Pediatric Lower Extremity Trauma: Pearls, Pitfalls and the Physis

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Disclosures

- I have none.

Pre-test

1. What are the two most important components of evaluating the pediatric trauma patient?

   a) Physical exam and patient weight
   b) X-ray and MRI
   c) Physical exam and X-ray
   d) Physical exam and history

Pre-test

2. A 15mo old boy was going down a slide earlier today in his fathers lap. At the bottom of the slide he was crying but consolable and refused to walk. He is afebrile, crawling around your exam room and has pain only with rotatory stress of his lower leg. His x-rays are negative so he does not have a fracture.

   a) True
   b) False
   c) Neither
   d) All the above and report father to CPS

Pre-test

3. Are all pediatric fractures seen on initial X-ray?

   a) No
   b) Yes
   c) Maybe, depends on if swelling is present
   d) Depends on the cooperation of the child

A Childs Occupation…is to play

…and a child's work is not without risk:

Step 1: History

Trauma is:

- **Specific**
- **Witnessed***
- **Definitive timeline**

Step 2: Examine Your Patient

I. Be the vulture

- Start as far away from the pain as possible and circle in.
  - Ex: Examine asymptomatic side

II. Rely on your history and exam!

- Just because an x-ray is negative doesn't mean you dismiss a fracture
- '+' X-rays confirm. '-' X-rays do not deny!

III. When all else fails:

- Examine your patient

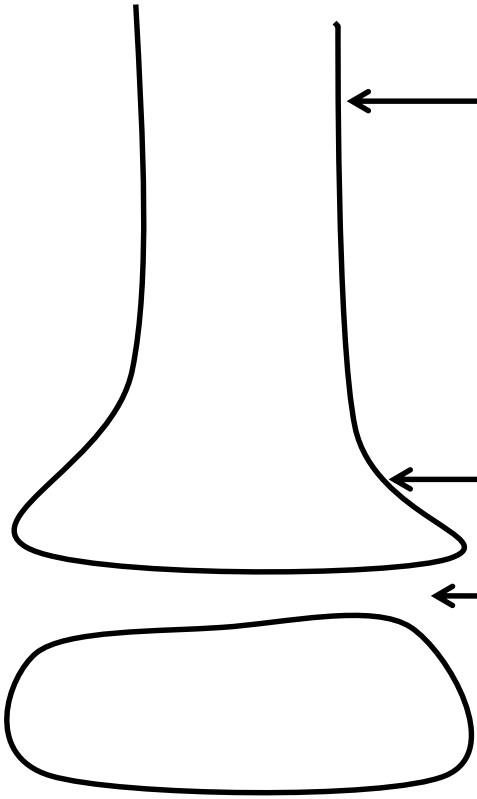
IV. Always consider infection

Step 3: X-ray Your Patient

Describing the X-ray: (Like a Vulture)

I. Age and sex of your patient.
II. Open or Closed
III. Side: Left, Right, Bilateral
IV. Location on bone:
    - Distal, Proximal, etc.
    - Metaphysis, Diaphysis, etc.
V. Bone
VI. Displaced?
VII. Angulation?

Fracture Basics: Parts of Bones



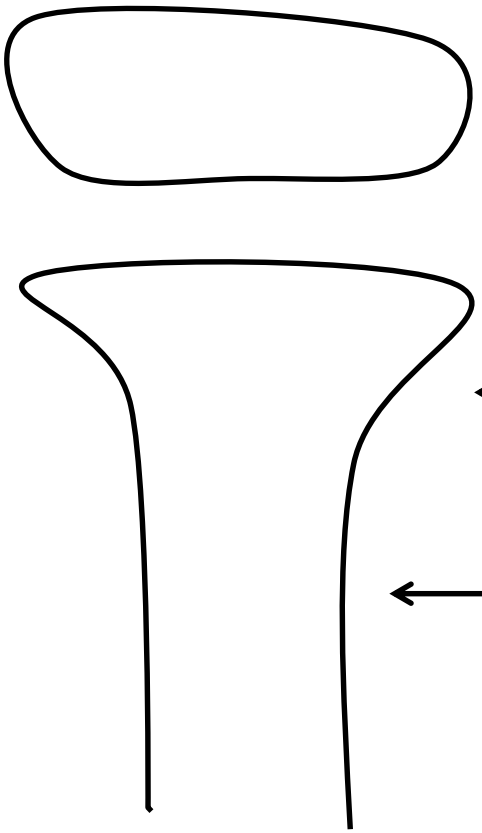
Diaphysis (the skinny part)

Metaphysis (the flared part)

Physis (the Growth Plate)

Epiphysis (the ice cream on the cone)

