting his right ankle.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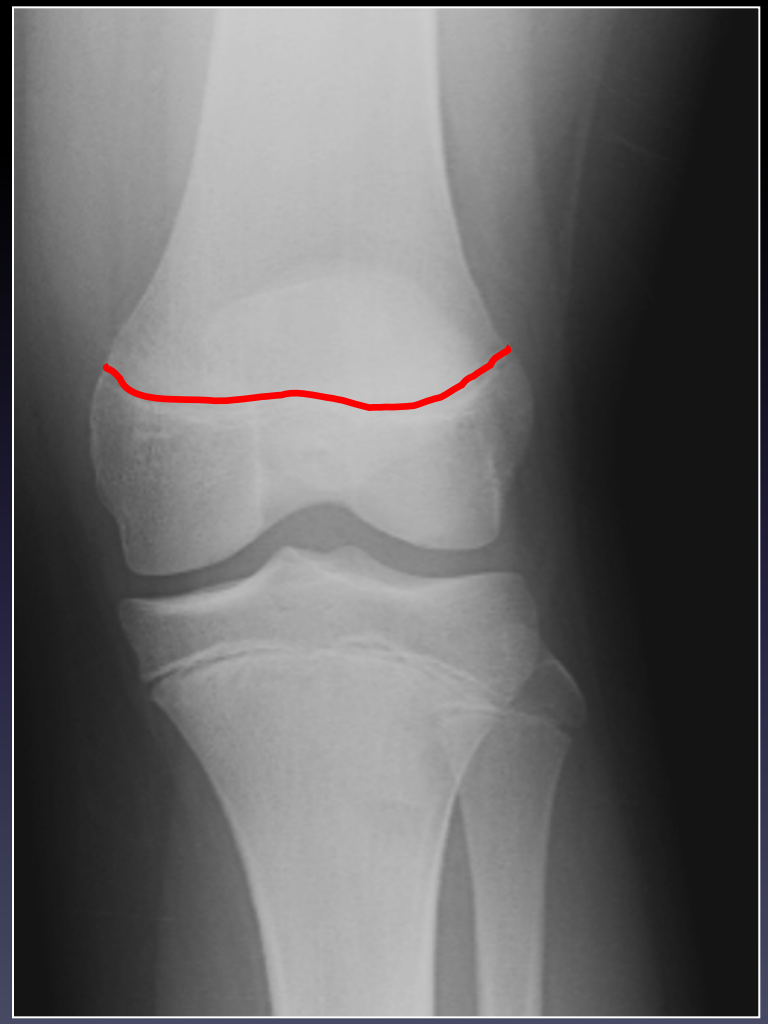
What is the correct Salter Harris classification of this fracture?