Fracture Basics: Parts of Bones



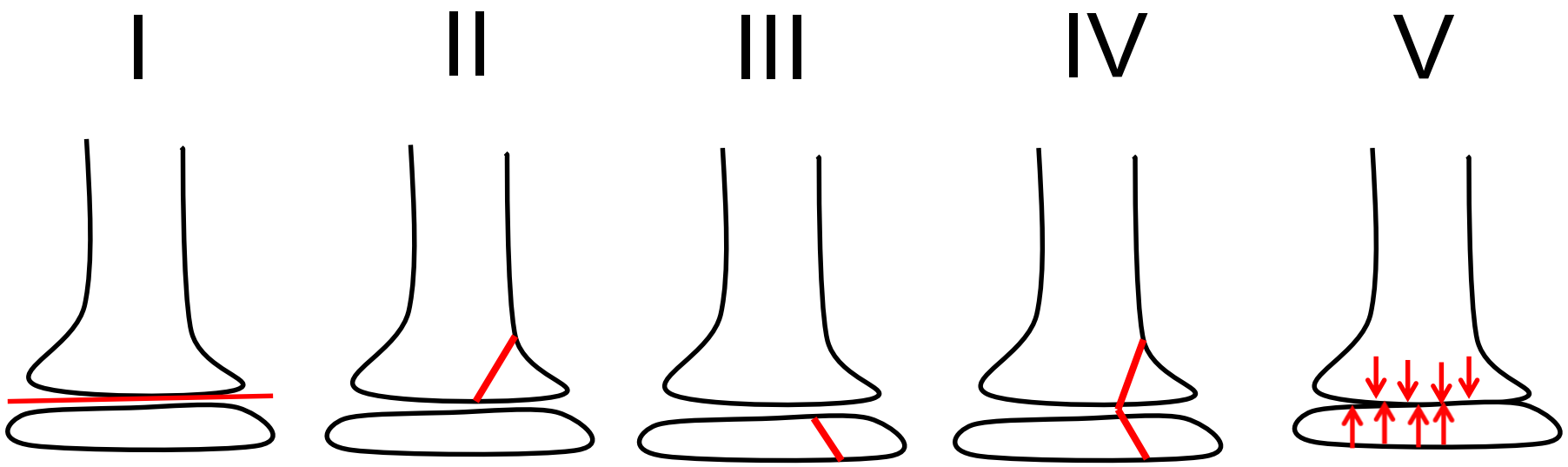
Epiphysis

Physis

Metaphysis

Diaphysis

Fracture Basics: The Salter Harris Classification



Straight (across) **A**bove **L**ower **T**hrough **ER**

I II III IV

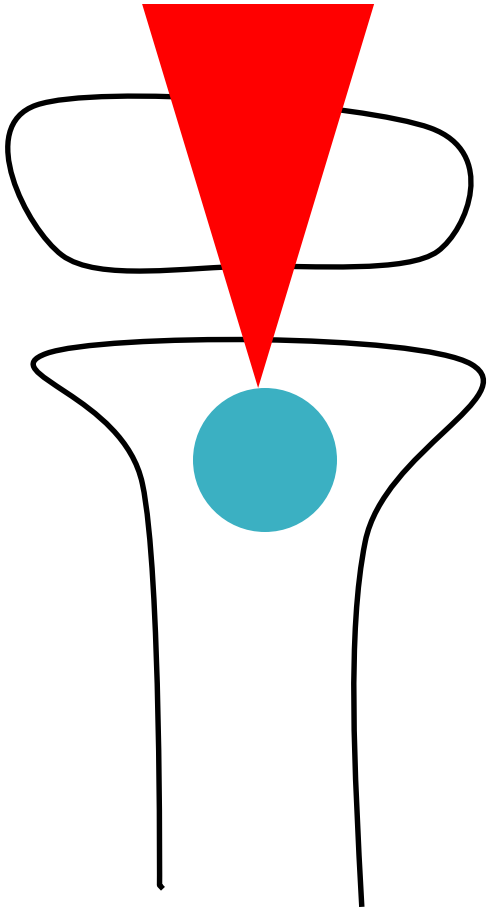
Fracture Basics: The Other Growth Plate

I. Apophyses:

- Growth plate on the surface of the bone
  Ex: Iliac crest
- Growth plate at muscle attachment
  Ex: Tibial Tubercle
- Provide “roundness” to the bone

II. Epiphyseal Plate (Physis):

- At the end of long bones
- Longitudinal growth



Fracture Basics: Pediatric Fracture Pattern Pearls

I. Immature bone can bow and/or compress

= fracture patterns not seen in adults

II. Ligaments and Tendons are stronger than growing bone

=10 yo and younger tend to break (***rarely sprain***)

III. Periosteum is thicker, stronger and more biologically active

= Usually remains intact after fracture

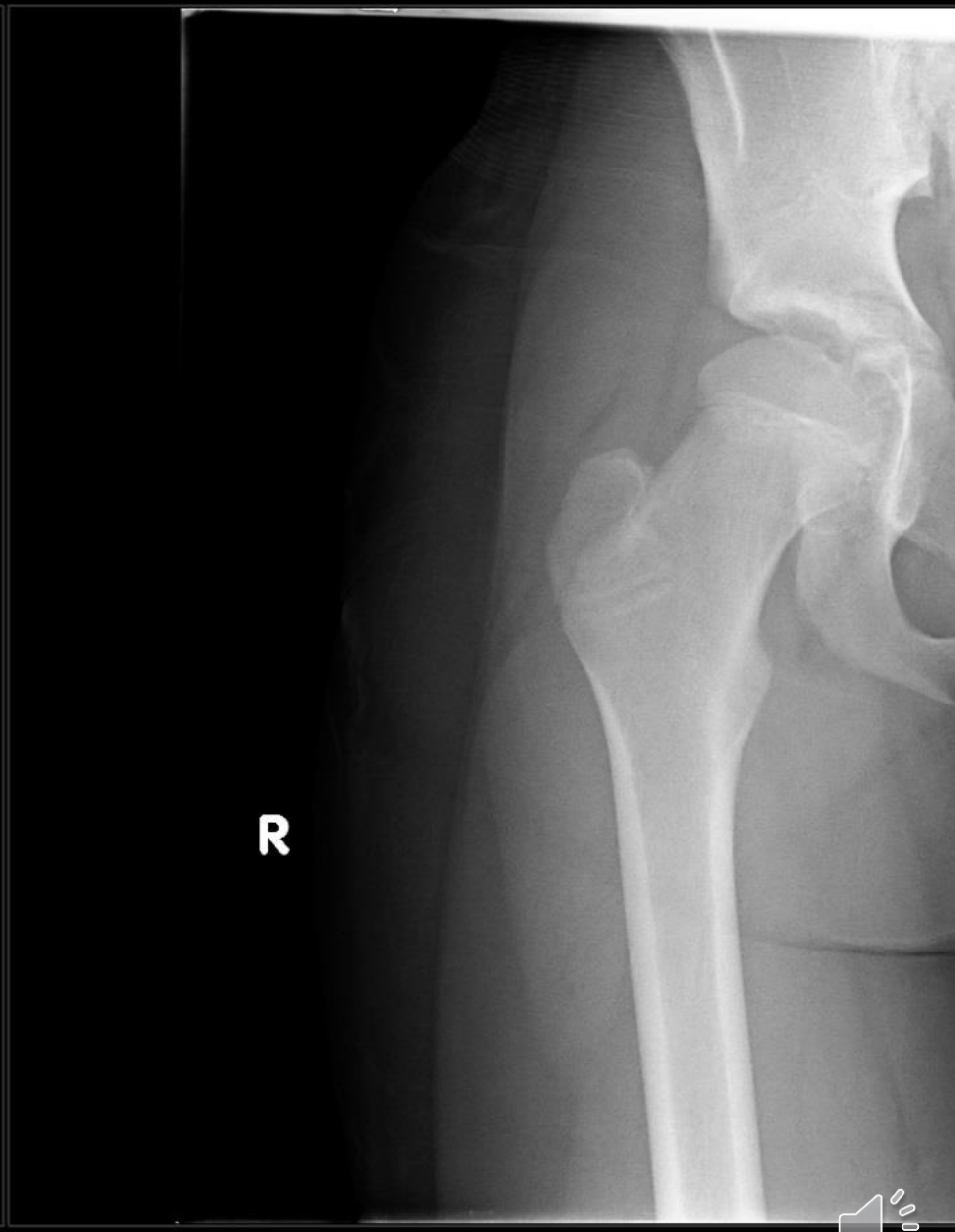
Case

HPI:

- 13 yo boy kicking a soccer ball, felt a “pop”
- Immediate pain in R hip and inability to ambulate

O:

- Symmetric internal and external rotation of the hip but pain on the right.
- Pain with resisted straight leg raise
- Pain over AIIS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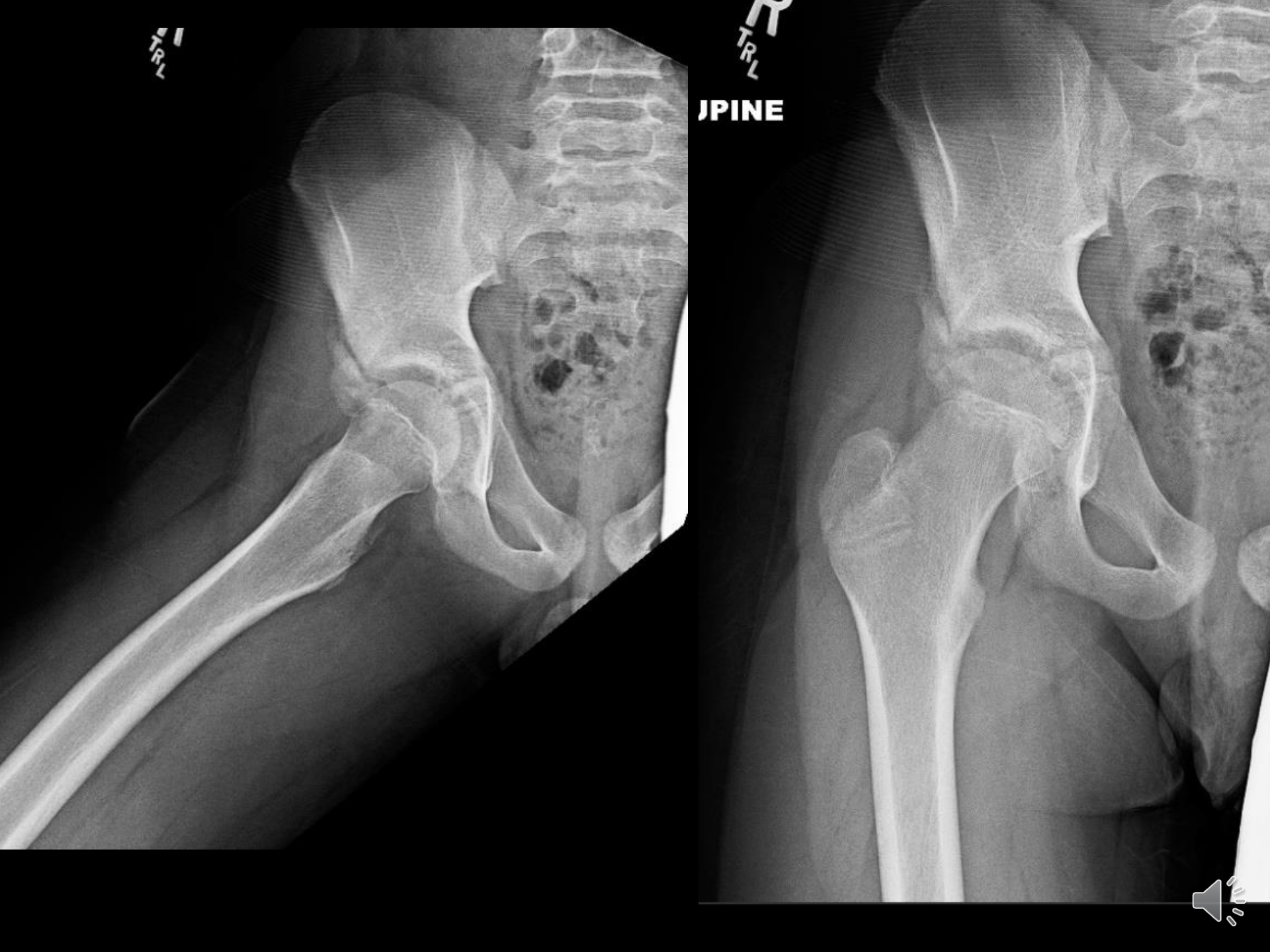

TRL
TRL
UPINE

Pelvic Avulsion Fractures (AIIS, ASIS, iliac crest, ischium)

Pearls:

- Pain with straight leg raise
  - AIIS = rectus femoris
  - ASIS = sartorius
  - Iliac crest = abdominals
- Pain with resisted flexion of the knee
  - ischium

Pitfalls:

- No x-ray

Case

HPI:

- 13 yo boy, L hip pain x 3 weeks
- Kicking a soccer ball, felt a “pop”
- Increasing pain and inability to ambulate x 3 days

O:

- Limited internal rotation of the hip

Slipped Capital Femoral Epiphysis (SCFE)

Pearls:

- Often in the setting of previous pain
- Unilateral out-toeing
- asymmetric hip exam

Pitfalls:

- Asymmetry

Case

HPI:

- 14 yo boy, 4 weeks of anterior knee pain
- Fell while playing basketball and now limping intermittently but continues to play.
- X-ray = “fractured patella”
- Fighting with his parents about crutches

O:

- No swelling
- Minimally tender over patella
- Negative apprehension
- Tight quadriceps and hamstrings bilaterally

Bipartite Patella

Pearls:

- **Normal Ossification Variant**
- **50% bilat = consider contralateral film**

Pitfalls:

- **Can avulse…**

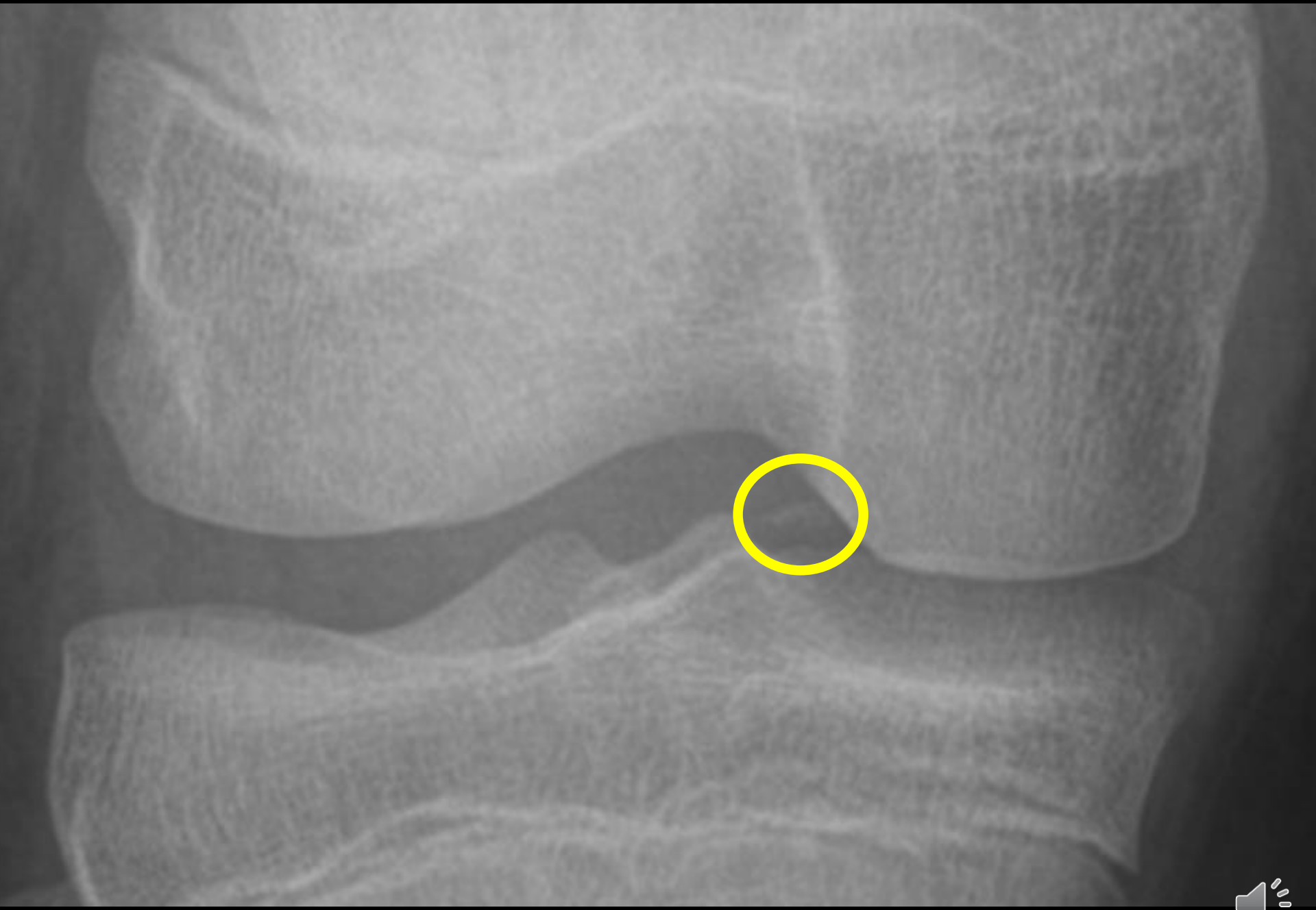
Case

HPI:

- 14 yo boy jumped down stairs
- Heard "pop"
- Immediate pain and inability to ambulate

O:

- Significant swelling of the knee
- Severe pain with attempts at Lachman's

Tibial Eminence Fracture

Pearls:

- ACL avulsion of tibial spine
- MRI

Pitfalls:

- Frequently not seen on x-ray

Case

HPI:

- 15 mo girl, fell from bed last week
- Seen at outside facility: “No fracture.”
- Continues to refuse to ambulate on L
- No recent illness

O:

- Happy, afebrile, sitting in mothers lap
- Full ROM of hips
- Pain over proximal tibia