1. Salter Harris type I
2. Salter Harris type II
3. Salter Harris type III
4. Salter Harris type IV

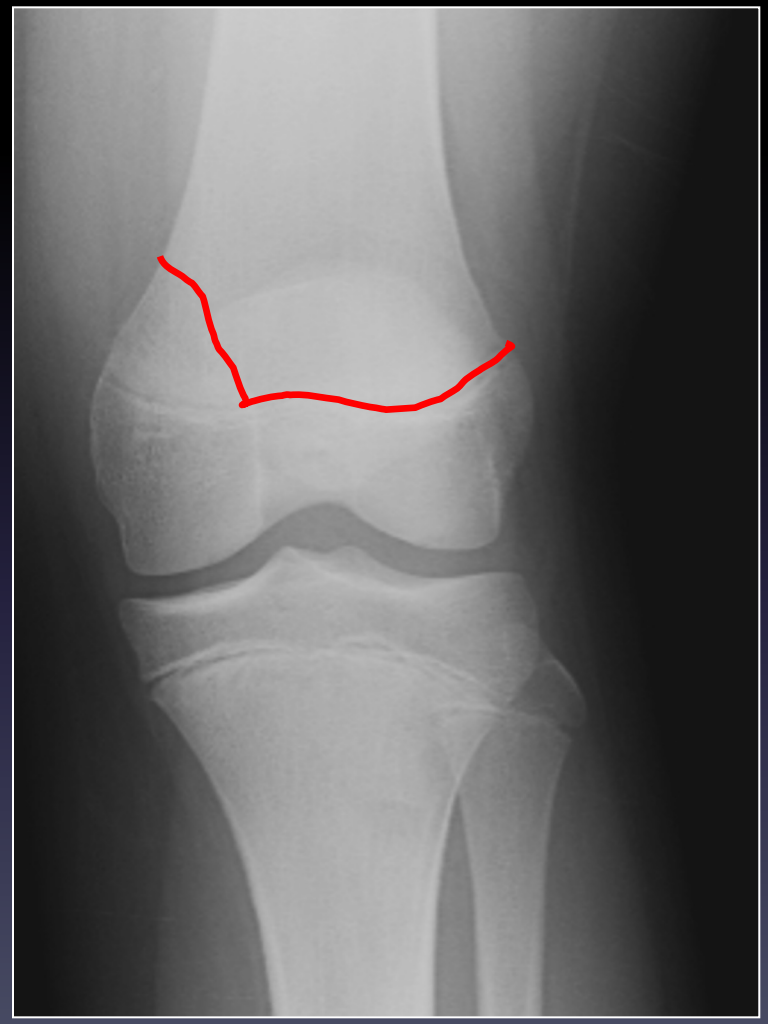
Salter Harris Fractures

- Salter I
  - Fracture through physis
  - 5-7%



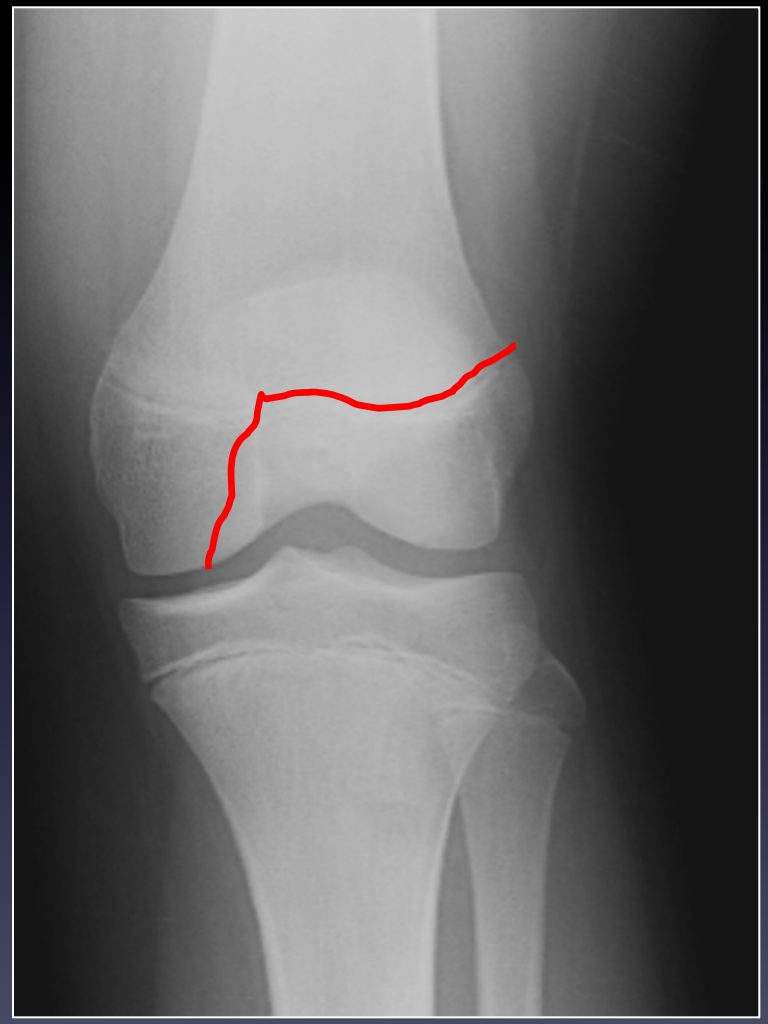
Salter Harris Fractures

- Salter II
  - Fracture through metaphysis and physis
  - 75%



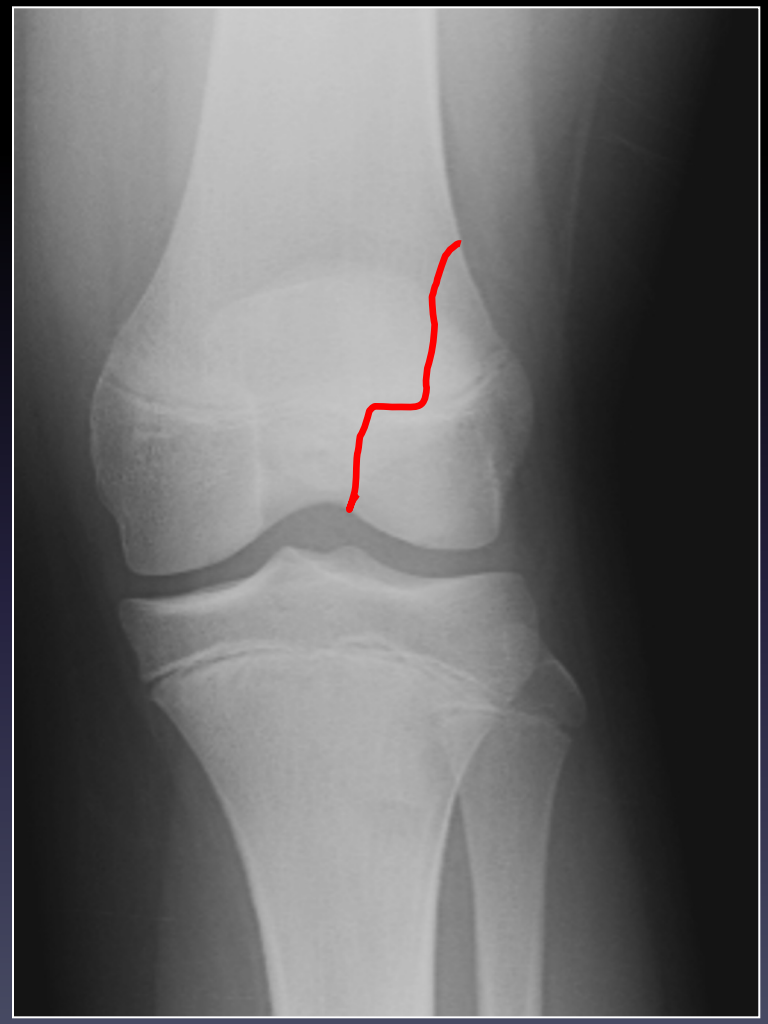
Salter Harris Fractures

- Salter III
  - Fracture through epiphysis and physis
  - 7-10%



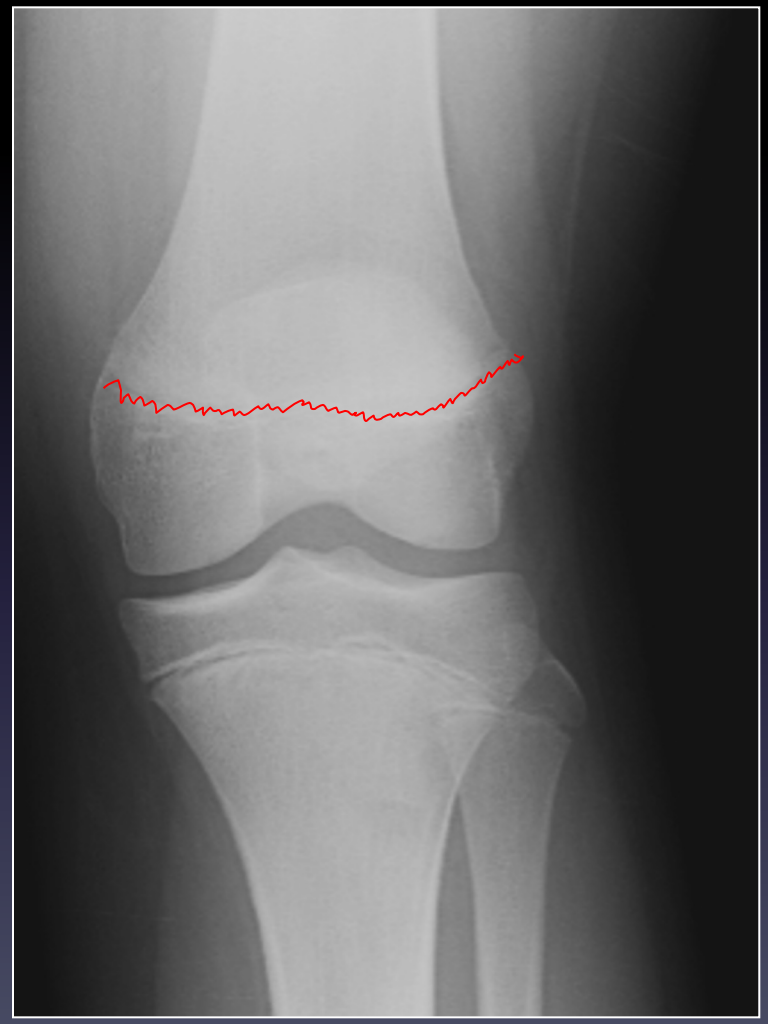
Salter Harris Fractures

- Salter IV
  - Fracture through physis
  - 10%



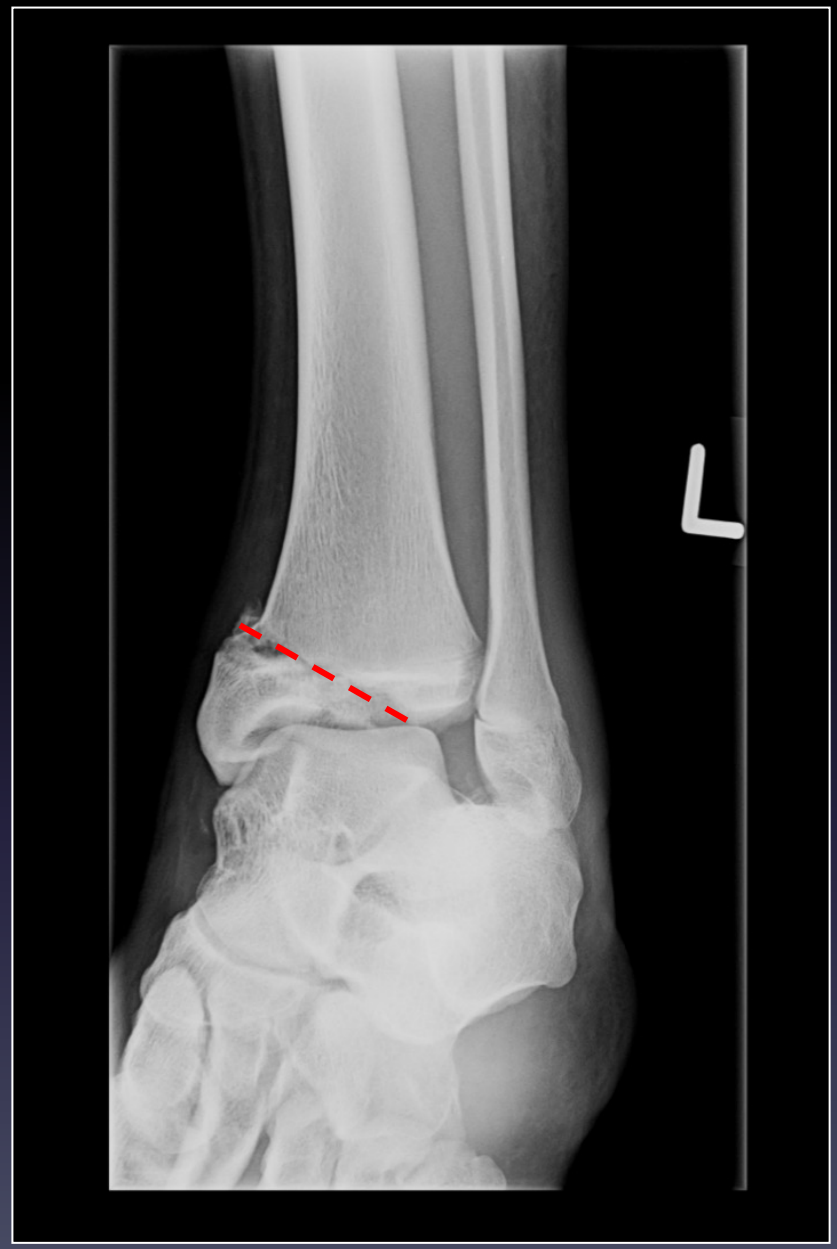
Salter Harris Fractures

- Salter V
  - Fracture through physis
  - <1%



What is the correct Salter Harris classification of this fracture?

1. Salter Harris type I
2. Salter Harris type II
3. Salter Harris type III
4. Salter Harris type IV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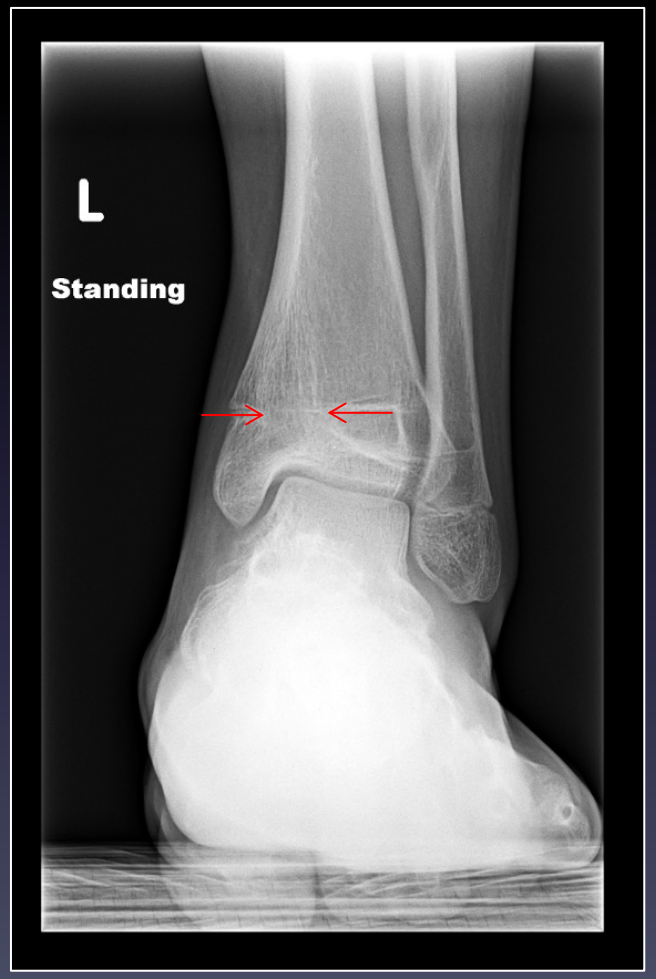
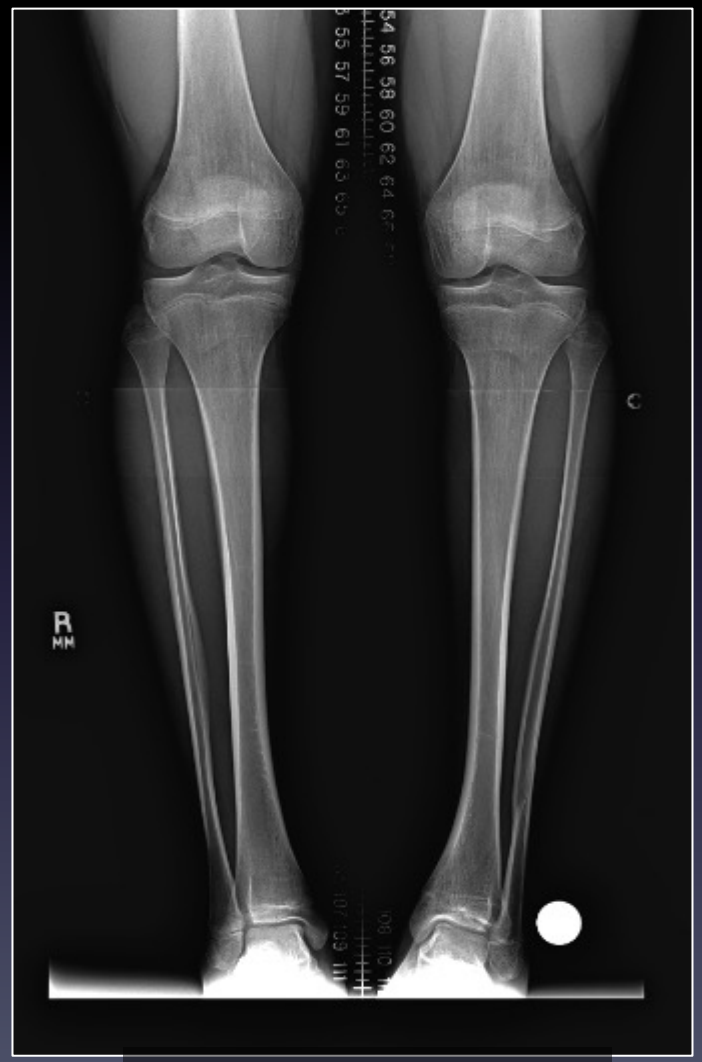
Complications of Physeal Injuries



- Premature fusion physis
  - SH III and IV fractures
  - Growth disturbance
    - Abnormal length
    - Abnormal angulation

Complications of Physeal Injuries



Tibiotalar Valgus

- Premature fusion physis
  - SH III and IV fractures
  - Growth disturbance
    - Abnormal length
    - Abnormal angulation

Complications of Physeal Injuries

- Premature fusion physis
  - SH III and IV fractures
  - ↑Growth disturbance
    - Abnormal length
    - Abnormal angulation

Complications of Physeal Injuries

Genu valgum and leg length discrepancy

- Premature fusion physis
  - SH III and IV fractures
  - ↑Growth disturbance
    - Abnormal length
    - Abnormal angulation

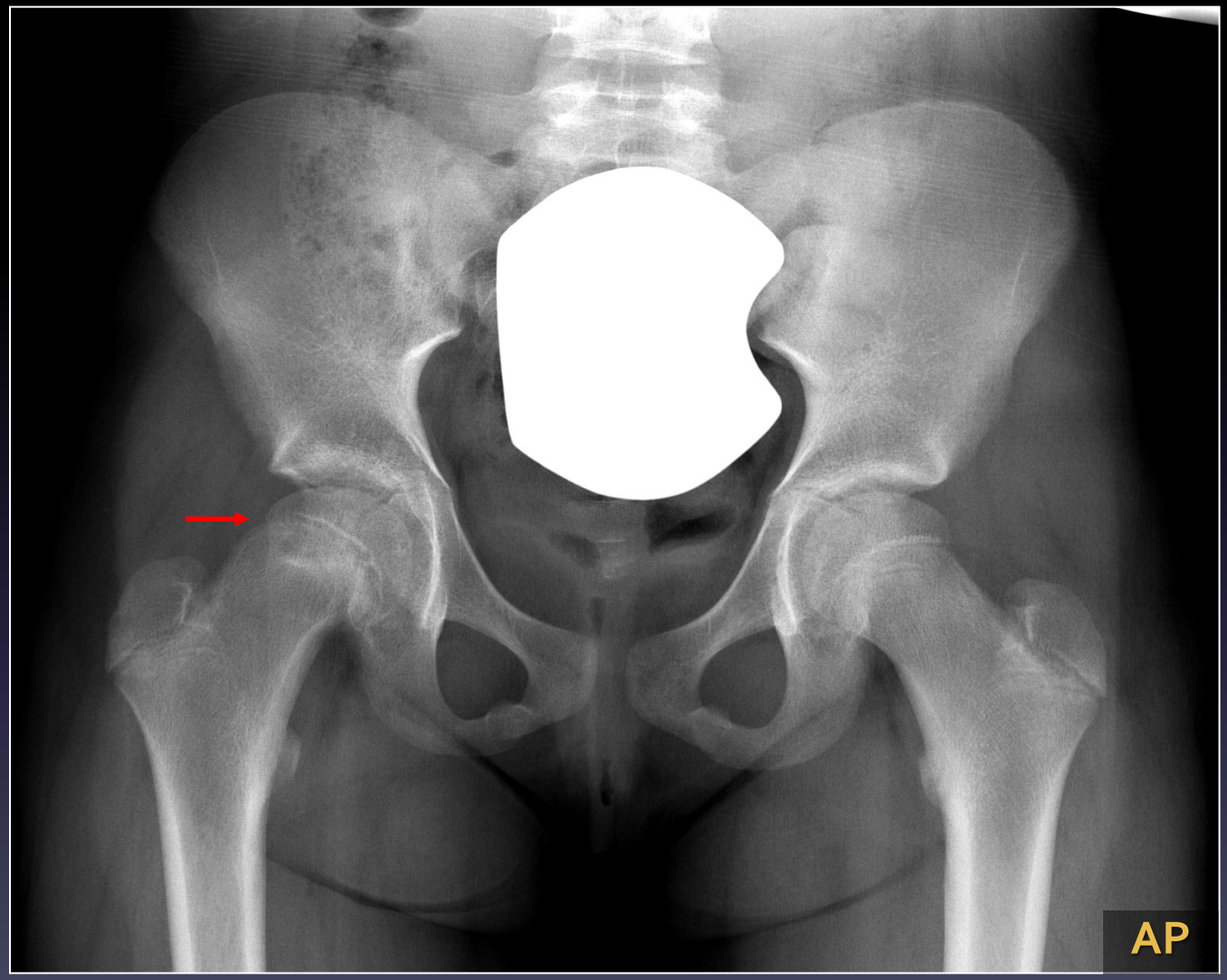
Case 4

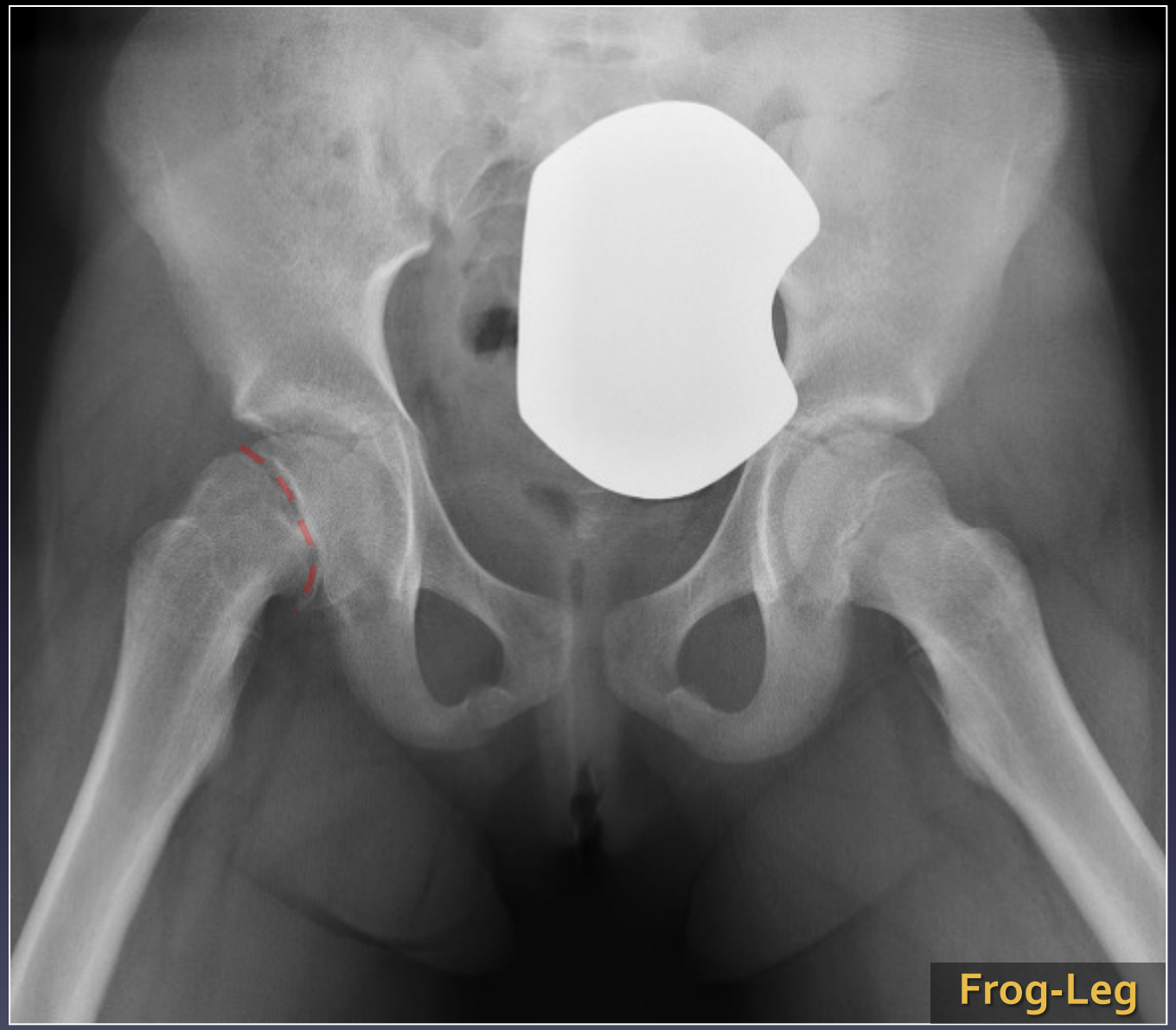
Clinical Scenario:

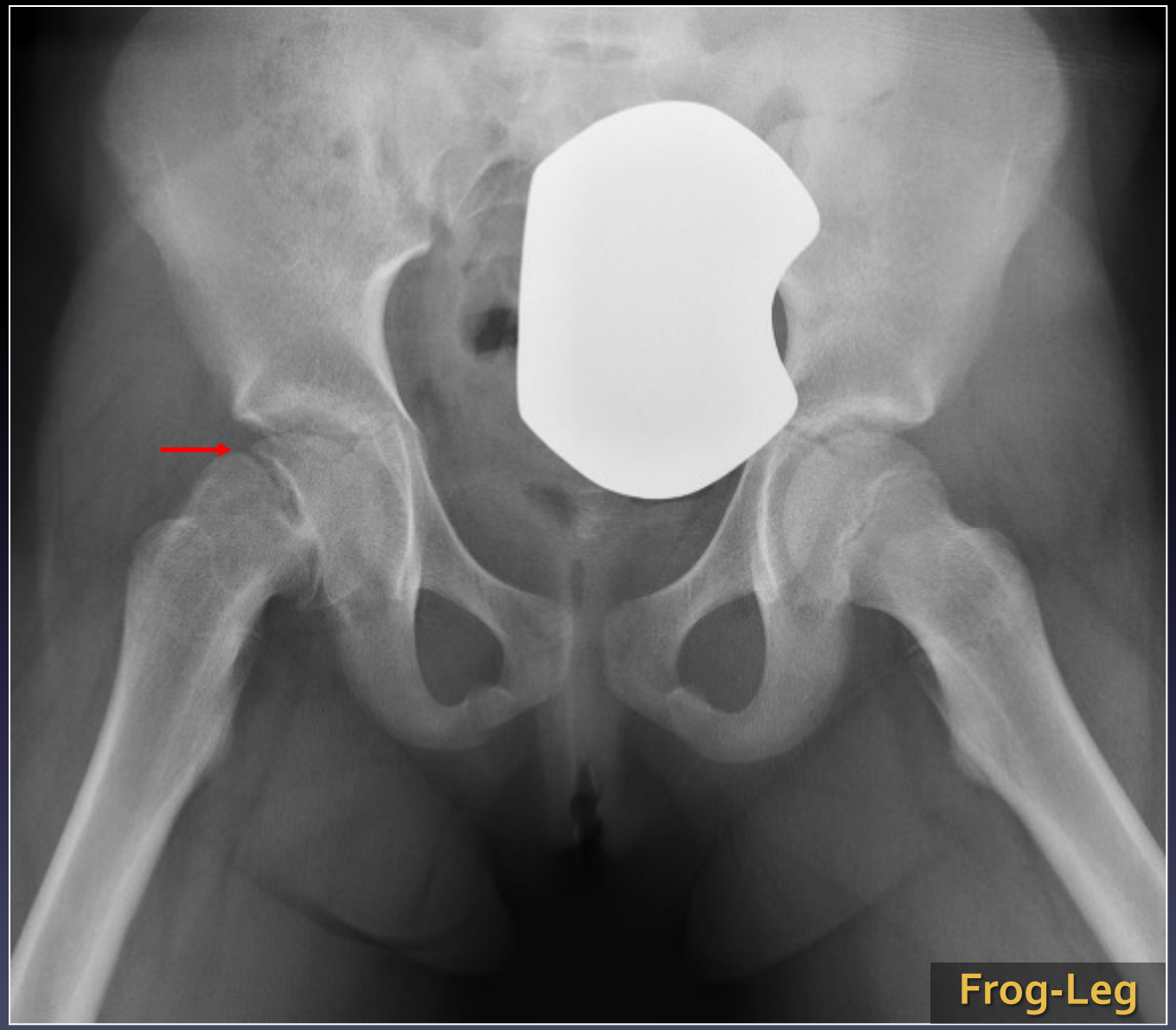
9 yo obese female with one month of left hip pain.

The most appropriate next step is:

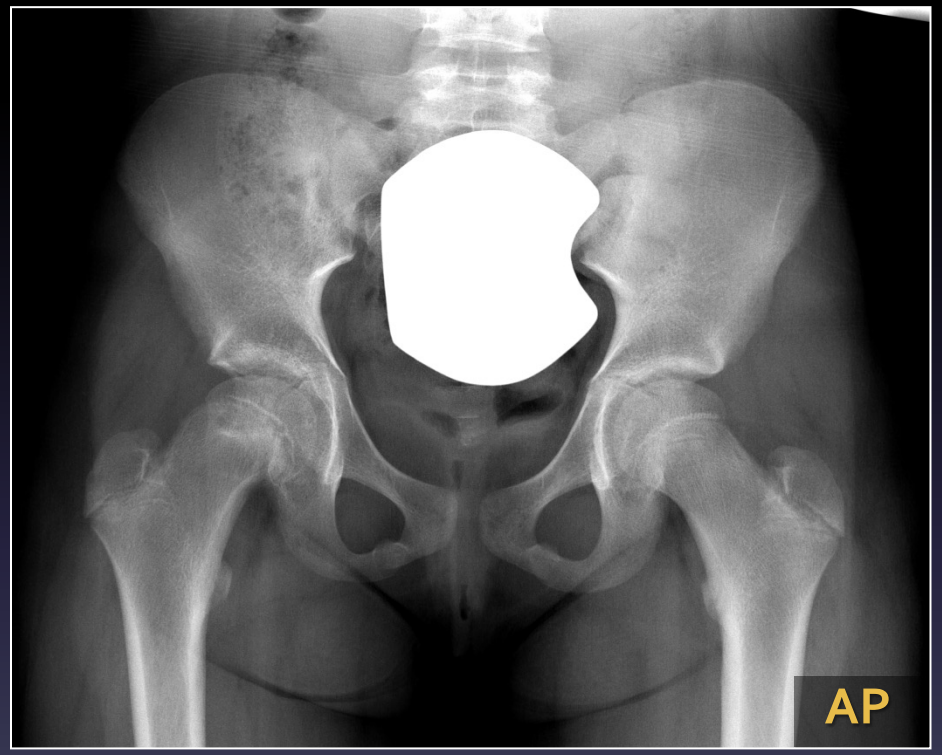
1. AP radiograph of the right hip
2. AP and frog leg view of the right hip
3. AP and frog leg view of the pelvis
4. MRI of pelvis


AP


Frog-Leg

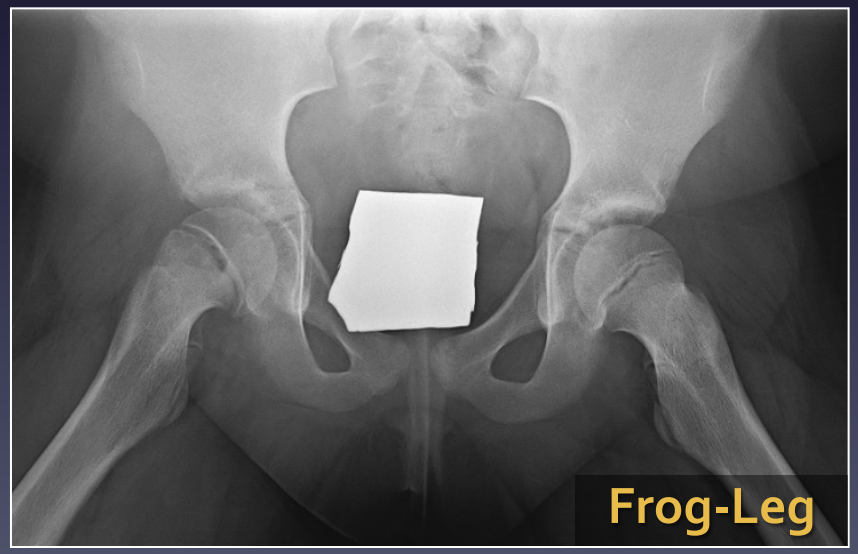

Frog-Leg

Right slipped Capital Femoral Epiphysis

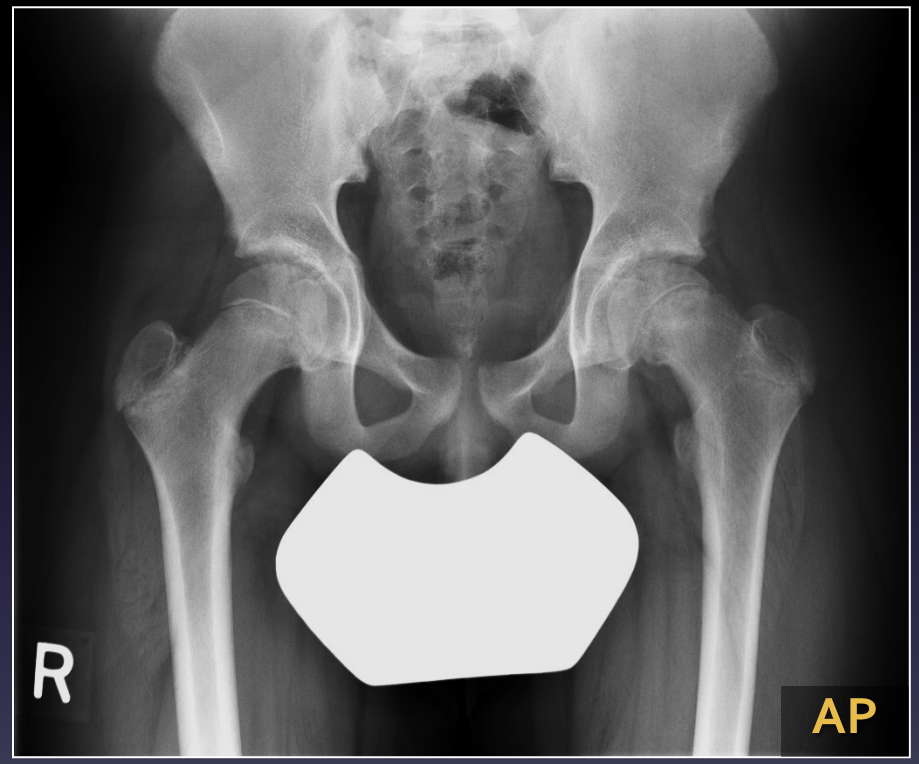


Slipped Capital Femoral Epiphysis

- Displacement of epiphysis
  - ↑↑ posterior
  - ↑ medial
- Etiology
  - Multifactorial
  - Obesity
  - Delayed skeletal maturity
    - Hypothyroidism
    - hypogonadism
  - Rickets