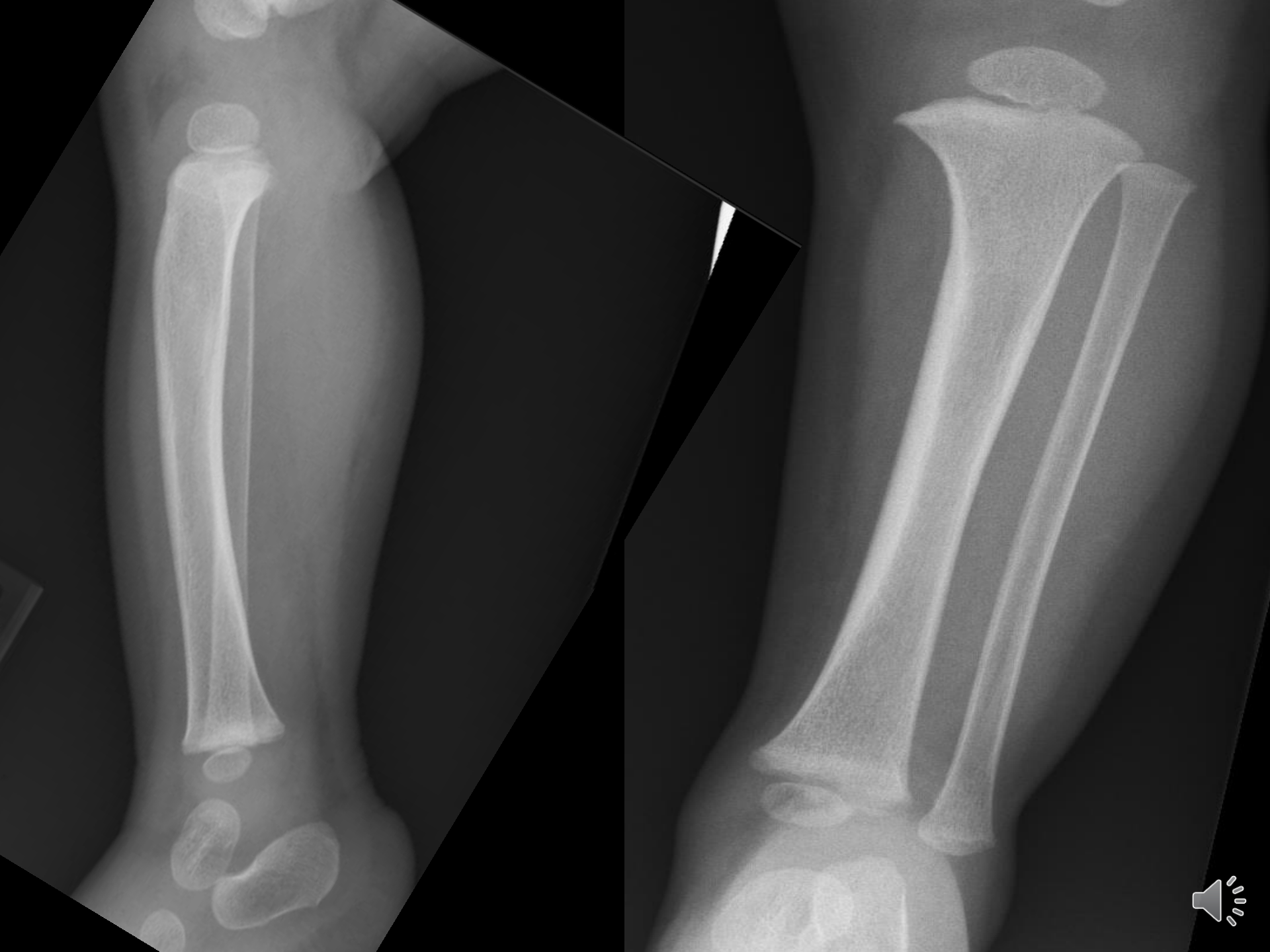
Proximal Tibia Fracture

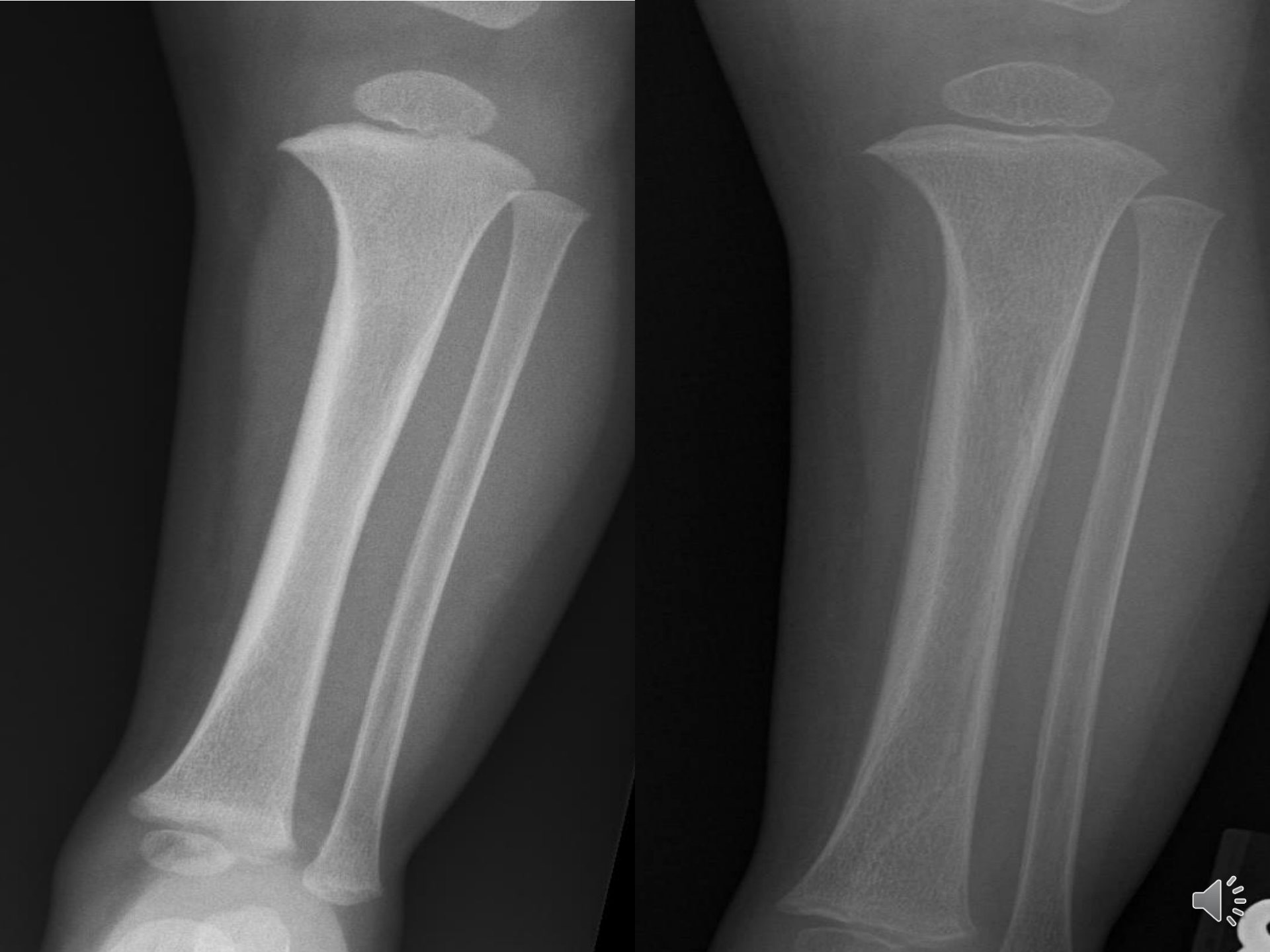
Pearls:

- Examine your patient!
- Immobilize in a long leg cast.

Pitfalls:

- Can cause valgus deformity





Tibia Toddlers Fracture

Pearls:

- Minimal Trauma; often with a twist
- Revert to crawling
- No swelling of joints
- Pain with rotatory stress
- X-ray often “negative”
- Treatment = no immobilization needed?

Pitfalls:

- Infection!

Case

HPI:

- **12 yo girl fell 10 feet from a tree after 15 hour meditative tree sit.**
- **Unable to ambulate**

O:

- **Significant pain and swelling of lower leg.**
- **No pain at ankle or knee.**


X-TABLE
R
CB
R
CB


R
X-TABLE
POST REDUCTION
POST REDUCTION
R
AP


R
ACC

Tibia Shaft Fracture (with intact fibula)

Pearls:

- Long leg cast 6-8 weeks
  - Can transition to short leg at 3-4 week mark if stable
- Monitor for first 2-3 weeks

Pitfalls:

- Beware the intact fibula!

Case

HPI:

- 9yo girl, playing soccer one week earlier, “twisted ankle”
- Unable to ambulate off the field

O:

- Non-tender through proximal tib/fib
- Non-tender through medial and lateral ligaments
- Tender over distal fibula
- Swelling over distal fibula