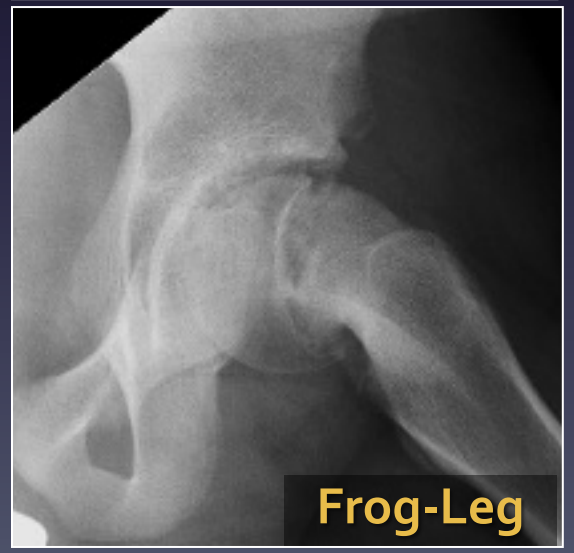


Slipped Capital Femoral Epiphysis



- Clinical
  - Poorly localized hip/groin pain may radiate to knee
  - Can be bilateral
    - 18-63%
    - Importance of AP/frog leg both hips and pelvis

Slipped Capital Femoral Epiphysis



- Clinical
  - Poorly localized hip/groin pain may radiate to knee
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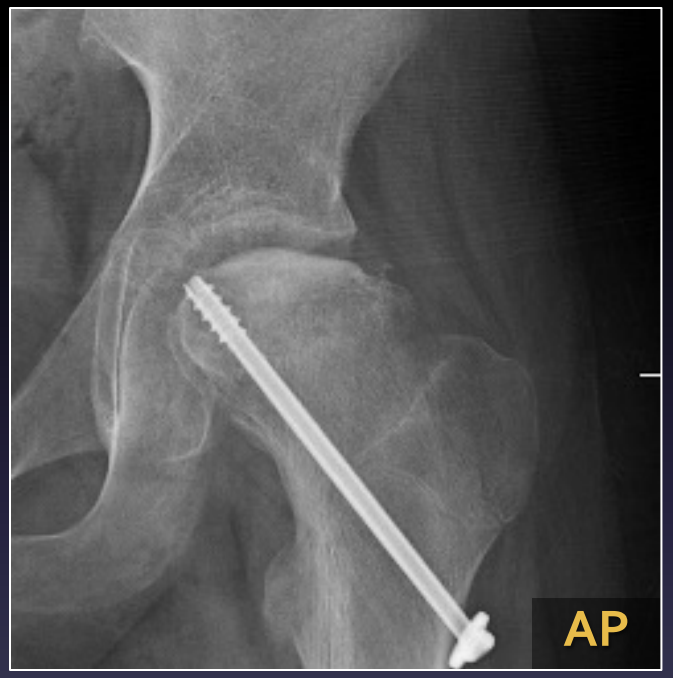
The most appropriate next step is:

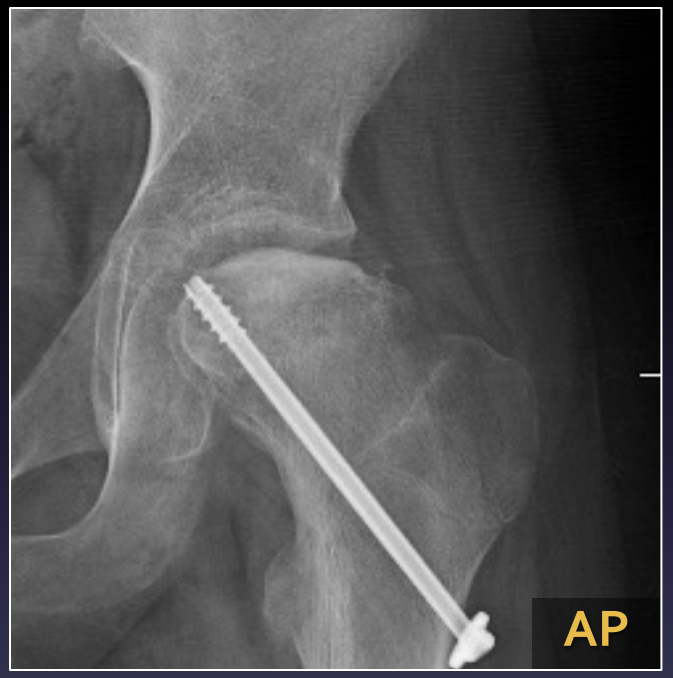
1. AP radiograph of the right hip
2. AP and frog leg view of the right hip
3. AP and frog leg view of the pelvis
4. MRI of pelvis

Slipped Capital Femoral Epiphysis



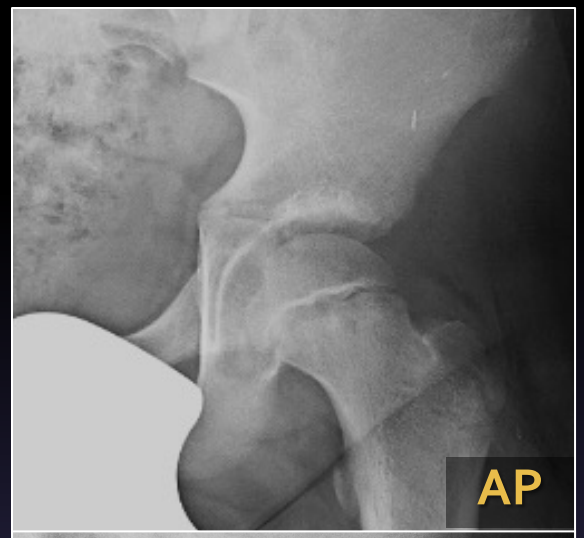
- Clinical
  - Poorly localized hip/groin pain may radiate to knee
  - Can be bilateral
    - 18-63%
    - Importance of AP/frog leg both hips and pelvis
  - Stable (90%) vs Unstable (10%)
    - Ability to bear weight
    - Avascular necrosis

Slipped Capital Femoral Epiphysis



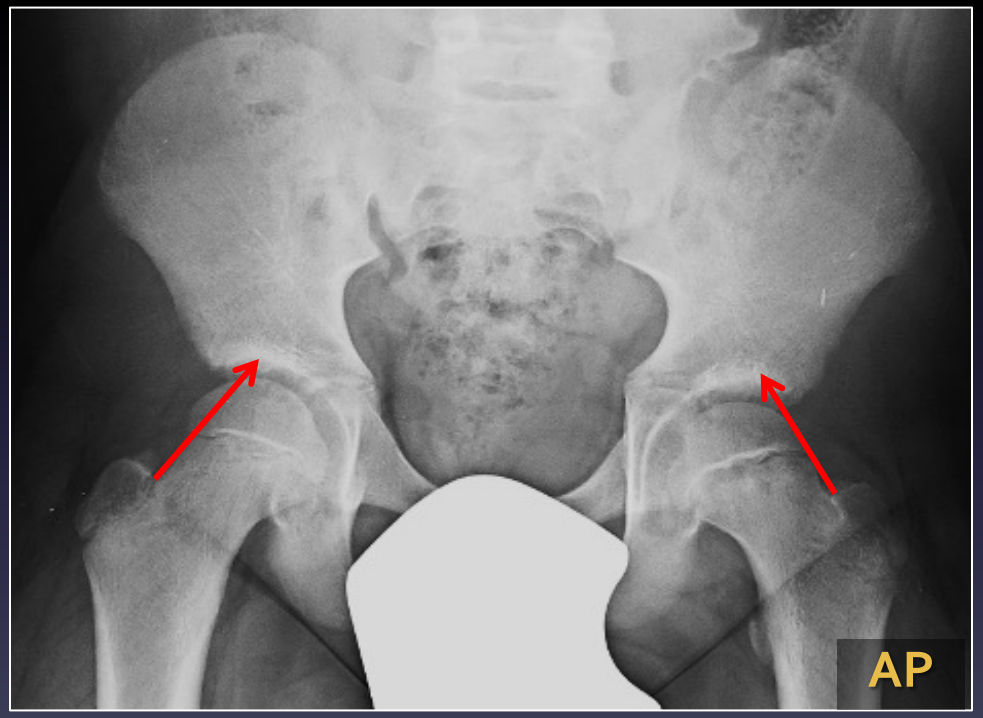
- Clinical
  - Poorly localized hip/groin pain may radiate to knee
  - Can be bilateral
    - 18-63%
    - Importance of AP/frog leg both hips and pelvis
  - Stable (90%) vs Unstable (10%)
    - Ability to bear weight
    - Avascular necrosis
  - Acute vs chronic
    - Symptoms <3 weeks

Slipped Capital Femoral Epiphysis



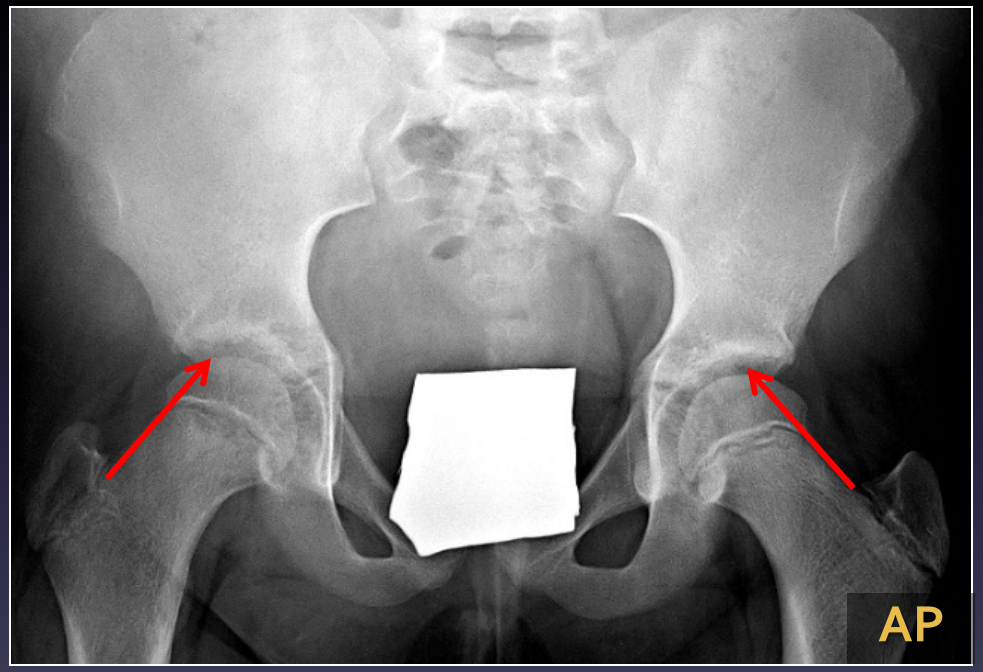
- Radiographic findings
  - Physeal widening
  - Posterior slip

Slipped Capital Femoral Epiphysis



- Radiographic findings
  - Physeal widening
  - Posterior slip
  - Klein's line (AP)

Slipped Capital Femoral Epiphysis



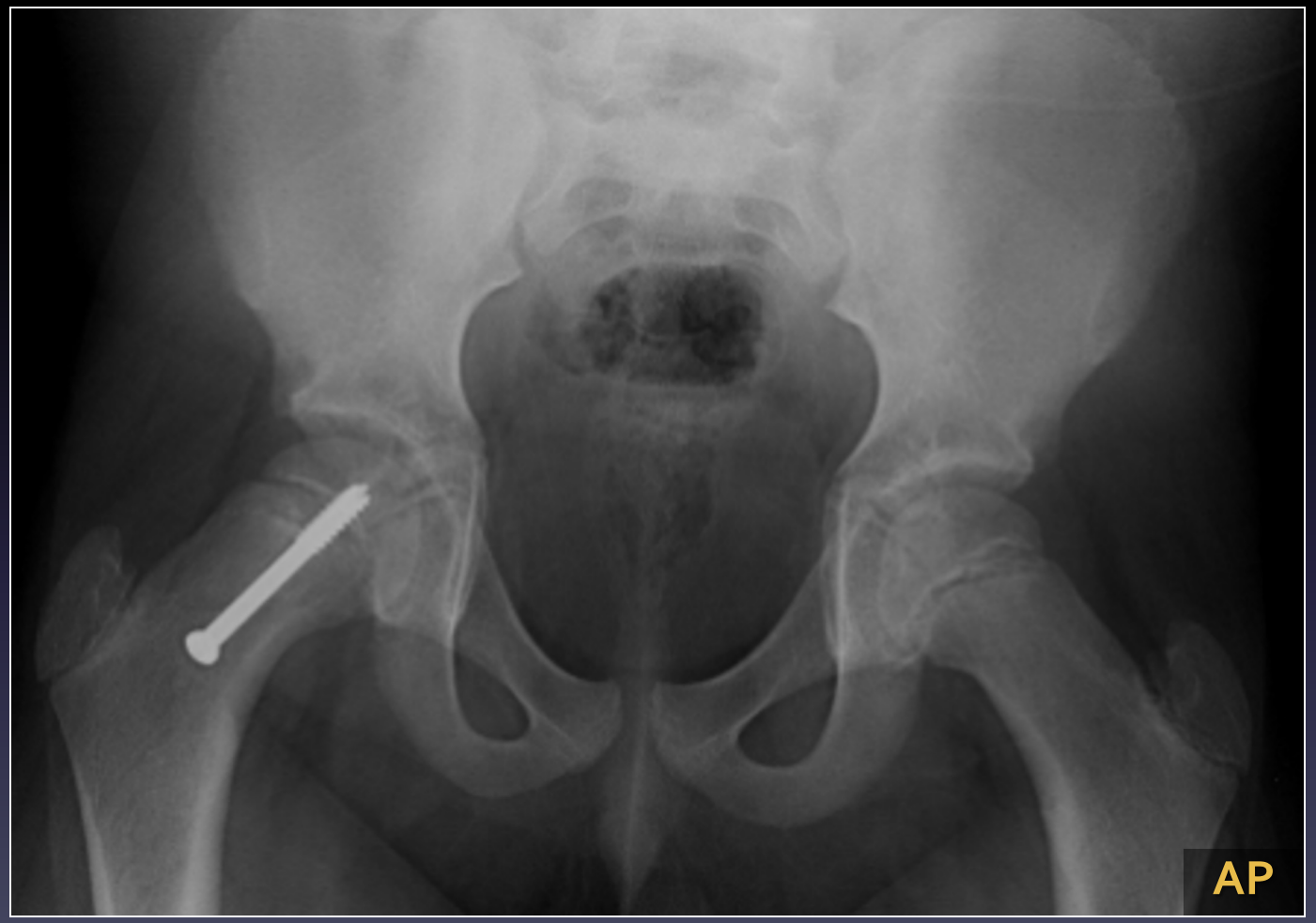
- Radiographic findings
  - Physeal widening
  - Posterior slip
  - Klein's line (AP)
    - >2mm Δ from control hip
    - Importance of AP/frog leg both hips and pelvis

Slipped Capital Femoral Epiphysis

- Radiographic findings
  - Physeal widening
  - Posterior slip
  - Klein's line (AP)
    - >2mm Δ from control hip
    - Importance of AP/frog leg both hips and pelvis
  - Decreased height of epiphysis

Slipped Capital Femoral Epiphysis

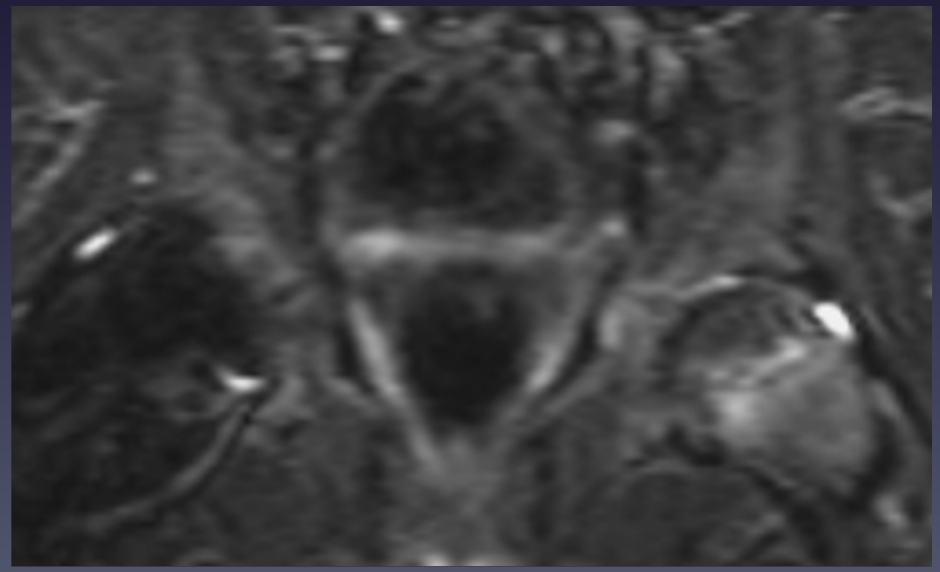
- Radiographic findings
  - Physeal widening
  - Posterior slip
  - Klein's line (AP)
    - >2mm Δ from control hip
    - Importance of AP/frog leg both hips and pelvis
  - Decreased height of epiphysis
  - Metaphyseal blanch sign



13 yo boy with decreased internal rotation left hip, no pain

Pre-slip Left SCFE

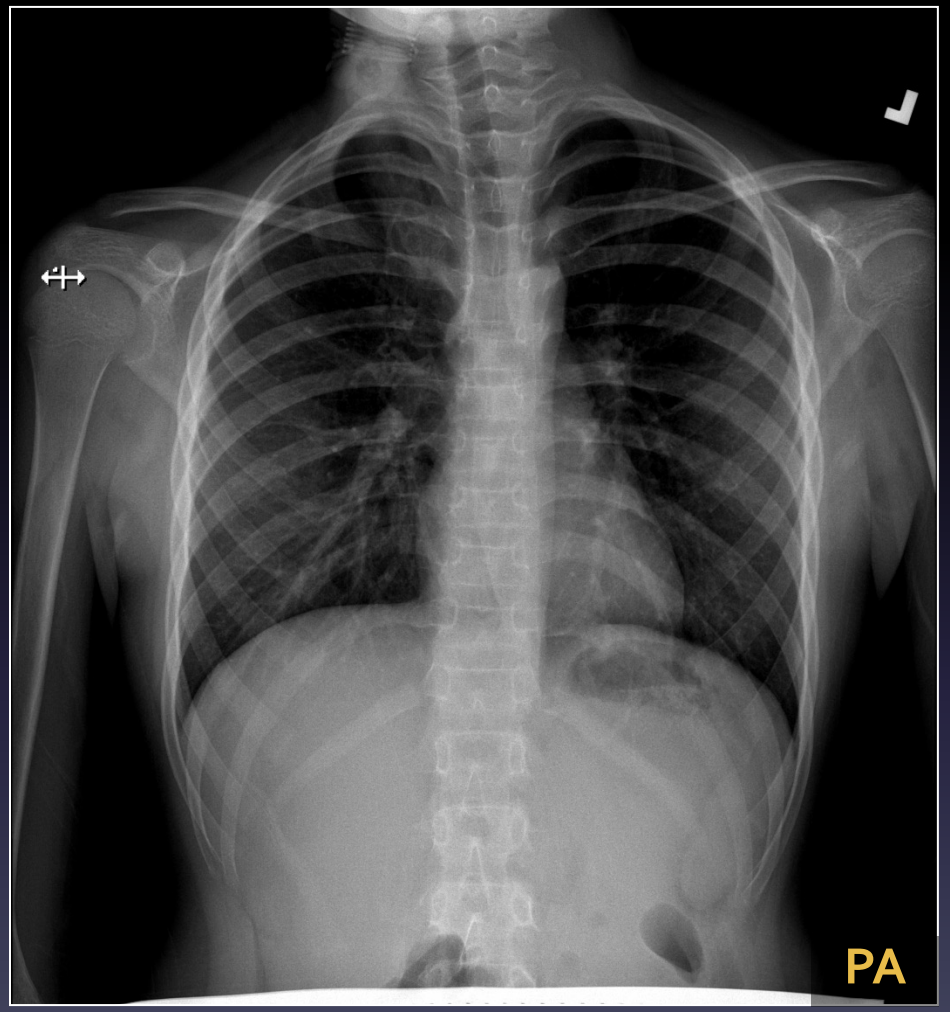
- Clinical
  - Hip pain with normal radiographs
  - Subtle findings on physical exam
- MRI Findings:
  - Mild periphyseal edema
  - Early physeal changes prior to slip



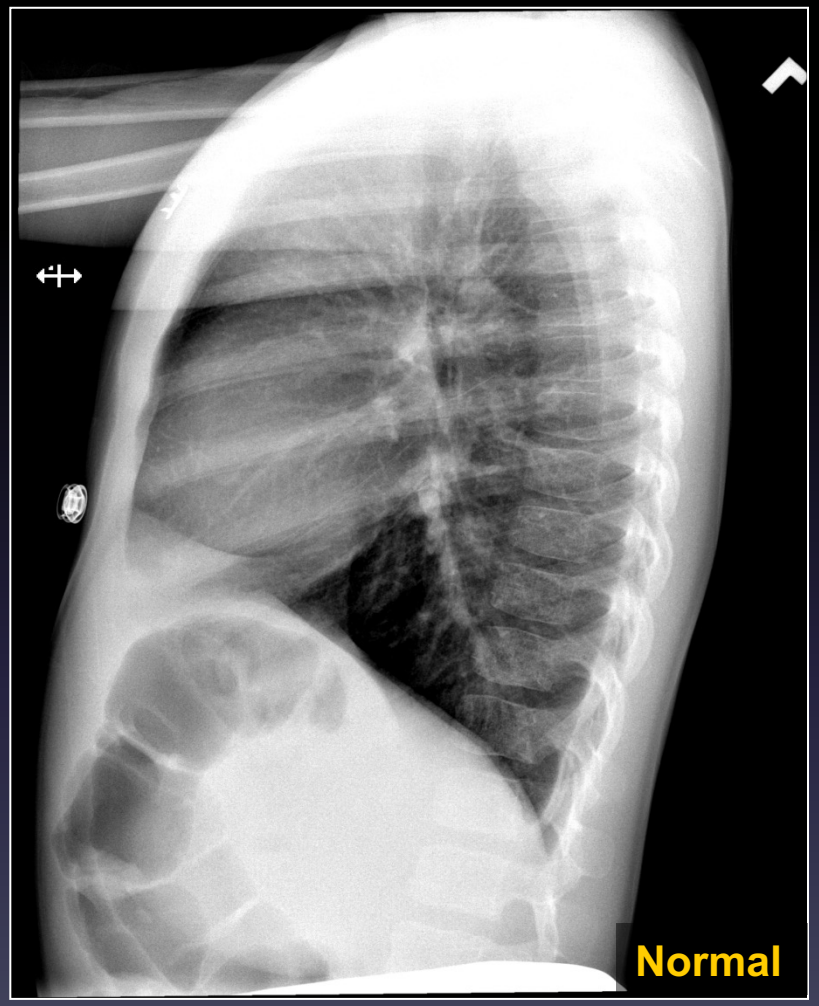
Case 5

Clinical Scenario:

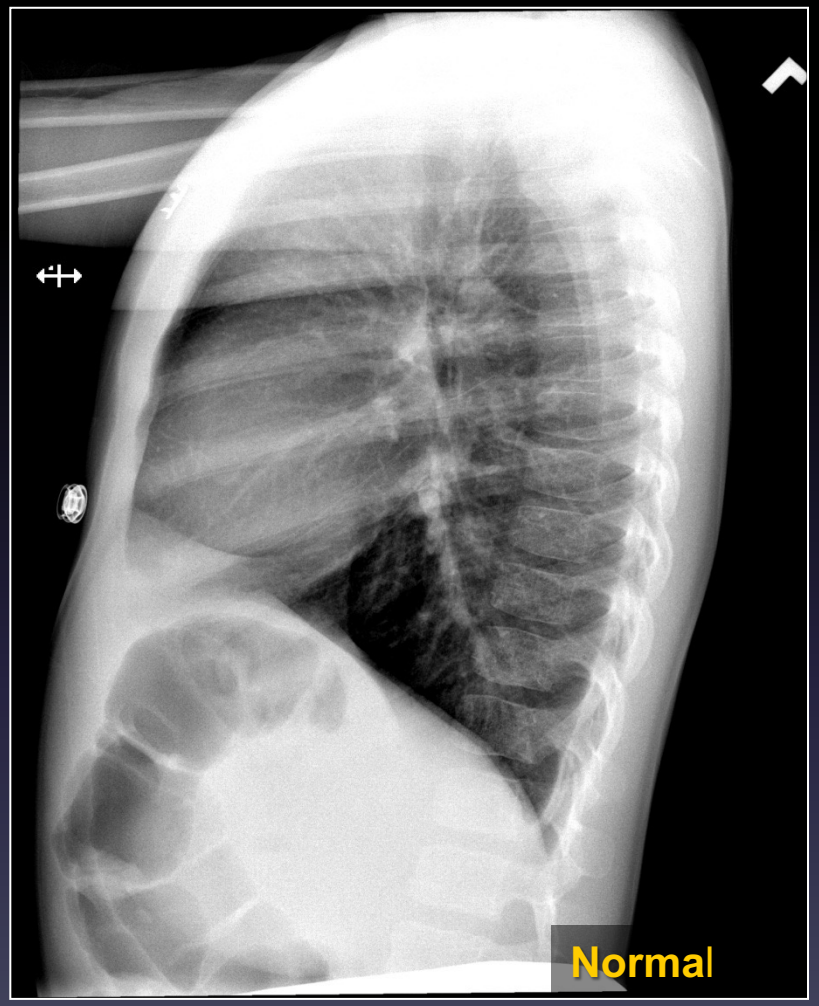
9 yo female with back pain for 2 weeks. Two months of left wrist pain and swelling.