Salter Harris I Fracture of Distal Fibula

Pearls:

- **Unable to ambulate**
- **Tender over physis**
- **Treated in a cam boot (just like a sprain.)**

Case

HPI:

- 15 yo boy landed on opponents foot after rebound
- Right ankle pain
- Unable to ambulate

O:

- Significant swelling of entire ankle.
- PMI over distal fibula and through distal third of tib/fib
- + syndesmosis squeeze test


R
ASA


R
ASA


R
JRV

Distal Fibula Fracture with Syndesmosis Injury

Pearls:

- **Consider gravity stress view in the skeletally mature, or nearly skeletally mature when PE not consistent with “simple” distal fibular physeal injury.**

Case

HPI:

- 9 yo girl inverted ankle
- Pain over lateral aspect of foot
- Unable to ambulate

O:

- Swollen foot
- Pain over base of 5th Metatarsal
- Pain with resisted abduction

Fifth Metatarsal Base Fracture (and Iselin's apophysis)

Pearls:

- Fracture runs perpendicular
- Apophysis runs horizontal

Pitfalls:

- Beware the Jones fracture
  - Metaphyseal/diaphyseal junction

Case

HPI:

- 2 years intermittent heel pain
- Significant increase over last three weeks with lacrosse
- Now limping
- Told he has a “heel fracture”

O:

- No swelling
- + “squeeze” test


R
TLG

Sever's Apophysitis

Pearls:

- Bilateral = No x-ray
- Ice, rest, heel cups

Pitfalls:

- Unilateral
- Know the differential in the heel:
  - Achilles tendonitis
  - Enthesitis
  - Severs
  - Stress fracture vs. Cyst

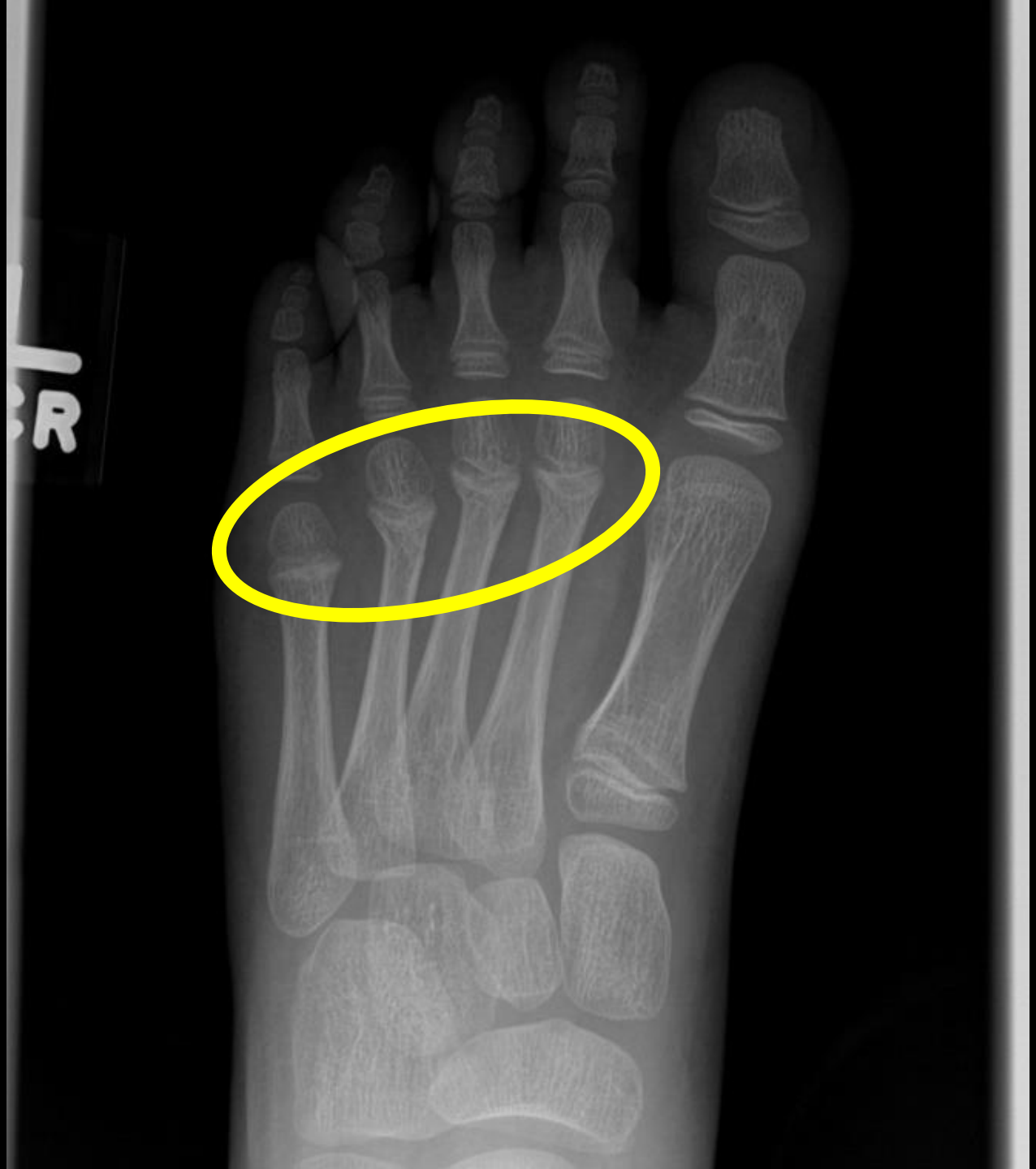
Case

HPI:

- 10yo boy doing a cartwheel and struck foot on ground
- Pain through MTP region
- Unable to ambulate

O:

- Swelling, pain and ecchymosis through dorsum of foot
- Pain through 2^{nd} - 5^{th} Metatarsal neck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Metatarsal Fractures

Pearls:

- **Cam boot vs. cast**

Pitfalls:

- **Beware the physis…**

5 Lower Extremity Pearls

1. Let your history and exam determine the differential.
2. X-rays confirm not deny
3. Beware of infection
4. Comparison x-ray's can be useful in children.
5. Your history & exam rules!

Thank you.

Bibliography

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