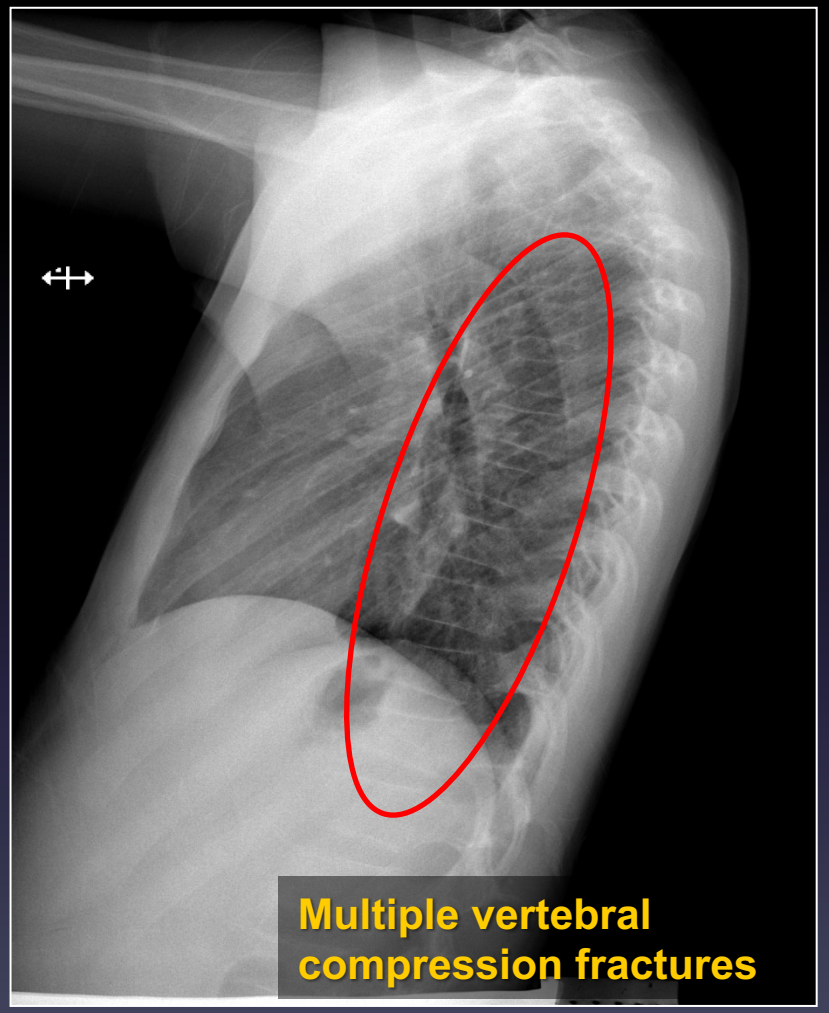

PA


Lateral

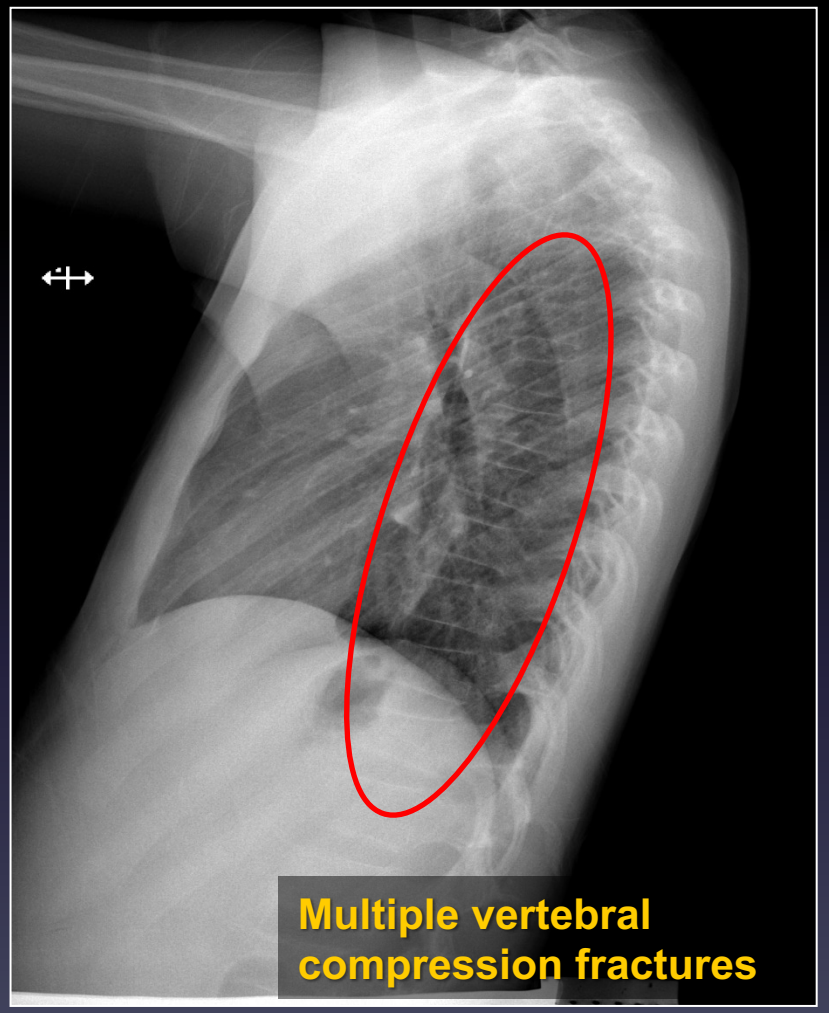

Normal


Demineralization


Normal


Multiple vertebral
compression fractures

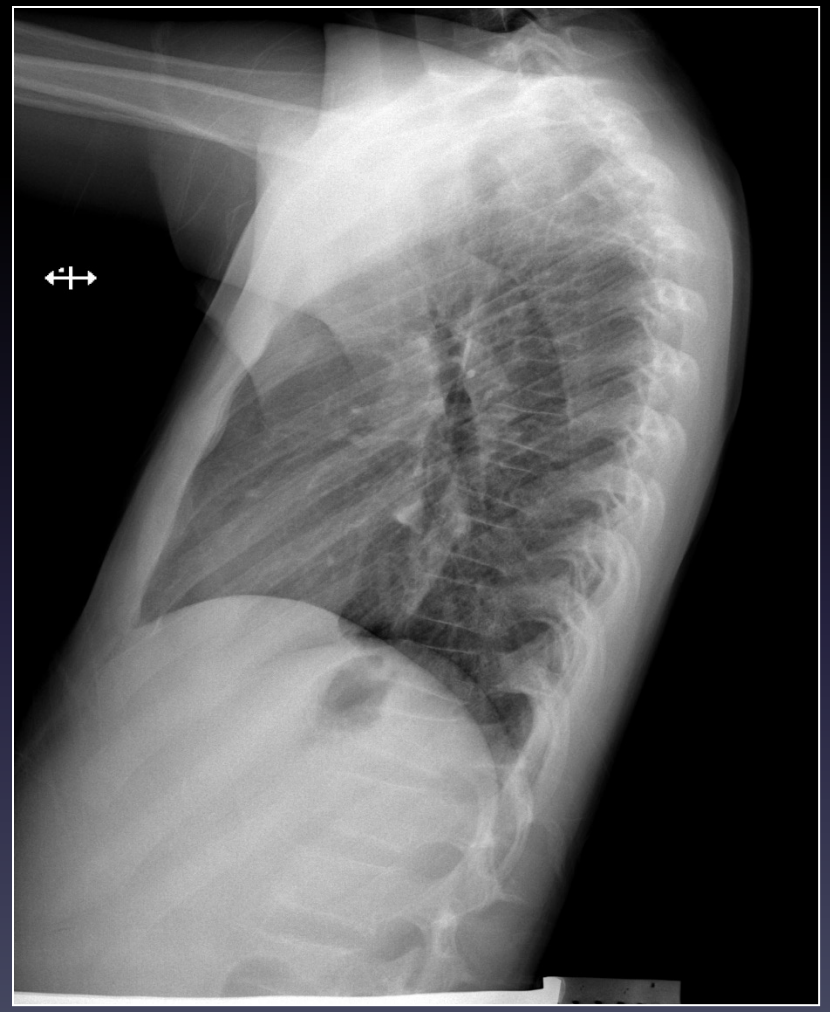
- Compression fractures
  - Trauma
  - Steroids
  - Osteogenesis imperfecta
  - Leukemia/lymphoma
  - LCH
  - Metastasis



Her mom reports no history of an underlying medical condition. There is no history or trauma. She does not take any medications.

Leukemia

- Musculoskeletal symptoms
  - 20-50% pts
- Sinigaglia et al (2008)
  - Pain
  - Functional impairment
  - Limping
  - Swelling
  - Joint effusion



Leukemia

- Musculoskeletal symptoms
  - 20-50% pts
- Radiographic manifestations
  - Generalized osteopenia
  - Metaphyseal lucent band
  - Periosteal reaction
  - Osteosclerosis
  - Osteolysis
  - Pathologic fracture
  - Permeative bone lesion

The most common osseous manifestation of leukemia is:

1. Pathologic fractures
2. Metaphyseal lucent bands
3. Osteoporosis
4. Lytic lesion

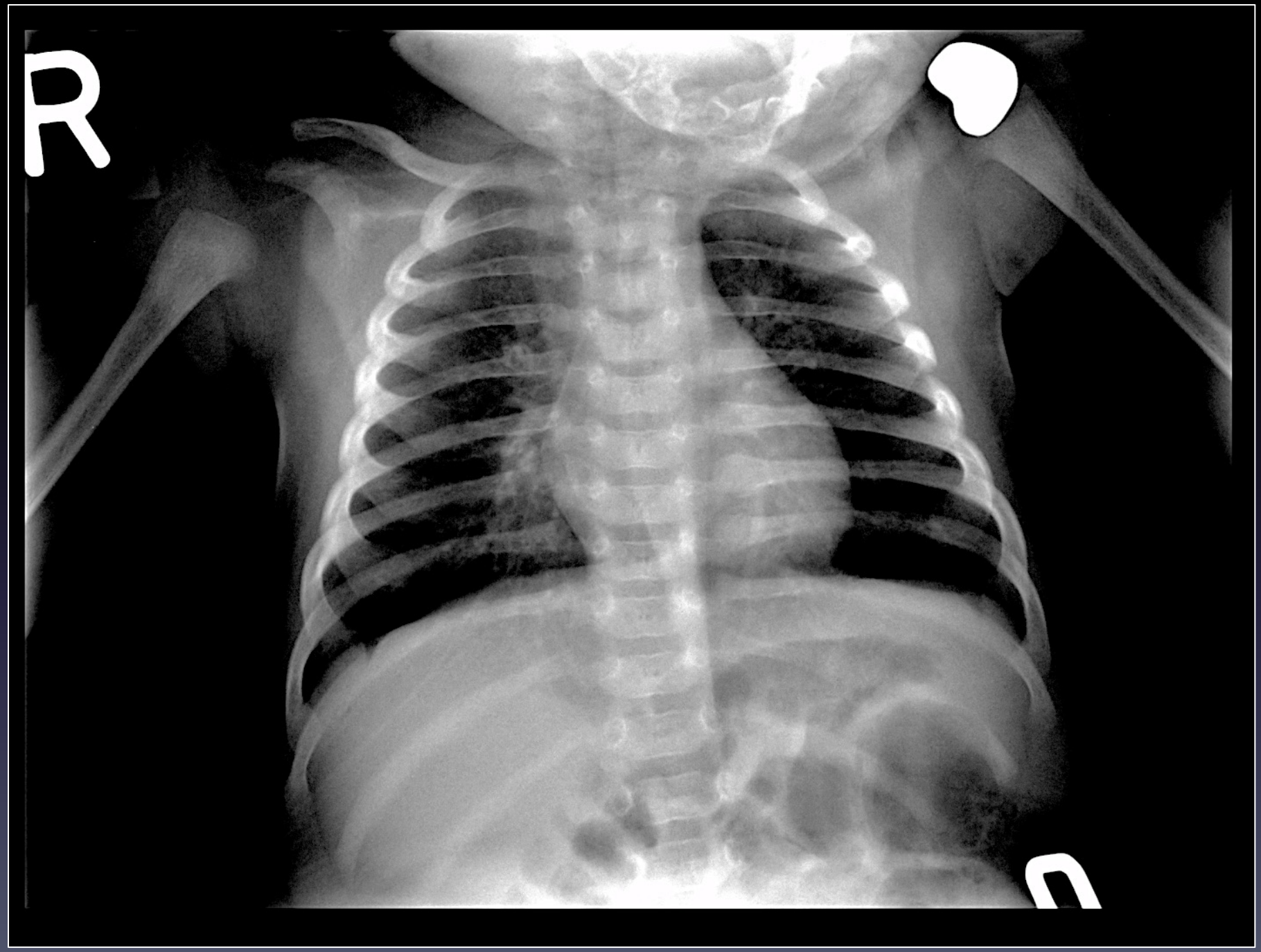
The most common osseous manifestation of leukemia is:

1. Pathologic fractures
2. Metaphyseal lucent bands
3. Osteoporosis
4. Lytic lesion

Case 6

Clinical Scenario:

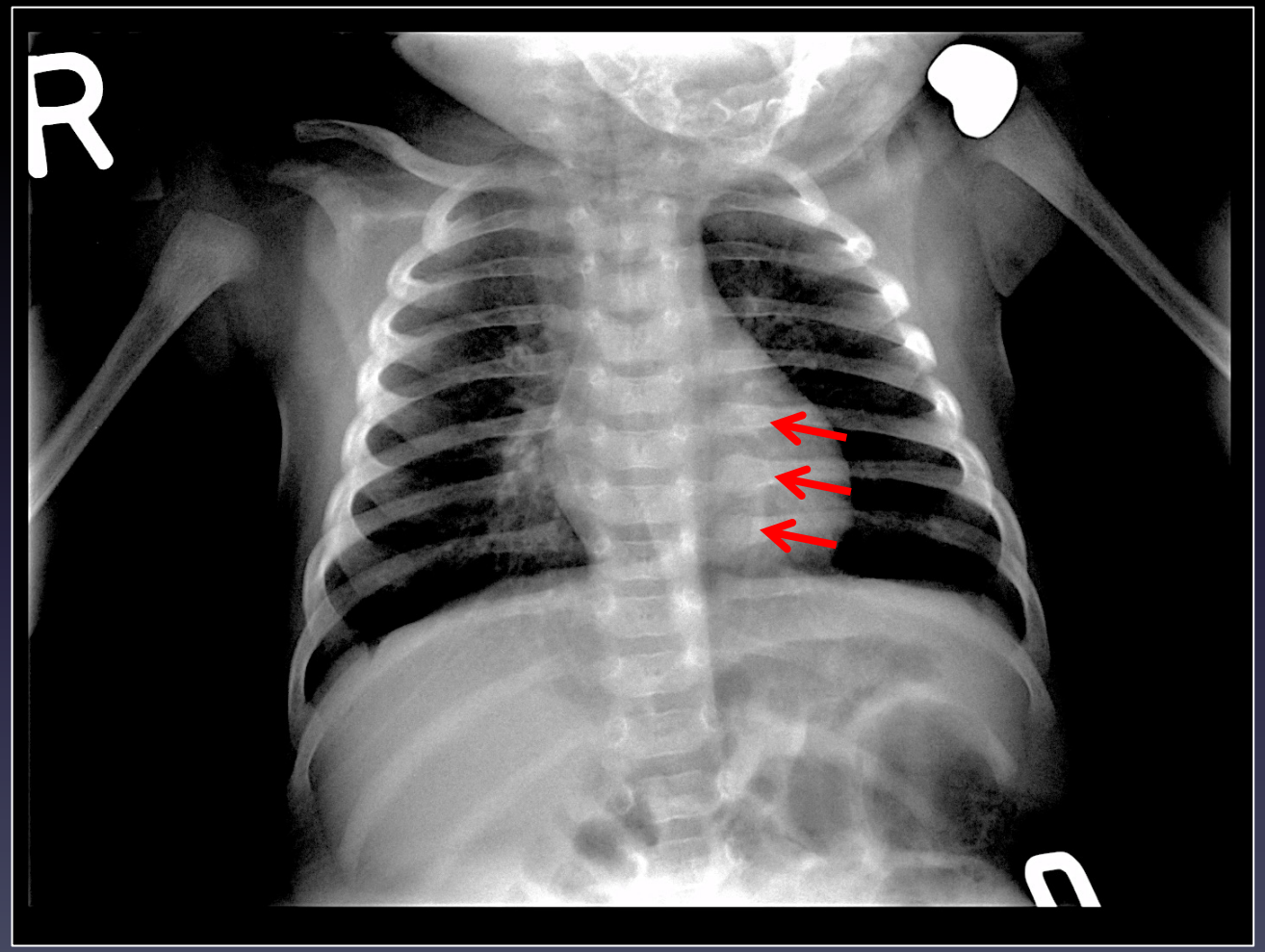
1 month old male presenting with cough.


R

What is the next best step:

1. Tc-99m bone scan
2. Discharge home with supportive care
3. Skeletal survey
4. Admit for IV antibiotics

Healing posterior rib fractures



American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: Suspected Physical Abuse — Child

Variant 1: Child 24 months of age or younger, no focal neurologic signs or symptoms.

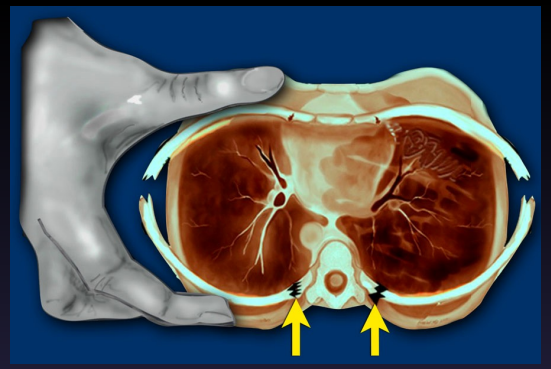
Radiologic Procedure	Rating	Comments	RRL*
X-ray skeletal survey	9		☢☢☢
CT head without contrast	7	Particularly for patients who are at "high risk" (eg, with rib fractures, multiple fractures, or facial injury, or less than 6 months of age).	☢☢☢
MRI head without contrast	5	If further evaluation is indicated after CT examination.	O
MRI head without and with contrast	5	If further evaluation is indicated after CT examination. Administration of contrast is suggested if indicated due to prior CT findings or findings on noncontrast portion of MRI. See statement regarding contrast in text under "Anticipated Exceptions."	O
Tc-99m bone scan whole body	4	If skeletal survey is negative and high clinical suspicion remains.	☢☢☢
CT head without and with contrast	1		☢☢☢☢
CT head with contrast	1		☢☢☢

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level

Child abuse – rib fractures

- One of most common and specific injuries in abused childnre; PPV up to 95% in children < 3yo
- No known association with birth trauma
- Other high specificity for abuse fractures:
  - Classic metaphyseal lesion, aka corner/bucket handle fx
  - "S" fractures: sternum, spinous process, scapula



https://radiologyassistant.com

Case 7

Clinical Scenario:

13 yo female presenting with right knee pain, swelling, and ecchymosis after twisting her knee while jumping rope. She cannot actively extend her knee.

What is the next best step?

1. Radiographs of the left knee
2. MRI of the left knee
3. Ultrasound of the left knee
4. CT of the left knee

ACR Appropriateness Criteria:

Acute Knee Pain

Variant 2: **Adult or child >1 year old. Fall or twisting injury, with one or more of the following: focal tenderness, effusion, inability to bear weight. First study.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray knee	9		☢
MRI knee without contrast	5		O
US knee	2		O
CT knee without contrast	2	The RRL for the adult procedure is ☢.	☢☢
Tc-99m bone scan with SPECT lower extremity	2		☢☢☢
MRI knee without and with contrast	1		O
MRA knee without and with contrast	1		O
MRA knee without contrast	1		O
CT knee with contrast	1	The RRL for the adult procedure is ☢.	☢☢
CT knee without and with contrast	1	The RRL for the adult procedure is ☢.	☢☢

Rating Scale: **1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate** ***Relative Radiation Level**

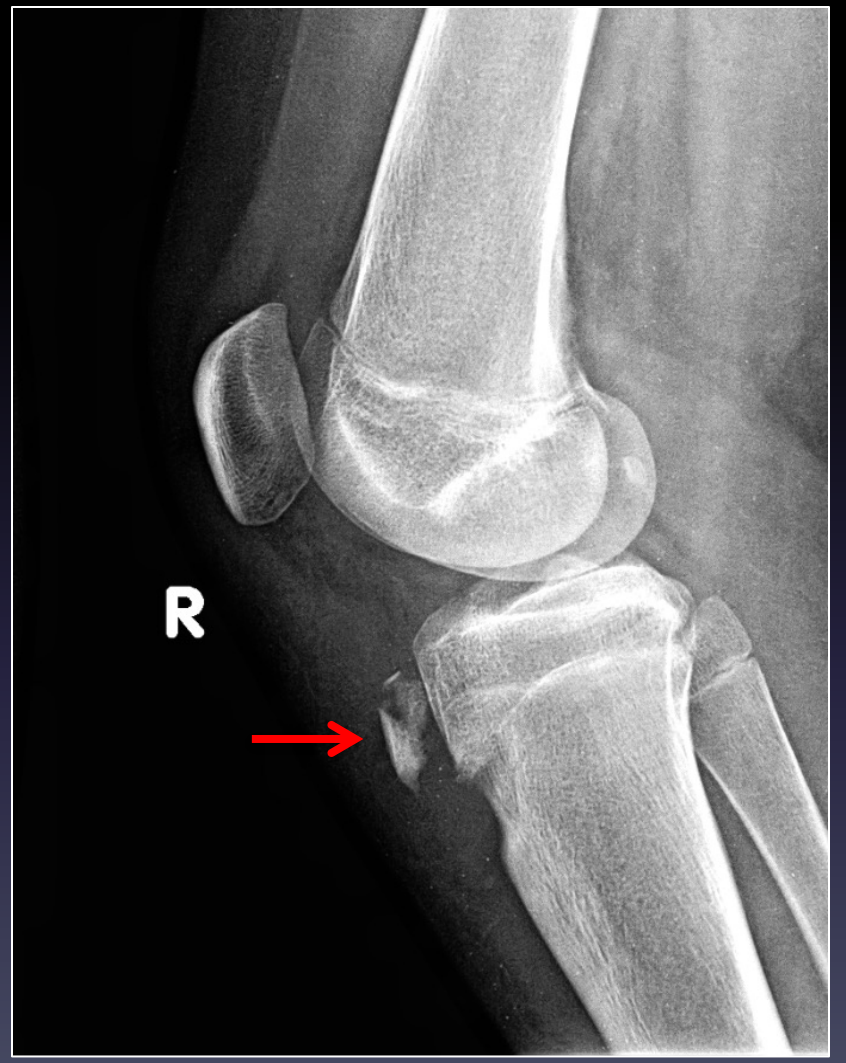
What is the next best step?

1. Radiographs of the left knee
2. MRI of the left knee
3. Ultrasound of the left knee
4. CT of the left knee


R
AP


R
Lateral


Normal

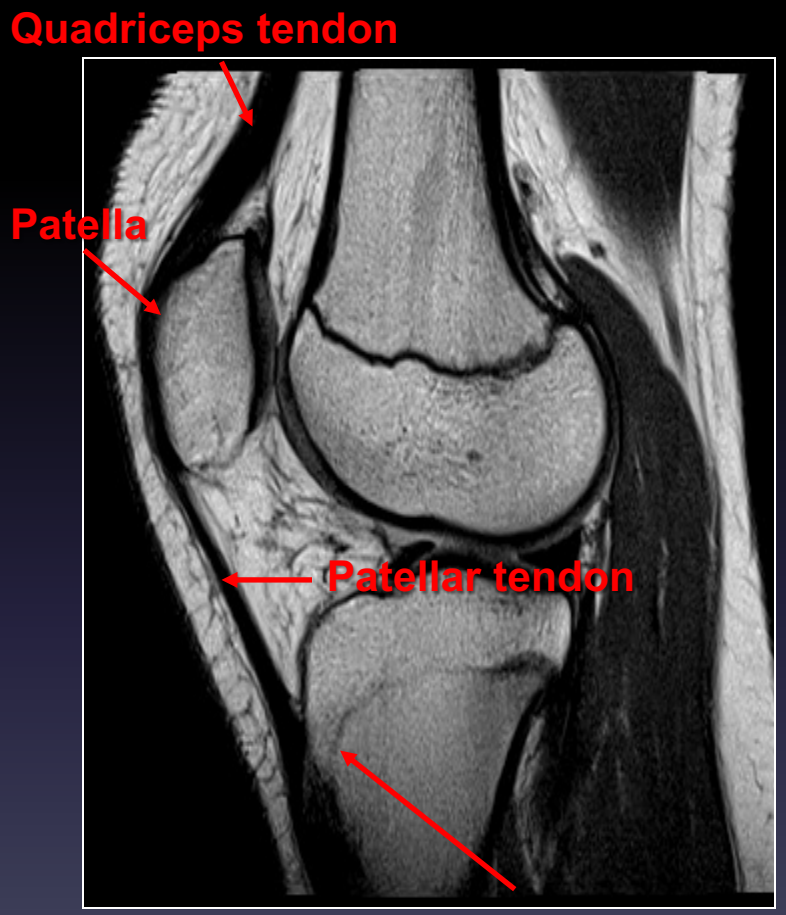

R

Tibial Tuberosity Avulsion

- Adolescents approaching skeletal maturity
  - 14-17yrs of age
- Mechanism
  - Vigorous quadriceps contraction
  - Jumping sports

17 yo boy w/ injury following a jump while playing basketball

Tibial Tuberosity Avulsion



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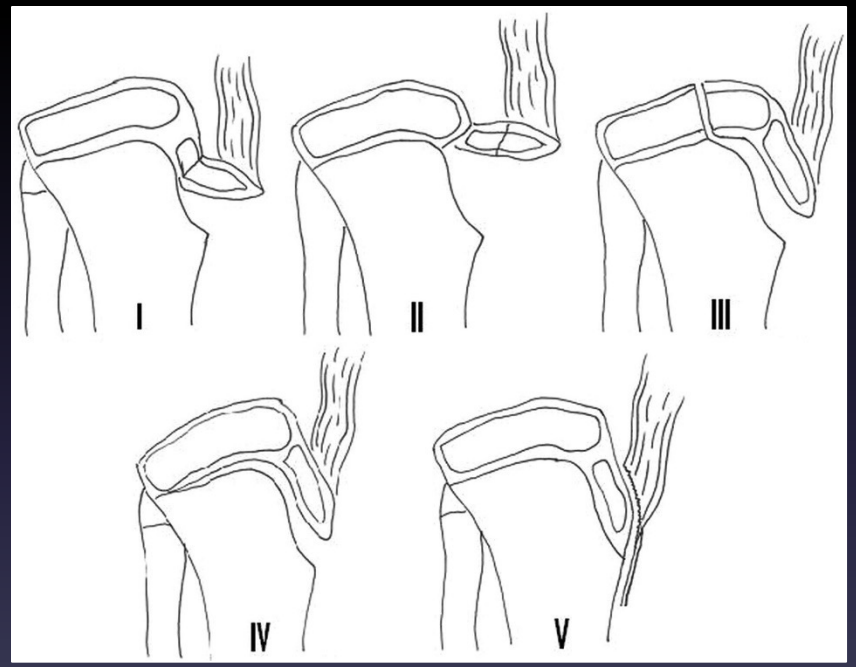
  - Jumping sports

Tibial Tuberosity Avulsion



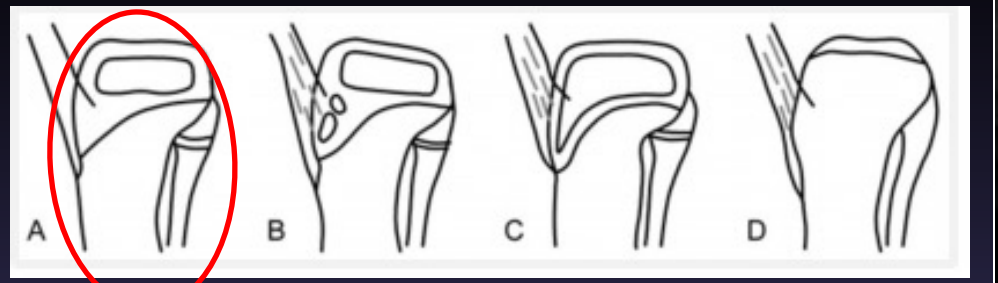
- Adolescents approaching skeletal maturity
  - 14-17yrs of age
- Mechanism
  - Vigorous quadriceps contraction
  - Jumping sports
- Treatment
  - Displacement
  - Comminution
  - Intra-articular extension

Shital N. Parikh et al. J Bone Joint Surg Am 2010;92:2947-2958

Non displaced avulsion fracture?

Normal variant

4 Stages of Development of the Tibial Tubercle

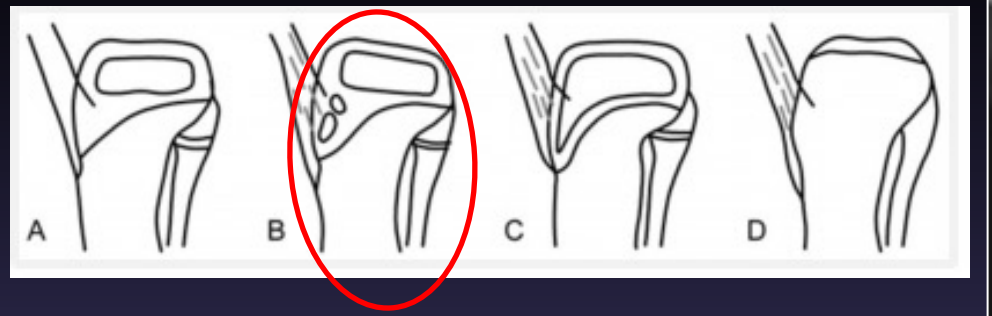


Cartilaginous

Girls: < 8yrs

Boys: <9yrs

4 Stages of Development of the Tibial Tubercle

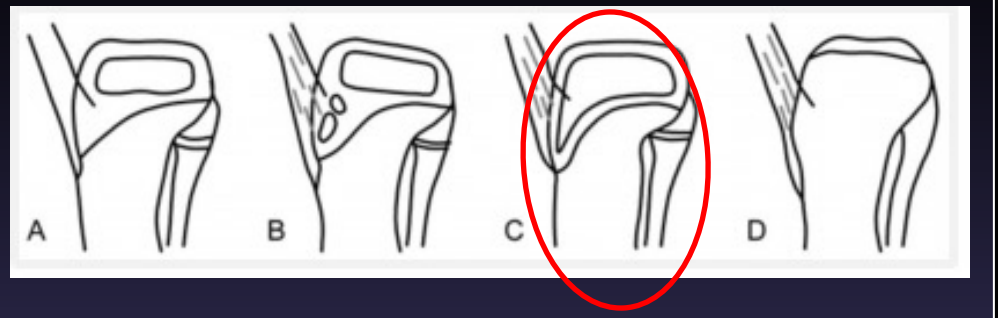


Apophyseal

Girls: 8-12yrs

Boys: 9-14yrs

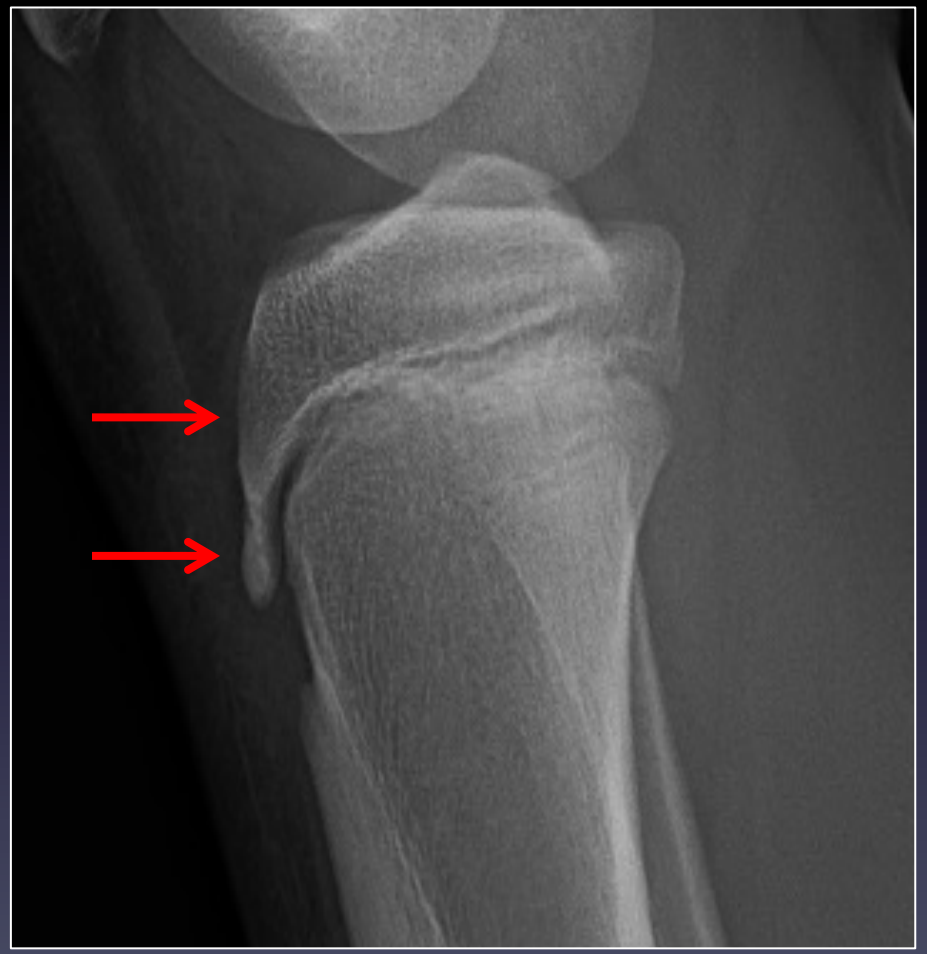
4 Stages of Development of the Tibial Tubercle



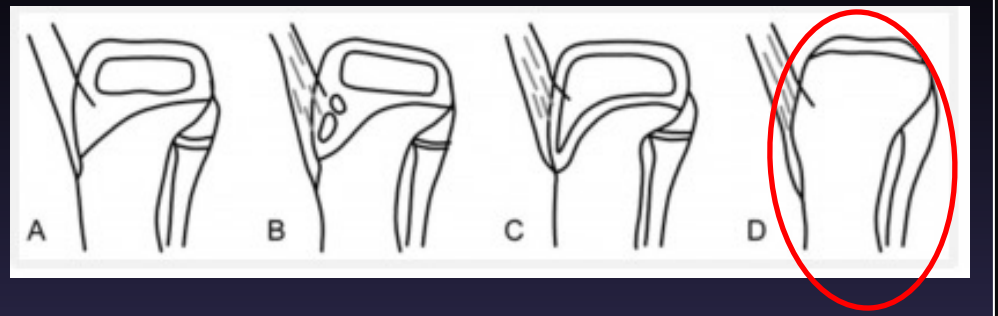
Epiphyseal

Girls: 10-15yrs

Boys: 11-17yrs



4 Stages of Development of the Tibial Tubercle



Bony

Girls: 15yrs

Boys: 17yrs

Osgood Schlatter Disease

- Common cause of anterior knee pain
- Overuse injury
  - repetitive traction of the patellar tendon upon the tibial tubercle
- Age 10-15
- 30% bilateral

Osgood Schlatter Disease

- Radiographic findings

13 year old female volleyball player with knee pain

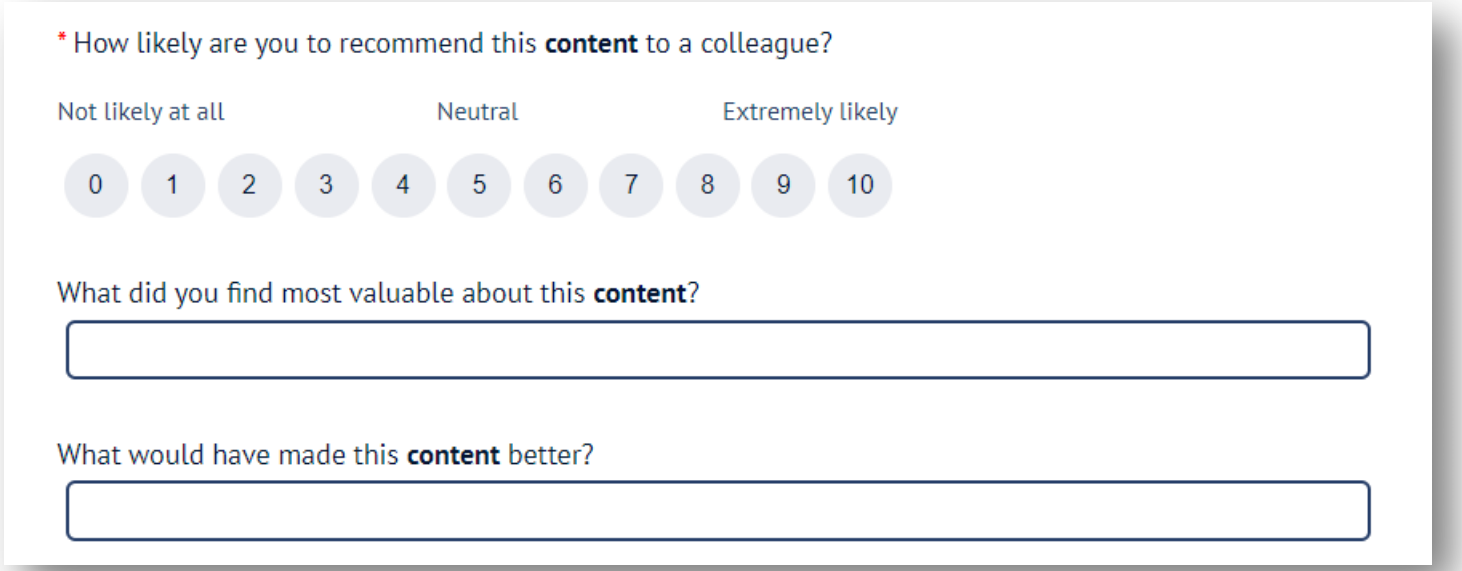
How you can drive change:

1. In a limping toddler with non-localizable symptoms, obtain radiographs of the tibia/fibula prior to obtaining other films.
2. In the setting of elbow trauma, consider ordering an internal oblique radiographs of the elbow for diagnosis of lateral condylar fracture and displacement of lateral condylar fracture
3. If there is concern for slipped capital femoral epiphysis, obtain an AP and frog leg view of the pelvis.

Session Evaluation

DRIVING CHANGE 2023
THE URGENT CARE CONVENTION

- Your feedback is valuable, take a moment to complete the survey for this session.
- To claim CME, you must complete a separate survey available after the convention.



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